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Welcome

Dear participants,
Dear colleagues,

It is a great pleasure to welcome you to the 37th Annual Meeting of the European Bone and Joint Infection Society in Helsinki.

During the 2,5 conference days, you will experience a diverse programme that includes keynote sessions, free paper sessions, industry symposia and poster presentations. You will get a unique opportunity to meet experts within the field and be updated on bone and joint infection research happening across Europe.

The main subjects of the conference are:

- *Prosthetic joint infections*
- *Bone and soft tissue reconstruction*
- *Demanding infections*
- *Treatment and diagnostics*
- *Biomaterials – role of bone substitutes in the treatment of infected bone*
- *Future trends in bone and joint infection management*

Furthermore, we have arranged some exciting social events, so you will get the chance to experience the historical side of Helsinki, but also get a taste of the nature surrounding the capital.

We hope you will enjoy the conference and your stay in Helsinki!

On behalf of the local organising committee and the EBJIS board,

Nina Lindfors
Conference Chair

Martin McNally
President of EBJIS

Become a member of EBJIS!

The aim of the Society is:

- To promote the knowledge of all infections affecting the Musculoskeletal System (Bone and Joint Infections)
- To promote high quality, prevention, treatment and the development of diagnostic tools of these infections diseases
- To enhance education in Bone and Joint Infections
- To establish networking between physicians and healthcare and educational institutions

We encourage you to become an EBJIS Member and support the Society's objectives together.

Benefits of your membership

- Reduction in fee for EBJIS Annual Meeting (equivalent to annual subscription)
- Apply for the EBJIS Travelling Fellowship – supported by EBJIS itself
- Access to the Journal of Bone and Joint Infection (reduced publication fee): www.jbji.net
- Access the Case Discussion Portal – FORUM
- Be part of the EBJIS Endorsement process (papers and events)
- Access to all EBJIS newsletters and to all recent news related to bone and joint infection

At the moment, the annual membership fee is 110 euro.

Visit the EBJIS website to find more information: www.ebjis.org/membership and sign up: www.ebjis.org/ebjis-registration

If you have any question please do not hesitate to contact our office at info@ebjis.org

The journal of bone and joint infection

The Journal of Bone and Joint Infection (JBJI) is a publication of the European Bone and Joint Infection Society and publishes papers of highest quality in all areas of orthopaedic infections.

The journal has met all PubMed requirements and is now being indexed in PubMed Central.

Types of articles:

· Research papers
· Short research communications
· Reviews and mini-reviews
· Commentaries, opinions

Call for papers - submit your paper now!

Original papers covering the field of BJI may be submitted to JBJI.
Find more information on the website: www.jbji.net

Organisation

EBJIS Executive Committee

President	Martin McNally
Vice President	Rihard Trebse
Past President	Klaus Kirketerp-Møller
General Secretary	Charles Vogely
Treasurer	Martin Clauss
Members	Alex Soriano Ricardo Sousa
Associate member	Christof Wagner

Local Organising Committee

Chair	Nina Lindfors
Members	Kaisa Huotari Juho Salo Inka Romo Markus Parkkinen

General information

Conference website
www.ebjis2018.org

Conference venue
Finlandia-talo Oy
Mannerheimintie 13 e
00100 Helsinki
Finland

Badges
The conference name badges must be worn at all times during the conference. Access to the conference venue will not be granted without the name badge issued by the conference organisers.

Entitlements for participants
Admission to all scientific sessions and industry symposia, admission to exhibition, conference bag with programme- and abstract book, CME credits, coffee breaks and lunch, welcome reception on Thursday 6/9, farewell lunch on Saturday 8/9 and certificate of attendance.

CME credits
The conference has been granted 14 European CME credits (ECMEC) by the European Accreditation Council for Continuing Medical Education (EACCME). In order to obtain the CME credits please log your attendance each day before 14.00 by scanning your badge at the logging stations in the registration area. You are able to print out your certificate after 14.00 on your last day of attendance.

Cloak room
A cloak room located near the registration desk will be available throughout the conference. Opening hours:

Thursday 6 September	7.00 - 17.45
Friday 7 September	7.45 - 19.15
Saturday 8 September	8.00 - 14.30

Conference language
The conference will be held in English.

Information for Speakers
Bring your presentation to the Speakers' preview room at the venue. An assistant will help you upload the presentation to the computer. Please make sure to upload your presentation at least 30 min. before your session starts. Please bring your presentation on a USB stick. We do not allow the use of personal laptops for presentations. At the end of the conference, all presentations will be deleted in order to secure that no copyright issues will arise.

Speakers' preview room (VIP Foyer)
Opening hours:

Thursday 6 September	7.30-17.00
Friday 7 September	7.45-17.00
Saturday 8 September	8.00-11.00

WIFI
Free access to the WIFI at Finlandia Hall is provided. Connect to Finlandia Hall (no password needed).

Conference Secretariat
CAP Partner
Nordre Fasanvej 113, 2
DK-2000 Frederiksberg
Denmark
info@cap-partner.eu
www.cap-partner.eu
Tel.: +45 70 20 03 05

Social events

Welcome Reception

Date: 6 September 2018
Time: 18.00-20.00
Place: The House of Nobility (Ridderhuset), Riddaregatan 1, 00170 Helsinki

The Welcome Reception will take place at The House of Nobility of Helsinki (Riddarhuset) at 18.00 - 20.00. Make sure to be there for an evening in a beautiful historic building. The reception is included in the registration fee.

NB: As the House of Nobility is a historical building protected by the Board of Antiquities, sharp high heels are not allowed to wear.

EBJIS Gala Dinner

Date: 7 September 2018
Time: 20.00 - 23.00
Place: Kulosaaren Casino, Hopeasalmenpolku 1, 00570 Helsinki

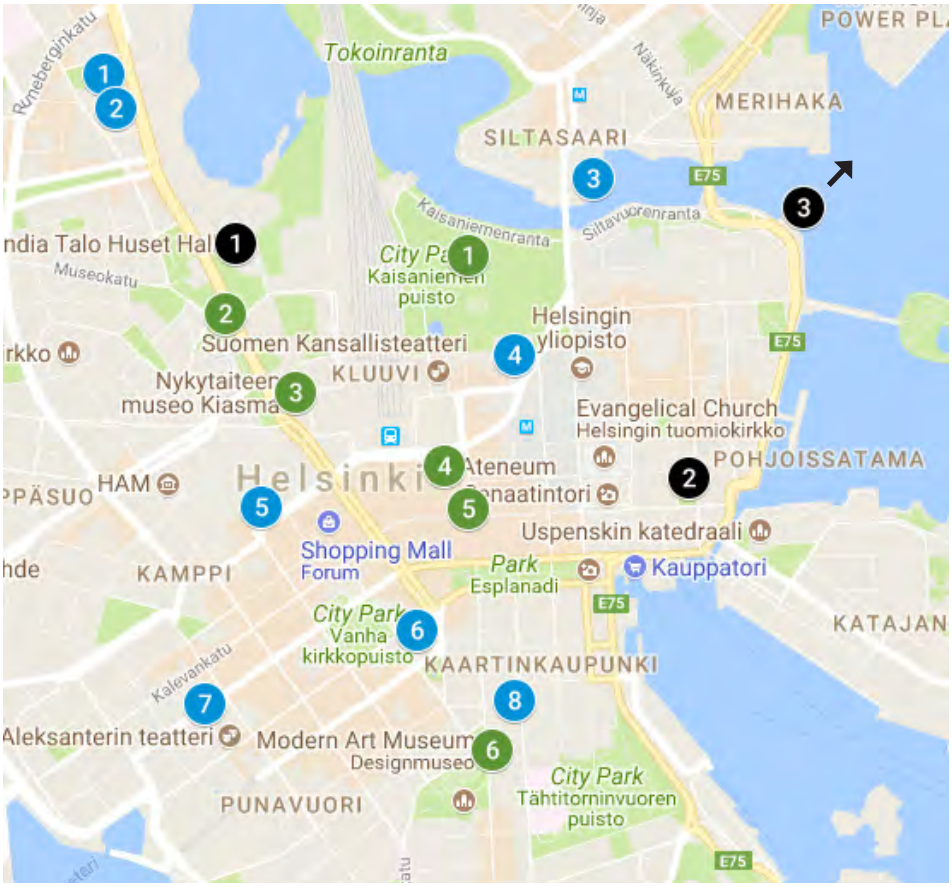
The gala dinner will take place at the Kulosaaren Casino from 20.00 - 23.00. Bus transportation has been arranged to and from the dinner venue for attendees.

Bus transportation

Departure from Scandic Park Hotel and Crowne Plaza Hotel — Time: 19.45
BUS1: From Crowne Plaza / Mannerheimintie 50, 00260 Helsinki
BUS2: From Scandic Park / Mannerheimintie 46, 00260 Helsinki

Departure from Kulosaaren Casino — Time: 23.00
BUS1: To Crowne Plaza / Mannerheimintie 50, 00260 Helsinki
BUS2: To Scandic Park /Mannerheimintie 46, 00260 Helsinki

Map of Helsinki



Conference venues

1. Finlandia Hall
2. Finnish House of Nobility
3. Kulosaaren Casino

Top sights in Helsinki

1. Kaisaniemi, Botanical Garden
2. Kansallismuseo, Historical museum
3. Museum of Contemporary Art Kiasma
4. Ateneum
5. World of TRE, Designer shopping
6. Design Museum Helsinki

Hotels

1. Crowne Plaza Helsinki
2. Scandic Park Helsinki
3. Hilton Helsinki Strand
4. Hotel Arthur
5. Scandic Hotel Simonkenttä
6. Klaus K Hotel
7. GLO Hotel Art
8. Hotel Lilla Roberts

Programme overview

Thursday 6 September 2018

	Room: Finlandia Hall	Room: Helsinki Hall
07.00	**Registration**	
08.30 - 08.50	Welcome & Opening Ceremony	
08.50 - 09.50	Key Session 1: Debridement, antibiotics and implant retention: how to do it?	
09.50 - 10.50	Key Session 2: Antibiotic treatment in bone and joint infections: what is the evidence?	
10.50 - 11.20	**Coffee, poster visit and exhibition**	
11.20 - 12.45	Free Papers A	Free Papers B
12.45 - 14.00	**Lunch**	**Lunch**
12.50 - 13.50	**Industry Symposium A**	
14.00 - 15.00	Key Session 3: Bone and soft tissue reconstruction	
15.00 - 15.50	Free Papers C	Free Papers D
15.50 - 16.20	**Coffee, poster visit and exhibition**	
16.20 - 17.15	Key Session 4: Demanding infections	
18.00 - 20.00	**Welcome Drinks Reception at The House of Nobility Riddarhuset** Address: Riddaregatan 1, 00170 Helsinki	

Friday 7 September 2018

	Room: Finlandia Hall	Room: Helsinki Hal
7.45 -	**Registration**	
08.15 - 09.15	Key Session 5: The role of bone subsitutes in infection treatment	
09.15 - 10.15	Key Session 6: Treatment and diagnostics	
10.15 - 10.30	2017 Travelling Fellowship Report	
10.30 - 11.00	**Coffee, poster visit and exhibition**	
11.00 - 13.00		**Country Delegate Meeting** (This meeting is by invitation only) NB! The meeting will take place in Terrace Hall.
11.00 - 12.30	Free Papers E	Free Papers F
12.30 - 13.45	**Lunch**	**Lunch**
12.35 - 13.35	**Industry Symposium B**	**Industry Symposium C**
13.45 - 14.45	Key Session 7: Periprostetic fractures and infection	Key Session 8: Managing bone infection in resource - poor regions
14.45 - 15.50	Free Papers G	Free Papers H
15.50 - 16.20	**Coffee, poster visit and exhibition**	
16.15 - 17.15		**EBJIS in resource - poor countries** (This meeting is by invitation only) NB! This meeting will take place at Aurora Hall.
16.20 - 17.10	Free Papers I	Free Papers J
17.20 - 18.45		**EBJIS General Assembly** (for members of EBJIS, by invitation only) NB! This meeting will take place at Terrace Hall.
20.00 - 23.00	**EBJIS Gala Dinner at Kulosaaren Casino** Address: Hopeasalmenpolku 1, 00570 Helsinki	

Saturday 8 September 2018

	Room: Finlandia Hall	Room: Helsinki Hall
09.00 - 10.15	Key Session 9: Future trends in bone and joint infection management	
10.15 - 10.45	**Coffee, poster visit and exhibition**	
10.45 - 12.10	Best Papers Session	
12.10 - 12.20	Honorary lecture: 30 years in EBJIS; what have I learnt?	
12.25 - 12.40	Closing Remarks & Prizes	
12.40 - 14.00	**Farewell lunch**	

Follow us on Facebook

EBJIS -The Bone & Joint Infection Society

Due to CME regulations no industry names or logos are allowed in the programme.
Detailed information about industry sessions is available on pages 25-30.

Thursday 6 September

	No.	Room: Finlandia Hall	
07.00		**Registration**	
8.30 - 8.50		**Welcome**	
		Opening Ceremony	**Nina Lindfors (Local Chair) & Martin McNally (EBJIS President)**
8.50 - 9.50		**Key session 1: Debridement, antibiotics and implant retention: how to do it?**	**Chairs: Inka Romo & Charles Vogely**
8.50 - 9.05		How to do DAIR!	Olivier Borens
9.05 - 9.20		Biofilm on polyethylene vs metal	Martin Clauss
9.20 - 9.35		Antimicrobial treatment after debridement and implant retention	Kaisa Huotari
9.35 - 9.50		Discussion	
9.50 - 10.50		**Key session 2: Antibiotic treatment in bone and joint infections: what is the evidence?**	**Chairs: Andrej Trampuz & Martin McNally**
9.50 - 10.05		Infected fractures and non-unions	Mario Morgenstern
10.05 - 10.20		Shortened treatment in pediatric osteoarticular infections	Markus Pääkkönen
10.20 - 10.35		Antimicrobial treatment: intravenous or peroral?	Matthew Scarborough
10.35 - 10.50		Discussion	
10.50 - 11.20		**Coffee, poster visit and exhibition**	
11.20 - 12.45		**Free Papers A (10 x 6 min + 2 min)**	**Chairs: Hannu Kuokkanen & Klaus Kirketerp-Møller**
11.20 - 11.28	FP1	Late acute prosthetic joint infections; should the implant be removed?	Marjan Wouthuyzen-Bakker
11.28 - 11.36	FP2	Tackling early prosthetic joint infection in primary joint arthroplasty by debridement, antibiotics and implant retention (DAIR)	Jon Goosen
11.36 - 11.44	FP3	Predicting failure in early acute prosthetic joint infection treated with debridement, antibiotics and implant retention: external validation of the KLIC score	Claudia Löwik
11.44 - 11.52	FP4	Staphylococcal acute post-operative prosthetic joint infection (PJI) treated with 'DAIR' (debridement and implant retention) and impact of rifampin: a retrospective cohort study in France	Tristan Ferry
11.52 - 12.00	FP5	Immediate postoperative start of rifampicin in patients with acute staphylococcal PJI treated with DAIR was not associated with development of rifampicin resistance in failures	Henk Scheper
12.00 - 12.08	FP6	Calprotectin cost less and is as accurate as alpha defensin in excluding a chronic prosthetic joint infection	Marjan Wouthuyzen-Bakker
12.08 - 12.16	FP7	Is lifelong antibiotic suppression successful in the management of Prosthetic Joint Infection	Luke Granger
12.16 - 12.24	FP8	Is dexamethasone infection safe in total hip and total knee arthroplasty: results from 18.872 operations	Markku Vuorinen
12.24 - 12.32	FP9	An antistaphylococcal bacteriophage lysate to treat drug resistant Staphylococcus aureus involved in prosthetic joint infections: an alternative strategy	Mariagrazia Di Luca
12.32 - 12.40	FP10	Good outcome of enterococcal PJI - importance of antimicrobial treatment	Nora Renz
12.45 - 14.00		**Industry Symposium A (12.50 - 13.50) + Lunch**	

Due to CME regulations no industry names or logos are allowed in the programme.
Detailed information about industry sessions is available on pages 25-30.

	No.	Room: Helsinki Hall	
		Coffee, poster visit and exhibition	
		Free Papers B **(10 x 6 min + 2 min)**	**Chairs:** **Patrik Lassus** **& Jan Geurts**
	FP11	Inter-user assessment of the BACH classification system for long bone osteomyelitis	Andrew Hotchen
	FP12	Incidence and risk factors for infection after intramedullary nailing of femoral and tibial diaphyseal fractures: prospective study	Priscila Oliveira
	FP13	Results of tibiotalocalcaneal arthrodesis with retrograde intramedullary nailing in post-infectious ankle or pilon fractures with severe soft tissue damage	Katharina Salmoukas
	FP14	Getting it right first time: the importance of a structured tissue sampling protocol for diagnosing fracture-related infections	Pien Hellebrekers
	FP15	An evidence base for tissue sampling and culture interpretation in fracture-related infection	Maria Dudareva
	FP16	Impact of the duration of perioperative antimicrobial prophylaxis and renal clearance on the development of fracture-related infection	Willem-Jan Metsemakers
	FP17	Prosthetic joint infections after hip fractures	Jussi Kosola
	FP18	The use of segmental antibiotic mega-spacers provide stable environments for staged preimplantation following large tumor and tumor-like defects at the hip and knee	Valdis Lelkes
	FP19	Result of revision surgery for infected total knee arthroplasty. Do surgical strategies matter?	Tesfaye H. Leta
	FP20	Value of radiological signs for the diagnosis of internal fixation-associated infection: results from a prospective cohort study	Cristina Ojeda Thies
		Lunch	

Thursday 6 September

	No.	Room: Finlandia Hall	
14.00 - 15.00		**Key session 3:** **Bone and soft tissue reconstruction**	**Chairs: Juho Salo** **& Alex Soriano**
14.00 - 14.15		Bone transport using unilateral fixateur and plate	Arnold Suda
14.15 - 14.30		Microvascular bone reconstruction in chronic bone and joint infections	Erkki Tukiainen
14.30 - 14.45		Flap selection and timing of soft tissue reconstruction in lower extremity trauma in order to minimize infection complications	Hannu Kuokkanen
14.45 - 15.00		Discussion	
15.00 - 15.50		**Free Papers C** **(6 x 6 min + 2 min)**	**Chairs:** **Markus Parkkinen** **& Christof Wagner**
15.00 - 15.08	FP21	The gastrocnemius flap in the management of infected knee prostheses: experience of 115 cases over 21 years in a single centre	Conrad Harrison
15.08 - 15.16	FP22	Management of infected segmental tibial defects with simultaneous ilizarov bone reconstruction and free muscle flaps	Martin McNally
15.16 - 15.24	FP23	Pediculated Suralis flap for closure of soft tissue defects associated with infection of the lower leg	Arnold Suda
15.24 - 15.32	FP24	Current practices in the managment of open fractures: a worlwide survey among orthopaedic trauma surgeons	Jan Pützler
15.32 - 15.40	FP25	Management of critical-sized bone defects in treatment of complex fracture-related infections; a systematic review and pooled analysis	Hans Bezstarosti
15.40 - 15.48	FP26	Comparison of Ilizarov acute shortening and relengthening with bone transport for treating infected segmental tibial bone defects	Irene Katharina Sigmund
15.50 - 16.20		**Coffee, poster visit and exhibition**	
16.20 - 17.15		**Key Session 4:** **Demanding infections**	**Chairs:** **Hannu Kuokkanen** **& Charles Vogely**
16.20 - 16.35		Microbiological and histological diagnosis of infection in non-unions	Martin McNally
16.35 - 16.50		Culture-negative PJI – How to deal with this mystery?	Andrej Trampuz
16.50 - 17.05		Opportunistic bone infections in face transplantation	Patrik Lassus
17.05 - 17.15		Discussion	
18.00 - 20.00		**Welcome Drinks Reception at The House of Nobility (Riddarhuset)** Address: Riddaregatan 1, 00170 Helsinki	

Due to CME regulations no industry names or logos are allowed in the programme.
Detailed information about industry sessions is available on pages 25-30.

No.	Room: Helsinki Hall	
	Free Papers D (6 x 6 min + 2 min)	**Chairs: Hannu Aro & Martin Clauss**
FP27	Overview of orthopedic-implant associated infection due Gram-negative bacilli and the impact of Acinetobacter Baumanni mutidrug resistance in a Brazilian center	Mauro Salles
FP28	Staphylococcus aureus infections after orthopedic surgery: incidence, mortality and direct costs in Germany	Holly Yu
FP29	Spinal implant-associated infections: results from a 3-year prospective cohort study	Donara Margaryan
FP30	Improved infection and functional outcome with a concerted surgical and antimicrobial treatment Concept: analysis of 127 cases of infections after internal fixation	Nora Renz
FP31	Septic knee arthritis after anterior cruciate ligament reconstruction (ACLR) : a series of 74 cases among 9.858 patients	Eric Bonnet
FP32	In vitro granuloma formation in response to Cutibacterium acnes infections: different immune behaviors depending on phylotypes	Stephane Corvec
	Coffee, poster visit and exhibition	

Friday 7 September

	No.	Room: Finlandia Hall	
7.45 -		**Registration**	
08.15 - 09.15		**Key Session 5:** **The role of bone subsitutes in infection treatment**	**Chairs: Hannu Aro** **& Andrej Trampuz**
8.15 - 8.30		Clinical evidence of bone substitutes	Chris Arts
8.30 - 8.45		The Oxford protocol	Martin McNally
8.45 - 9.00		Bioactive glass in the treatment of bone infection	Nina Lindfors
9.00 - 9.15		Discussion	
09.15 - 10.15		**Key Session 6:** **Treatment and diagnostics**	**Chairs:** **Erkki Tukiainen** **& Rihard Trebse**
9.15 - 9.30		The influence of antibiotic prophylaxis on culture yield is negligible	Marjan Wouthuyzen-Bakker
9.30 - 9.45		Treatment of lower extremity lymph oedema in infection	Sinikka Suominen
9.45 - 10.00		PET-imaging of osteomyelitis and implant infections	Hannu Aro
10.00 - 10.15		Discussion	
10.15 - 10.30		**2017 Travelling Fellowship Report**	
10.30 - 11.00		**Coffee, poster visit and exhibition**	
11.00 - 13.00			
11.00 - 12.30		**Free Papers E** **(10 x 6 min + 2 min)**	**Chairs:** **Inka Romo** **& Charles Vogely**
11.00 - 11.08	FP33	Positive intraoperative cultures at reimplantation of a two-stage exchange for prosthetic joint infection, what do they teach us?	Marjan Wouthuyzen-Bakker
11.08 - 11.16	FP34	Unexpected positive culture in total hip arthroplasty revision increases the re-revision risk. A national register study	Nikolaj Milandt
11.16 - 11.24	FP35	D-lactate, a bacterial specific marker for the diagnosis of prosthetic joint infection and septic arthritis	Svetlana Karbysheva
11.24 - 11.32	FP36	Reliability of Intra-Operative Frozen Section Study in Revision of Infected Hip Arthoplasty	Anbuchezhian Palanivel
11.32 - 11.40	FP37	Optimized decision algorithm for the microbiological diagnosis of osteo-articular infections in adults using joint fluids samples: a prospective study in two french hospitals including 423 synovial fluids	Frederic Laurent
11.40 - 11.48	FP38	The fate of biopsy negative and sonication positive cultures following revision of total hip and knee arthroplasties	Christen Ravn
11.48 - 11.56	FP39	Incidence of surgical site infection after primary hip and knee arthroplasty in rheumatic patients with special reference to anti-rheumatic treatment	Anna Stefánsdóttir
11.56 - 12.04	FP40	Clinical and microbiological characteristics of early acute prosthetic joint infection in severely obese patients	Claudia Löwik
12.04 - 12.12	FP41	Treatment of prosthetic-joint infections: success rate over the last 10 years	Arnaud Fischbacher
12.12 - 12.20	FP42	Septic revision total knee arthroplasty: treatment of extended bone defects using metaphyseal sleeves	Mathias Glehr
12.20 - 12.28	FP43	A mobile app for postoperative wound care after joint arthroplasty: perceived usefulness and ease of use	Henk Scheper
12.30 - 13.45		**Industry Symposium B (12.35 - 13.35) + Lunch**	

Due to CME regulations no industry names or logos are allowed in the programme.
Detailed information about industry sessions is available on pages 25-30.

	No.	Room: Helsinki Hall	
		Coffee, poster visit and exhibition	
		Country Delegate Meeting (This meeting is by invitation only) NB! The meeting will take place in Terrace Hall.	
		Free Papers F **(10 x 6 min + 2 min)**	**Chairs:** **Nina Lindfors** **& Alex Soriano**
	FP44	Vancomycin elution from a biphasic bone substitute: antibiotic concentrations measured in drainage fluid, serum and urine over 4 weeks	Mindaugas Stravinskas
	FP45	Single-Dose Bone Pharmacokinetics of Vancomycin in a Porcine Implant-Associated Osteomyelitis Model	Mats Bue
	FP46	Not all ceramic antibiotic carriers are the same. Outcomes for two different local antibiotic carriers in the management of chronic osteomyelitis	Jamie Ferguson
	FP47	Radiological and clinical outcomes in the medium-term of the use of an antibiotic bone substitute in the diabetic foot	Christine Whisstock
	FP48	In vitro antibacterial activity of Bioactive Glass S53P4 on multiresistant pathogens causing osteomyelitis and prosthetic joint infection	Mateus Cunha
	FP49	Treatment of chronic osteomyelitis with an absorbable gentamycin-loaded biocomposite, a retrospective consecutive series of 97 cases.	Hans Gottlieb
	FP50	Role of bacterial colonization of spacers in two-stage arthroplasty revision surgery	Sandra Huguet
	FP51	Prevention of calcaneal fracture synthesis infection using bone substitute eluting antibiotic	Damiano Papadia
	FP52	Histological assessment of bone remodelling within a bioabsorbable bone substitute in chronic osteomyleitis	Martin McNally
	FP53	Antibiotic loaded calcium sulphate hydroxy apatite bio composite in diabetic foot surgery	Nijil Vasukutty
	FP54	Hypercalcaemia in the management of bone and joint infection: a comparison of 2 antibiotic delivery systems	Nemandra Sandiford
		Industry Symposium C (12.35-13.35) + Lunch	

Friday 7 September

	No.	Room: Finlandia Hall	
13.45 - 14.45		**Key Session 7:** **Periprostetic fractures and infection**	**Chairs:** **Kaisa Huotari** **& Martin Clauss**
13.45 - 14.00		Current management of periprosthetic fracture and infection around the hip and knee	Rihard Trebse
14.00 - 14.15		Current management of periprosthetic fracture and infection around the hip and knee - ID specialist view	Parham Sendi
14.15 - 14.30		Case discussion	Olivier Borens
14.30 - 14.45		Discussion	
14.45 - 15.50		**Free Papers G** **(8 x 6 min + 2 min)**	**Chairs:** **Kaisa Huotari** **& Ricardo Sousa**
14.45 - 14.53	FP55	Preoperative oral antibiotic use and the risk of periprosthetic joint infection after primary knee or hip replacement	Meeri Honkanen
14.53 - 15.01	FP56	Candida periprosthetic joint infection: a case series	Andrej Trampuz
15.01 - 15.09	FP57	The fate of periprosthetic joint infection in patient with multiple prosthetic joint	Shih Hui Peng
15.09 - 15.17	FP58	Complications of resection arthroplasty during two-stage revision for periprosthetic hip infection	Irene Katharina Sigmund
15.17 - 15.25	FP59	Poor outcome of gram-negative periprosthetic joint infection: results from a 7-year cohort study	Susanne Feihl
15.25 - 15.32	FP60	Prevalence and characteristics of unexpected diagnosis of infection in revision surgeries following internal fixation: results from a prospective cohort study	Cristina Ojeda Thies
15.32 - 15.40	FP61	Synovial versus serum PTX3 for the diagnosis of periprosthetic joint infection: a single-center prospective diagnostic study	Matteo Ferrari
15.40 - 15.48	FP62	Role of joint aspiration prior to re-implantation in patients with a cement spacer in place	Sandra Huguet
15.50 - 16.20		**Coffee, poster visit and exhibition**	
16.15 - 17.15			
16.20 - 17.10		**Free Papers I** **(6 x 6 min + 2 min)**	**Chairs:** **Nina Lindfors** **& Barry Brause**
16.20 - 16.28	FP71	FISH-based detection and identification of bacteria in orthopedic implant-associated infections	Bruce van Dijk
16.28 - 16.36	FP72	High diagnostic accuracy of white blood cell scintigraphy for fracture related infections: results of a large retrospective single-center study	Paul Bosch
16.36 - 16.44	FP73	Repetitive extragenic palindromic pcr (rep-pcr) versus conventional microbiological techniques in the diagnosis of coagulase-negative staphylococcus infection in orthopedic surgery	Gema Muñoz-Gamito
16.44 - 16.52	FP74	Use of biomarkers and cell count on synovial fluid in the diagnosis of prosthetic joint infection	Alisdair James Felstead
16.52 - 17.00	FP75	Diagnostic accuracy of serum inflammatory markers in fracture-related infection: a systematic review and meta-analysis	Paul Bosch
17.00 - 17.08	FP76	Limited predictive value of serum inflammatory markers for diagnosing fracture related infections: results of a large retrospective multicenter cohort study	Janna van den Kieboom
17.20 - 18.45			
20.00 - 23.00		**EBJIS Gala Dinner at Kulosaaren Casino** (Address: Hopeasalmenpolku 1, 00570 Helsinki)	

No.	Room: Helsinki Hall	
	Key Session 8: **Managing bone infection in resource-poor regions**	**Chairs:** **Heikki Peltola** **& Christof Wagner**
	Implementation of osteomyelitis treatment in resource-poor environments: challengees and future perspectives	Jan Geurts
	Osteomyelitis in developing countries. Surgical aspects of osteomyelitis connected with sickle cell disease	Erkki Tukiainen (10 min)
	Why oral treatment in paediatric osteomyelitis?	Heikki Peltola (10 min)
	Managing bone infection in resource-poor regions	Len Marais
	Discussion 10 min	
	Free Papers H **(8 x 6 min + 2 min)**	**Chairs:** **Nina Lindfors** **& Jan Geurts**
FP63	Biofilm prevention of carbapenem-resistant enterobacteriaceae (CRE) and vancomycin resistant enterococci (VRE) by antibiotic-loaded calcium sulfate beads (ABLCB) in vitro	Devendra Dusane
FP64	Extreme high local intra-operative gentamicin concentrations are needed to prevent biofilm formation in-vivo	Louise Kruse Jensen
FP65	Simultaneous and Sequential applications of phages and Ciprofloxacin in killing mixed-species biofilm of Pseudomonas aeruginosa and Staphylococcus aureus	Tamta Tkhilaishvili
FP66	Comparison of sonication and chemical methods for the biofilm detection, including chelating and reducing agents	Svetlana Karbysheva
FP67	Specific antibiofilm properties of bacteriophage Sb-1 make it suitable for the therapy of prosthetic joint infections due to Staphylococcus aureus: biofilm matrix degradation and persister cells killing	Mariagrazia Di Luca
FP68	Staphylococcus aureus bone and joint infection : comparison of rifamycin intraosteoblastic activity and impact on intracellular emergence of small colony variants.	Frederic Laurent
FP69	Delayed and incomplete penetration of vancomycin to porcine intervertebral disc and vertebral cancellous bone	Mats Bue
FP70	Colonization of orthopedic implants in children, preliminary report	Pablo Schaufele
	Coffee, poster visit and exhibition	
	EBJIS in resource-poor countries (This meeting is by invitation only) NB! The meeting will take place at Aurora Hall.	
	Free Papers J **(6 x 6 min + 2 min)**	**Chairs:** **Henrik Sandelin &** **Mario Morgenstern**
FP77	Innovative treatment of acute and chronic osteomyelitis of the lower extremity: Case-series of 33 patients.	Sebastian Pesch
FP78	A systematic review of the single-stage treatment of chronic osteomyelitis	Rathan Jeyapalan
FP79	Indications and results of bone-reconstruction with the Masquelet-technique in treatment of osteomyelitis	Rita Schoop
FP80	Associations of interleukin-1 beta gene polymorphisms (rs16944, rs1143627, rs1143634 and rs2853550) and the risk of developing extremity chronic osteomyelitis in Chinese population	Nan Jiang
FP81	Outcomes and complications of diabetic foot soft tissue infections and osteomyelitis	Easton Ryan
FP82	Treatment concept and long-term outcome after acute posttraumatic osteomyelitis following unstable type C pelvic injuries	Simon Hackl
	General Assembly (for members of EBJIS, by invitation only) NB! This meeting takes place at Terrace Hall.	

Saturday 8 September 2018

	No.	Room: Finlandia Hall	
09.00 - 10.15		**Key Session 9:** **Future trends in bone and joint infection management**	**Chairs:** **Rami Madanat** **& Olivier Borens**
9.00 - 9.15		Genetics in diagnosis of bone infection	Theresa Street
9.15 - 9.30		International consensus group on management of infected fractures	Willem-Jan Metsemakers
9.30 - 9.45		Update on the PJI of the ICM 2018 Meeting in Philadelphia	Barry Brause
9.45 - 10.00		Voting for Criteria for diagnosis in PJI	Rihard Trebse
10.00 - 10.15		Discussion	
10.15 - 10.45		**Coffee, poster visit and exhibition**	
10.45 - 12.10		**Best Papers** **(10 x 6 min + 2 min)**	**Judges: Klaus Kirketerp-Møller, Rihard Trebse & Alex Soriano**
10.45 - 10.53	BP1	Epidemiology of 17.527 bone and joint infections addressed in referral centers in France between 2012 and 2016	Eric Senneville
10.53 - 11.01	BP2	Factors affecting bone formation in infected defects, filled with an absorbable, antibiotic-loaded bone substitute	Jamie Ferguson
11.01 - 11.09	BP3	The diagnostic accuracy of 18F-FDG-PET/CT in diagnosing fracture related infections: a retrospective dual center cohort study	Justin Lemans
11.09 - 11.17	BP4	Microbiology of Osteomyelitis at the Oxford Bone Infection Unit: MRSA Rates Falling	Maria Dudareva
11.17 - 11.25	BP5	Impact of Staphylococcus aureus infection on bone homeostasis	Frederic Laurent
11.25 - 11.33	BP6	Surgical site infections following implant removal: the effect of antibiotic prophylaxis; results of the WIFI-trial	Fay Sanders
11.33 - 11.41	BP7	The effect of local antibiotic prophylaxis in open limb fractures: a systematic review and meta-analysis	Alejandro Vallejo
11.41 - 11.49	BP8	Molecular typing shows the need for a new definition of Cutibacterium acnes orthopedic-device related infections	Faten El Sayed
11.49 - 11.57	BP9	PJI by multi-drug and extensively-drug resistant Gram negative bacteria: a multi-center cohort study	Efthymia Giannitsioti
11.57 - 12.05	BP10	Clinical outcome and risk factors for failure in late acute prosthetic joint infections treated with debridement and implant retention	Marjan Wouthuyzen-Bakker
12.10 - 12.20		**Honorary lecture: 30 years in EBJIS; what have I learnt?**	Volkmar Heppert
12.25 - 12.40		**Closing Remarks & Prizes**	
12.40 - 14.00		**Farewell lunch**	

Industry Section

BONESUPPORT™

EBJIS 2018
HELSINKI 6-8 September

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SYMPOSIUM | Thursday 6th September 12:50 -13:50 AUDITORIUM

EVOLUTION OF LOCAL ANTIBIOTIC DELIVERY IN THE MANAGEMENT OF BONE INFECTION

Expert Panel:
Mr. Martin McNally
Dr. Willem-Jan Metsemakers
Mr. Jamie Ferguson
Dr. Michael Diefenbeck

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Industry Symposia A

Thursday 6 September, 12.50 - 13.50 | **Room: Finlandia Hall**

BONESUPPORT™

Evolution of local antibiotic delivery in the management of bone infection

Speakers:
Mr. Martin McNally
Dr. Willem-Jan Metsemakers
Mr. Jamie Ferguson
Dr. Michael Diefenbeck

Bonalive Satellite Symposium
Friday September 7, 12:35-13:35
Room: Finlandia Hall

Smart Healing Solutions for Bone Infection Treatment

European Bone & Joint Infection Society
EBJIS

EBJIS 2018
Helsinki, Finland
September 6-8, 2018

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12:35-12:45	**Introduction** Dr. Fredrik Ollila, Finland
12:45-12:55	**Stimulating our own biological machinery to drive regeneration. Can this be done?** Assoc. Prof. Nina Lindfors, Finland
12:55-13:05	**What is the role of S53P4 bioactive glass in septic non-union surgery** Dr. Martin Glombitza, Germany
13:05-13:15	**S53P4 bioactive glass – a highly cost-effective solution in clinical treatment of chronic osteomyelitis** Dr. Jan Geurts, the Netherlands
13:15-13:25	**First steps towards regenerating segmental defects with S53P4 bioactive glass** Prof. Thierry Bégué, France
13:25-13:35	**Discussion**

Industry Symposia B

Friday 7 September, 12.35 - 13.35 | **Room: Finlandia Hall**

bonalive

Smart Healing Solutions for Bone Infection Treatment

As the world seeks answers to the growing threat of antibiotic resistance, Bonalive's Smart Healing solutions represent a new standard in patient care. Evolving at the intersection of technology and human biology, the Bonalive technologies reduce the need for antibiotic treatments and enable a better quality of life for patients.

Please join our symposium to learn about the latest experiences in the use of Bonalive® bioactive glass in bone infection surgery.

12:35-12:45	Introduction | Dr. Fredrik Ollila, Finland
12:45-12:55	Stimulating our own biological machinery to drive regeneration. Can this be done? | Assoc. Prof. Nina Lindfors, Finland
12:55-13:05	What is the role of S53P4 bioactive glass in septic non-union surgery | Dr. Martin Glombitza, Germany
13:05-13:15	S53P4 bioactive glass – a highly cost-effective solution in clinical treatment of chronic osteomyelitis | Dr. Jan Geurts, the Netherlands
13:15-13:25	First steps towards regenerating segmental defects with S53P4 bioactive glass | Prof. Thierry Bégué, France
13:25-13:35	Discussion

Please note that this symposium will be live streamed.

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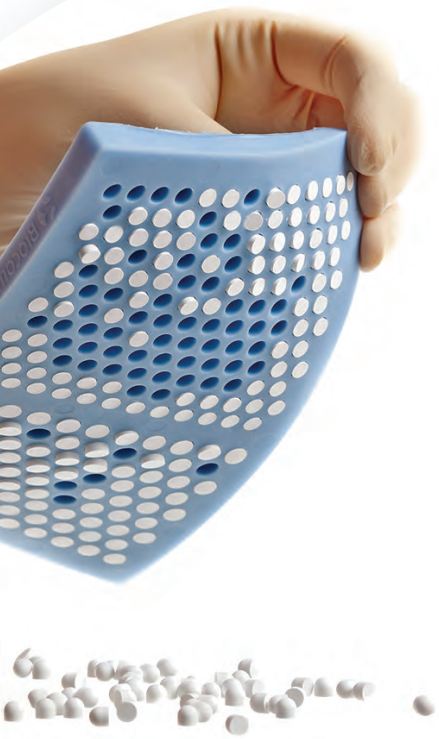

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Industry Symposia C

Friday 7 September, 12.35 - 13.35 | **Room: Helsinki Hall**

Biocomposites®

Lessons Learnt and Positive Outcomes: Over 300 Challenging Patients Across 2 University Hospitals

Speakers:

Dr Deepa Nayar
Consultant Medical Microbiologist
County Durham and Darlington NHS Foundation Trust

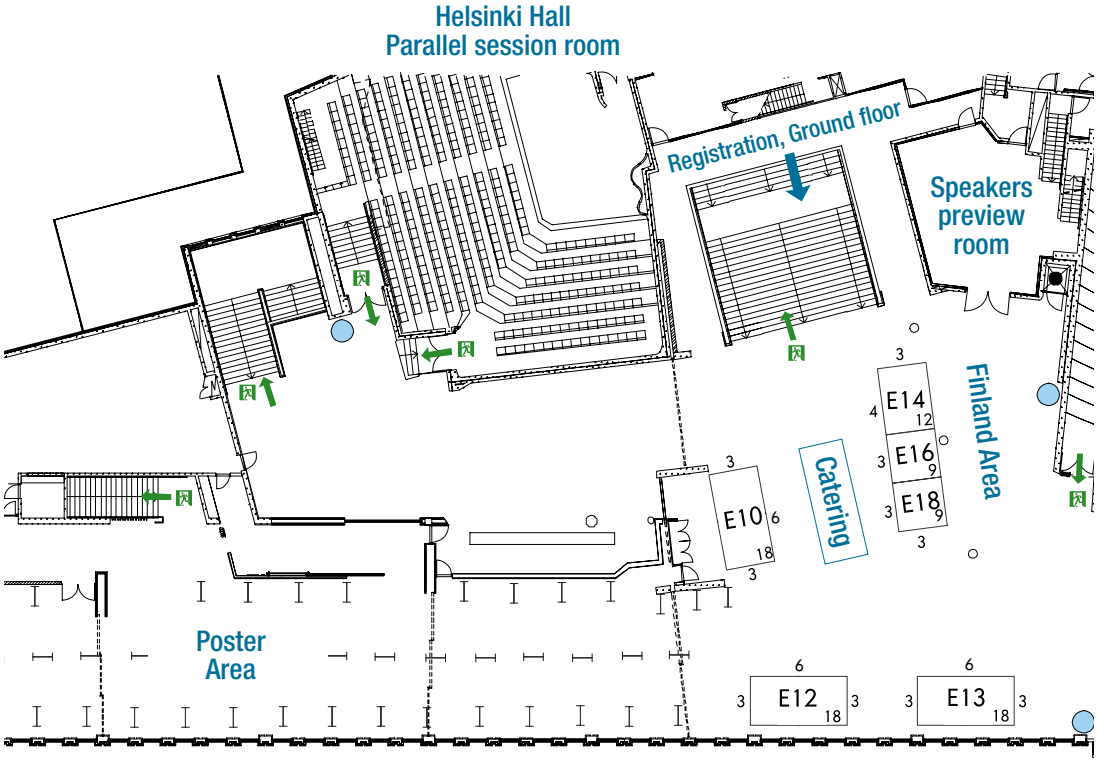
Mr Chris Gooding
Consultant Trauma and Orthopaedic Surgeon
Cambridge University Hospital NHS Foundation Trust, Associate Lecturer University of Cambridge

Exhibitor directory

Company	Contact details	Company description
Biocomposites	**Biocomposites Ltd** info@biocomposites.com Tel: +44 (0) 1782 338 580 www.biocomposites.com Booth E12	At Biocomposites, we are distinct in that our team of specialists is singularly focused on the development of innovative calcium compounds for surgical use. We are proud to be driving improved outcomes across a wide range of clinical applications, in musculoskeletal infection, trauma, spine and sports injuries, for surgeons and patients alike.
bonalive	**Bonalive Biomaterials Ltd** contact@bonalive.com Tel: +358 (0)401 77 44 00 www.bonalive.com Booth E14	At the intersection of technology and human biology, Bonalive® granules reduces the need for antibiotics in the resolution of chronic bone infections. Bonalive Biomaterials provides patients and surgeons with well-proven and safe bone regenerative products in orthopedics, trauma, spine, septic bone and ear surgery. It's time to heal smarter. #SmartHealing
BONESUPPORT™	**BONESUPPORT AB** info@bonesupport.com Tel: +46 46 286 53 70 www.bonesupport.com Booth E10	BONESUPPORT™ is an orthobiologic company specializing in the development of innovative injectable bone graft substitutes that remodel into bone within 6 to 12 months. Used in more than 35,000 patients, and includes the only CE marked injectable antibiotic eluting bone graft substitutes; CERAMENT®IG with gentamicin, and CERAMENT® V with vancomycin.
correvio	**Correvio International SARL** info@correvio.com Tel.: +41 (0)22 907 79 70 www.correvio.com Booth E26	Correvio is a rapidly growing specialty biopharmaceutical, dedicated to the development and commercialization of new therapies that will improve the health of patients suffering from heart disease and infectious disease worldwide. Correvio's mission is to offer patients and healthcare providers innovative therapeutic options that effectively, safely, and conveniently manage acute medical conditions.
G21 STRENGTH FOR LIFE	**G21 S.r.l.** info@g-21.it Tel.: +39 053 530 312 www.g-21.it Booth E24	G21 is a leading developer and manufacturer of bone cements and acrylic resins with years experience in orthopedics, oncology orthopedics and minimal invasive spine surgery. We are proud to affirm our unique and complete range of products for PJI care, in particular our custom modular spacer SpaceFlex for hip, knee and shoulder.
Heraeus	**Heraeus Medical GmbH** contact.medical@heraeus.com Tel: +49 6181 35 3399 www.heraeus.com Booth E13	Heraeus Medical stands for delivering value to the patient, the healthcare professional and the healthcare system through innovation and evidence based medicine in Implant Fixation, Infection Management and regenerative treatments for bone, cartilage and soft tissue. Over the years the company built up extensive experience in the field of therapeutic support for PJI with local antibiotics and is a reliable and committed partner in all aspects that deal with the management of musculoskeletal infections.

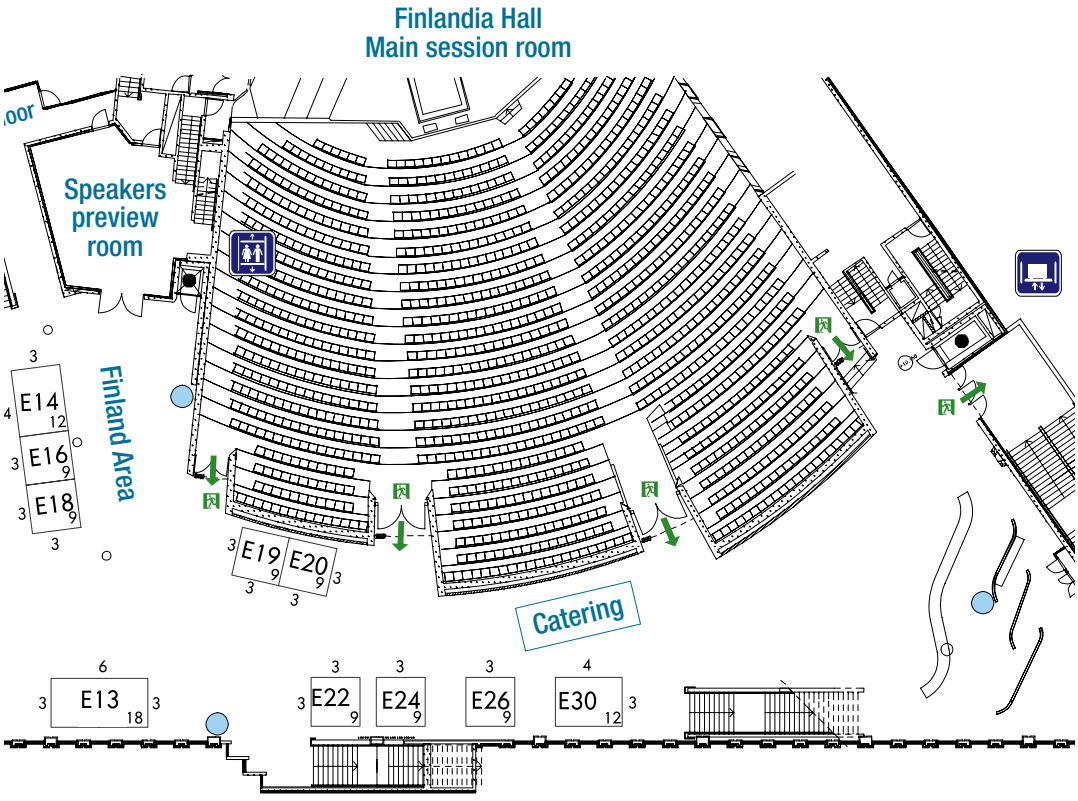
Company	Contact details	Company description
LYFSTONE	**Lyfstone AS** eivind@lyfstone.com Tel: +47 960 19681 www.lyfstone.com Booth E19	Lyfstone AS is a molecular biology company developing informative and functional biomarkers for the orthopaedic market. Our mission is to provide the orthopaedic health care professionals with better tools to make informed decisions and delivering the best patient care. Lyfstone AS has developed, and obtained the CE label for a novel PJI biomarker, measuring Calprotectin in synovial fluid biopsis. Lyfstone Calprotectin excludes PJI within 15 minutes.
NuVasive Specialized Orthopedics	**NuVasive Specialized Orthopedics, Inc.** mriepertinger@nuvasive.com Tel: +49 162 214 8164 www.nuvasive.com Booth E22	NuVasive is a world leader in minimally invasive, procedurally-integrated solutions. From complex spinal deformity to limb length discrepancy and non-union solutions, NuVasive is transforming surgery with innovative technologies designed to deliver reproducible surgical outcomes. The PRECICE® system provides remote control technology for the treatment of limb length discrepancies and non-unions. For more information, visit nuvasive.com.
Planmed	**Planmed** sales@planmed.com Tel. +358 20 7795 300 www.planmed.com Booth E16	Planmed designs, manufactures and markets advanced medical imaging equipment. Planmed mammography and orthopedic imaging products are known for performance, design, and ergonomics. Since 1989, Planmed has helped to improve the quality of healthcare around the world. Planmed belongs to Planmeca Group, a leading medical and dental company based in Finland.
TECRES	**Tecres S.p.a.** info@tecres.it Tel: +39 045 9217311 www.tecres.it Booth E20	Tecres has got years of experience as manufacturer of bone cements for orthopaedics. Cemex bone cements and Spacers, the unique temporary antibiotics-loaded prostheses for two-stage septic revision, are successfully sold world-wide. These products are available also in the combination Vancomycin-Gentamicin. CalCEMEX is our innovative reinforced bone substitute.
ZIMMER BIOMET Your progress. Our promise.®	**Zimmer Biomet** Tel: +41 58 854 80 00 www.zimmerbiomet.com Booth E30	Founded in 1927 and headquartered in Warsaw, Indiana, Zimmer Biomet is a global leader in musculoskeletal healthcare. We design, manufacture and market orthopaedic reconstructive products; sports medicine, biologics, extremities and trauma products; office based technologies; spine, craniomaxillofacial and thoracic products; dental implants; and related surgical products.

Floor plan



Exhibiting companies

E10	Bonesupport AB	**E19**	Lyfstone AB
E12	Biocomposites Ltd.	**E20**	Tecres spa
E13	Heraeus Medical GmbH	**E22**	NuVasive Specialized Orthopedics, Inc.
E14	Bonalive Biomaterials Ltd	**E24**	G21 S.r.l.
E16	Planmed	**E26**	Correvio International SARL
E18	Medanta	**E30**	Zimmer Biomet


Finlandia Hall
Main session room
Speakers preview room
Finland Area
E14
E16
E18
E19
E20
Catering
E13
E22
E24
E26
E30

Oral Abstracts

Best Papers

Free Papers A-J

[BP1] EPIDEMIOLOGY OF 17.527 BONE AND JOINT INFECTIONS ADDRESSED IN REFERRAL CENTERS IN FRANCE BETWEEN 2012 AND 2016

Adrien Lemaignen[1], Pascal Astagneau[2], Simon Marmor[3], Tristan Ferry[4], Piseth Seng[5], Didier Mainard[6], Jean-Yves Jenny[7], Frederic Laurent[8], Marion Grare[9], Anne Jolivet-Gougeon[10], **Eric Senneville**[11], Louis Bernard[1]

[1] *University Hospital of Tours, Infectious Diseases, Tours, France*
[2] *Cclin Paris Nord, Paris, France*
[3] *Gh Diaconesses-Croix-Saint-Simon, Centre de Référence des Infections Ostéo-Articulaires Complexes, Paris, France*
[4] *Maladies Infectieuses, Chu de Lyon, Lyon, France*
[5] *Ap-Hm, Ihu Mediteranean Infection, Marseille, France*
[6] *Chru de Nancy, Orthopaedic, Nancy, France*
[7] *University Hospital Strasbourg, Ccom, Illkirch, France*
[8] *Centre International de Recherche En Infectiologie - Hospices Civils de Lyon, Lyon, France*
[9] *Chu de Toulouse, Toulouse, France*
[10] *Chu de Rennes, Rennes, France*
[11] *Dron Hospital, Infectious Diseases, Tourcoing, France*

Aim: Bone and joint infections (BJI) are associated with a heavy morbidity and high health costs. Comorbidities, device associated infections and complicated journeys are associated with increased mortality, treatment failures and costs. For this reason, 24 referral centers (RC) have been created in 2009 in order to advise about management of "complex" BJI in weekly multidisciplinary meetings (MM). Since end of 2012, data from these meetings are gathered in a national database. We aimed to describe the data from this French registry of BJI and determine factors associated with the definition of "complex" BJI.

Method: Demographic, clinical, microbiologic and therapeutic characteristics of patients are systematically recorded in the database. Data from the first presentation in RC for each adult patients are presented. Complexity of BJI is recorded after each meeting according to 4 criteria (first failure, complex antibiotic therapy, precarious underlying conditions or complex surgical procedure). Part of unavailable data have been completed by pattern extraction from text-encoded commentaries. Factors associated with complexity were determined by multivariate logistic regression.

Results: From 2012 to 2016, 17.527 patients were included corresponding to 30.300 presentations in MM. Median age was 64 years (IQR 50-76) with masculine predominance (61.8%). Comorbidity was present in 50.3%, with at least 2 comorbidities in 26%. Prosthetic joint infection represented 41.4% of patients, followed by chronic osteitis with/without foreign material (24%). Definite microbiologic documentation was available in 68.8% of cases, mostly *Staphylococcus aureus* (43.9%) followed by Coagulase negative *Staphylococci* (28.6%) and enterobacteriaceae (23.1%), with 27.4% of polybacterial infections. Antibiotic treatment was proposed in 81.6% and surgery in 70% of cases. BJI were defined as complex in 55.4%, mostly because underlying conditions (50%), and in 57.6% with at least 2 complexity criteria. Factors positively associated with definition of complexity in MM were: background: number of comorbidities, immunodeficiency, neoplasia, liver or kidney failure, intra-cardiac device; microbiology: Mycobacteria, Fungus, MRSA, MSSA, MR-CoNS, MDR enterobacteria, non-fermentative BGN, and atypical pathogens (actinomycetes, nocardia, intra-cellular …); infection characteristics: prosthetic joint infection, osteitis, foreign material infection, arthritis and number of infected sites; surgical procedures: surgical flap, 2 stages prosthesis exchange, spacer, arthrodesis, and joint removal. Simple debridement was negatively associated with complex definition.

Conclusions: This registry is the first national prospective database about management of BJI in France and provide many information about epidemiology and management of BJI in France, as well as a more precise definition of complexity.

[BP2] FACTORS AFFECTING BONE FORMATION IN INFECTED DEFECTS, FILLED WITH AN ABSORBABLE, ANTIBIOTIC-LOADED BONE SUBSTITUTE

Jamie Ferguson[1], Michael Diefenbeck[1], Martin McNally[1]

[1] *Bone Infection Unit, Nuffield Orthopaedic Centre, Oxford University Hospitals, Oxford, United Kingdom*

Aim: Antibiotic-loaded biomaterials are often used in dead space management after excision of infected bone. This study assessed the chronological progression of new bone formation in infected defects, filled only with an absorbable, osteoconductive bone void filler with Gentamicin (1).

Method: 163 patients were treated for osteomyelitis or infected fractures with a single-stage excision, implantation of antibiotic carrier, stabilisation and wound closure. All had Cierny & Mader Type III (n=128) or Type IV (n=35) infection. No bone grafting was performed in any patient.

Patients were followed up for a minimum of 12 months (mean 21.4 months; 12-56). Bone void filling was assessed on serial digitised, standardized radiographs taken immediately after surgery, at 6 weeks, 3, 6 and 12 months and then yearly. Data on defect size, location, degree of void filling, quality of the bone-biomaterial interface and material leakage were collected.

Bone formation was calculated at final follow-up, as a percentage of initial defect volume, by determining the bone area on AP and lateral radiographs to the nearest 5%.

Results: 138 patients had adequate radiographs for assessment. Infection was eradicated in 95.7%. 2.5% of patients suffered a fracture during follow-up. Overall, bone formation was good (mean 73.8% defect filling), with one quarter of patients having complete defect filling and 87% having more than 50% of the defect healed. Bone formed better in metaphyseal defects compared to diaphyseal defects (mean 79% filling vs 66%; $p<0.02$). Good interdigitation of the biomaterial with the host bone, seen on the initial radiograph, was associated with more bone formation (77% vs 69%; $p=0.021$). Leakage of the biomaterial out of the defect reduced mean bone formation from 77% to 62% ($p=0.006$).

38 cases had radiographs more than 2 years after implantation. In 24 (63.2%), bone formation continued to increase after the first year radiograph.

Conclusion: This biomaterial was effective in allowing significant amounts of bone to form in the defect. This removed the need for bone grafting in this series, with a low risk of fracture or recurrent infection. However, bone formation is affected by the site of the lesion and the adequacy of filling at surgery. It is important to achieve good contact between the bone surface and the biomaterial at operation. Bone formation is slow and progresses for at least 2 years after implantation, in two thirds of patients.

(1) Cerament G

[BP3] THE DIAGNOSTIC ACCURACY OF 18F-FDG-PET/CT IN DIAGNOSING FRACTURE RELATED INFECTIONS: A RETROSPECTIVE DUAL CENTER COHORT STUDY

Justin Lemans[1], Monique Hobbelink[1], Frank IJpma[2], Janna van den Kieboom[1], Paul Bosch[2], Loek Leenen[1], Moyo Kruyt[1], Joost Plate[1], Andor Glaudemans[2], Geertje Govaert[1]

[1] *University Medical Center Utrecht, Utrecht, Netherlands*
[2] *University Medical Center Groningen, Groningen, Netherlands*

Aim: Diagnosing Fracture Related Infections (FRI) is challenging. White blood cell (WBC) scintigraphy is considered the best nuclear imaging technique to diagnose FRI; a recent study by our group found a diagnostic accuracy of 92%. However, many centers use ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F-FDG-PET/CT) which has several logistic advantages. Whether ^{18}F-FDG-PET/CT has better diagnostic performance than white blood cell (WBC) scintigraphy is uncertain. Therefore, we aimed: 1) to determine the diagnostic performance of ^{18}F-FDG-PET/CT for diagnosing FRI (defined as infection following an open fracture or fracture surgery) and 2) to determine cut-off values of standardized uptake values (SUV) that result in optimal diagnostic performance.

Method: This retrospective cohort study included all consecutive patients who received ^{18}F-FDG-PET/CT to diagnose FRI in two level 1 trauma centers. Baseline demographic- and surgical characteristics were retrospectively reviewed. The reference standard consisted of at least 2 representative microbiological culture results or the presence or absence of clinical confirmatory FRI signs in at least 6 months of clinical follow-up. A nuclear medicine specialist, blinded to the reference standard, re-reviewed all scans. Additionally, SUVs were measured using the "European Association of Nuclear Medicine Research Ltd. (EARL)" reconstructed ^{18}F-FDG-PET/CT scans. Volume of interests were drawn around the suspected- and corresponding contralateral area to obtain the absolute values (SUVmax) and the ratio between suspected and contralateral area (SUVratio). Diagnostic accuracy of the re-reviewed scans was calculated (sensitivity and specificity). Additionally, diagnostic characteristics of the SUV measurements were plotted in the area under the receiver operating characteristics curve (AUROC). The sensitivity and specificity at the optimal threshold was deducted from the AUROC with the Q-point method.

Results: 158 ^{18}F-FDG-PET/CTs were included. Mean age was 46.2 years, 71.5% was male. Most cases (56.3%) were tibial shaft- or ankle fractures. Sixty patients (38.0%) had FRI. The sensitivity and specificity of the FDG-PET/CT scan was 70.0% (95% CI 56.8-81.2) and 79.6% (95% CI 70.3-87.1) respectively. Diagnostic accuracy was 76.0% (95% CI 68.5-82.4). AUROCs of SUVmax and SUVratio were 0.80 (95% CI 0.73-0.87) and 0.73 (95% CI 0.64-0.81), respectively. The optimal SUVmax threshold of 4.2 resulted in 80.0% sensitivity and 71.3% specificity, while an SUVratio of 2.9 resulted in 58.3% sensitivity and 80.9% specificity.

Conclusions: The ^{18}F-FDG-PET/CT has a sensitivity of 70.0%, specificity of 79.6% and a diagnostic accuracy of 76.0%. This makes ^{18}F-FDG-PET/CT less accurate than WBC scintigraphy in diagnosing FRI, although adding SUV measurements may possibly increase its diagnostic accuracy.

[BP4] MICROBIOLOGY OF OSTEOMYELITIS AT THE OXFORD BONE INFECTION UNIT: MRSA RATES FALLING

Maria Dudareva[2], Andrew Hotchen[1], Susanne Hodgson[1], Bridget Atkins[3], Jamie Ferguson[3], Martin McNally[3]

[1] *University of Oxford, United Kingdom*
[2] *Department of Microbiology, John Radcliffe Hospital, Oxford University Hospitals NHS Foundation Trust, Oxford, United Kingdom*
[3] *Nuffield Orthopaedic Centre, Oxford University Hospitals, Oxford University Hospitals, Oxford, United Kingdom*

Aim: This study quantified changes in the microbiology of osteomyelitis in a single specialist centre within the UK. The rate of infection with multi-drug-resistant (MDR) bacteria was measured over a ten year period in 388 patients.

Method: Patients with confirmed osteomyelitis who received curative surgery from 2013-2017 were included (n=222). Microbiology was compared to patients from a cohort between 2001-2004, using the same diagnostic criteria (n=166).[1] The proportion of MDR bacterial pathogens[2] from deep tissue culture in these cohorts were compared. Pathogens were analysed according to aetiology and the presence of metal-work.

Results: Both cohorts had similar baseline characteristics. A median of five tissue samples were submitted for each patient. The proportions of specific pathogens remained unchanged between the two cohorts, with the exception of a decrease in the proportion of coagulase-negative *Staphylococcus* (CoNS) (12.7% vs 5.3%, p<0.05). Although the overall proportion of *Staphylococcus aureus* remained similar, the rate of MRSA infection decreased in the 2013-2017 cohort when compared to the 2001-2004 cohort (30.7% vs. 10.5% of *Staphylococcus aureus*, p<0.05). However, the proportion of MDR *Enterococcus*, *Pseudomonas* and Enterobacteriaceae did not differ between the two cohorts (37.3% vs. 35.7%).

There were no differences in microbiology of the 2013-2017 cohort that related to presence of metal-work or aetiology of infection. A higher proportion of haematogenous osteomyelitis were culture-negative compared to other aetiologies (37.1% versus 20.3%).

Conclusions: In this UK centre over the past 10 years, rates of MRSA osteomyelitis have fallen by two thirds, which is in line with the reducing rate of MRSA bacteraemia nationally. However, the proportion of other MDR bacteria remained unchanged. A decrease in the proportion of CoNS may reflect improved sampling technique and culture. Furthermore, this study demonstrated that classification by aetiology or the presence of metal-work does not predict the pathogen in adults with chronic osteomyelitis.

References

[1] Sheehy et al. 2010. J Infect 60:338-343
[2] Magiorakos et al. 2012. Clin Microbiol Infect 18:268–281

[BP5] IMPACT OF STAPHYLOCOCCUS AUREUS INFECTION ON BONE HOMEOSTASIS

William Mouton[1], Alan Diot[2], Trouillet-Assant Sophie[3], Jérôme Josse[4], Jocelyne Caillon[2], Bouvard Daniel[3], Cédric Jacqueline[4], **Frederic Laurent**[3]

[1] *Institute for Infectious Agent - Croix Rousse Hospital-HCL, French National Reference Centre for Staphylococci, International Centre for Infectiology Research, Lyon, France*
[2] *Universite Medecine, Microbiology, Nantes, France*
[3] *Institut Albert Bonniot, Grenoble, France*
[4] *Irs2 - Nantes Biotech, Ea3826, Nantes University, Nantes, France*

Aim: Staphylococcus aureus (SA) chronic bone and joint infections (BJI) are characterized by a progressive destruction of bone tissue associated to SA persistence which results in a large number of relapses (10-20%). The main factors proposed for these failures are: i) a weak diffusion of antibiotics in bone tissue, ii) formation of biofilm, iii) the bacterial internalization by the cells responsible for bone mineralization, namely the osteoblasts (OB).

Our *in vitro* and *in vivo* work aimed at providing new information on the impact of SA, more specifically of internalized SA, on bone homeostasis.

Method: Effect of SA infection (8325-4/FnBP+; DU5883/FnBP-) on the viability, differentiation and mineralization of an OB cell line was measured *in vitro* by MTT and Phosphatase Alcaline (PAL) activity assays and quantification of calcium deposits using Alizarin red, respectively. A gentamicin protection assay (GPA) confirmed that the effects observed are due solely to the internalized SA. *In vivo*, X-ray microtomography (µCT) and 3D reconstruction was used to evaluate the impact of SA infection on bone formation and bone resorption in a mouse model of femur infection.

Results: *In vitro*, the infection of pre-OB decreases their capacity of differentiation into mature OB displaying a PAL activity. This effect depends on both the multiplicity of infection and invasion capacities of the strains used (8325-4 (invasion competent) vs DU5883 (invasion incompetent)). The infection delays mineralization after 5 days ($p < 0.0001$), likely due to a cytotoxic effect. Indeed, after bacterial clearance at J21, this delay is made up (no difference between infected and uninfected cells). These results are consistent with the preliminary *in vivo* observations (µCT) showing a significant decrease in the thickness of trabecular of infected femurs with 8325-4 compared to DU5883 and non-infected femurs ($p < 0, 0041$).

Conclusions: These results suggest that the internalization of SA leads to an imbalance of bone remodeling, in particular by a cytotoxic effect on the pre-OB and a slowed-down formation of bone tissue by OB, leading to a significant bone loss. The ongoing study of the cellular and bacterial mechanisms involved in this internalization should allow a better management of chronic BJI.

[BP6] SURGICAL SITE INFECTIONS FOLLOWING IMPLANT REMOVAL: THE EFFECT OF ANTIBIOTIC PROPHYLAXIS; RESULTS OF THE WIFI-TRIAL.

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Aim: Following clean (class I, not contaminated) surgical procedures, the rate of surgical site infection (SSI) should be less than approximately 2%. However, an infection rate of 12.2% has been reported following removal of orthopedic implants used for treatment of fractures below the knee. The objective of this trial was to evaluate the effect of a single dose of preoperative antibiotic prophylaxis on the incidence of SSIs following removal of orthopedic implants used for treatment of fractures below the knee.

Method: This multicenter, double-blind, randomized clinical trial included 500 patients from 19 hospitals with a follow-up of 6 months. Eligible were patients aged 18 to 75 years with previous surgical treatment for fractures below the knee who were undergoing removal of orthopedic implants. Exclusion criteria were an active infection or fistula, antibiotic treatment, reimplantation of osteosynthesis material in the same session, allergy for cephalosporins, known kidney disease, immunosuppressant use, or pregnancy. The intervention was a single preoperative intravenous dose of 1000 mg of cefazolin (cefazolin group, n = 228) or sodium chloride (0.9%; saline group, n = 242). Primary outcome was SSI within 30 days as measured by the criteria from the US Centers for Disease Control and Prevention. Secondary outcome measures were functional outcome, health-related quality of life, and patient satisfaction.

Results: Among 477 randomized patients (mean age, 44 years [SD, 15]; women, 274 [57%]; median time from orthopedic implant placement, 11 months [interquartile range, 7-16]), 470 patients completed the study. Sixty-six patients developed an SSI (14.0%): 30 patients (13.2%) in the cefazolin group vs 36 in the saline group (14.9%) (absolute risk difference, -1.7 [95% CI, -8.0 to 4.6], P = .60).

Conclusions: In patients undergoing surgery for removal of orthopedic implants used for treatment of fractures below the knee, a single preoperative dose of intravenous cefazolin compared with placebo did not reduce the risk of surgical site infection within 30 days following implant removal.

[BP7] THE EFFECT OF LOCAL ANTIBIOTIC PROPHYLAXIS IN OPEN LIMB FRACTURES: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Aim: Alongside debridement and irrigation, soft tissue coverage and osseous stabilization, systemic antibiotic prophylaxis is considered the gold standard in the management of open fractures and considerably reduces the risk of subsequent fracture-related Infections (FRI). The direct application of antibiotics into the surgical field (local antibiotics) has been used for decades as additional prophylaxis in open fractures, although definitive evidence confirming a beneficial effect is scarce. The purpose of the present study was to review the clinical evidence regarding the effect of prophylactic application of local antibiotics in open limb fractures.

Method: A comprehensive literature search was performed in PubMed, Web-of- Science and Embase. Cohort studies investigating the effect of additional local antibiotic prophylaxis compared to systemic prophylaxis alone in the management of open fractures were included and the data were pooled in a meta-analysis.

Results: Eight studies, with a total of 2738 patients were eligible for quantitative synthesis. Six of these studies investigated the effect of antibiotic loaded PMMA beads and two studies evaluated the effect of local antibiotics applied without a carrier. Meta-analysis showed a significantly lower infection rate when local antibiotics were applied (4.7%;94/1996) than in the control group receiving standard systemic prophylaxis alone (16.2%;129/797) (p-value < 0.001) (OR 0.30; 95%CI 0.22–0.40).

Conclusions: This meta-analysis suggests a clear risk reduction in FRI if additional local antibiotics are given prophylactically for open limb fractures. However, due to limited quality, heterogeneity and considerable risk of bias, the pooling of data from primary studies has to be interpreted with caution.

[BP8] MOLECULAR TYPING SHOWS THE NEED FOR A NEW DEFINITION OF CUTIBACTERIUM ACNES ORTHOPEDIC-DEVICE RELATED INFECTIONS.

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Aim. *Cutibacterium acnes*, a skin commensal, is responsible for 5-10% of prosthetic joint infections (PJI). All current microbiological definitions of PJI require two or more identical commensal isolates to be recovered from the same procedure to diagnose PJI and rule out contamination. Unlike coagulase negative staphylococci, *C.acnes* shows a highly stereotypical susceptibility profile making impossible to phenotypically assess the clonal relationship of isolates. In order to determine the clonal relationship of multiple *C.acnes* isolates recovered from arthroplasty revisions, we analyzed by multi-locus sequence typing (MLST) *C.acnes* isolates grown from orthopedic device-related infections (ODRI) in a reference center for bone and joint infection.

Methods. Laboratory records from January 2009 to January 2014 were searched for monomicrobial *C.acnes* ODRI with growth of *C. acnes* in at least 2 intraoperative and/or preoperative samples. Clinical, biological and demographic information was collected from hospital charts. All corresponding isolates biobanked in cryovials (-80°C) were subcultured on anaerobic blood agar, and identification confirmed by MALDI-TOF-MS. *C.acnes* isolates were typed using the MLST scheme described by Lomholt *et al*. Plasmatic pre-operative C-reactive protein (CRP) levels were determined using DimensionEXL (Siemens). A threshold of 10 mg/L was used to determine serologically positive ODRIs from negatives.

Results. Over a 5-year period, 37 cases of monomicrobial C.acnes ODRI were diagnosed in our center. Among these 37 cases, 113/153 C.acnes isolates were cryopreserved. 110/113, corresponding to 36/37 cases, were typed by MLST: 14/36 (39%) ODRI cases were found to feature isolates belonging to two or more different STs and were qualified to be heteroclonal whereas 22/36 (61%) of ODRI cases were found to feature isolates belonging to the same ST and were qualified to be homoclonal. Homoclonal infections were significantly more likely to have elevated CRP levels compared to heteroclonal cases (p=0.0011, Fisher test). Patients with only two positive intraoperative samples had significantly lower CRP values than patients with three or more positive intraoperative samples (12,7mg/L vs 67mg/L; p=0,01, homoscedastic two-tailed Student's t test).

Conclusions. This study suggests that what is classified microbiologically as *C.acnes* ODRIs comprises: i) true homoclonal infections eliciting an inflammatory response, ii) heteroclonal infections lacking inflammatory response where *C.acnes* could be an innocent bystander and iii) false positives where no strain achieves true microbiological significance. Our study shows that a stricter threshold of 3 intraoperative positive samples could be more adequate than 2**.** These results reinforces the need for a more specific definition of *C.acnes* ODRI.

[BP9] PJI BY MULTI-DRUG AND EXTENSIVELY-DRUG RESISTANT GRAM NEGATIVE BACTERIA: A MULTI-CENTER COHORT STUDY

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Aim: Data on Prosthetic joint infection (PJI) caused by multi-drug resistant (MDR) or XDR (extensively drug resistant) Gram negative bacteria (GNB) are limited. Treatment options are also restricted. We conducted a multi-national, multi-center assessment of clinical data and factors of outcome for these infections.

Method: PJI were defined upon international guidelines. Data from 2000-2015 on demographics, clinical features, microbiology, surgical treatment and antimicrobial therapy was collected retrospectively. Factors associated with treatment success were evaluated by logistic regression analysis.

Results: A total of 133 PJI were evaluated. Female (n=84, 61.4%) and the elderly [mean age (+/-SD) 73 (12.7)] predominated. Diabetes mellitus was the most frequent comorbidity (n=42,32.1%) followed by rheumatoid arthritis (n=14,10.7). Most PJI were early infections (84.4 %). XDR accounted for 23 cases; half of them due to *Pseudomonas aeruginosa*. Prevalence of MDR or XDR GNB was not different between early and late PJIs (p=0.114). Overall, *P.aeruginosa* (n=25, 19.1%) was followed by *Klebsiella* spp (n=23,17.6%) and *Enterobacter* spp (n=22,16.8%). PJI was located at the hip (n=85 65.6%), knee (n=41,31.3%), shoulder (n=3,2.3%) and ankle (n=1, 0.8%). Clinical characteristics included soft tissue infection (66.4%), pain (51.1%), fever (32.1%) and sinus tract(29.8%). Surgery for PJIs consisted of DAIR (debridement, antibiotics and implant retention), (n=64, 49.6%), followed by explantation of the arthro-

plasty (n=32, 24.8%), two-stage revision (n=16, 12,4%), one stage revision (n=9, 7%), arthrodesis (n=2, 1.6%). Median duration of antibiotic therapy was 51 days (IQR 25-75: 40-90 days). Cure after treatment was assessed in 78 patients (58.6%). No-DAIR surgical procedures in PJIs were more likely to be successful compared to DAIR surgery (75.8% *vs* 50%, OR 3.13, 95% CI:1.47-6.70, p=0.003)both in early or late infections.

Conclusions: PJI by MDR/XDR GNB affects female, the elderly with comorbidities and previous surgery for PJI. *P.aeruginosa* is frequent, mostly XRD. No-DAIR procedures have higher probability of treatment success than DAIR even in early infection. Despite surgery and long-term antimicrobial administration, treatment success was less than 60%, probably reflecting the lack of effective treatment options.

[BP10] CLINICAL OUTCOME AND RISK FACTORS FOR FAILURE IN LATE ACUTE PROSTHETIC JOINT INFECTIONS TREATED WITH DEBRIDEMENT AND IMPLANT RETENTION

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Aim: Debridement, antibiotics and implant retention (DAIR) is the recommended treatment for all acute prosthetic joint infections (PJI). However, the efficacy of DAIR and identification of risk factors for failure in patients with late acute PJI, is not well described.

Method: Patients diagnosed with late acute PJI between 2005 and 2015 were retrospectively evaluated. Late acute PJI was defined as the development of acute symptoms (≤ 3 weeks) occurring ≥ 3 months after arthroplasty. Failure was defined as: i) the need for implant removal, ii) infection related death, iii) the need for suppressive antibiotic therapy due to persistent signs of infection and/or iv) relapse or reinfection during follow-up.

Results: 340 patients from 27 centers were included. The overall failure rate was 45.0% (153/340). Failure was dominated by *Staphylococcus aureus* PJI (54.7%, 76/139). Preoperative risk factors for failure according to the multivariate analysis were: fracture as indication for the prosthesis (odds ratio (OR) 5.4), rheumatoid arthritis (OR 5.1), COPD (OR 2.9), age above 80 years (OR 2.6), male gender (OR 2.0) and C-reactive protein >150 mg/L (OR 2.0). Exchanging the mobile components during DAIR was the strongest predictor for treatment success (OR 0.35).

Conclusions: Late acute PJIs have a high failure rate. Treatment strategies should be individualized according to patients' age, comorbidity, clinical presentation and microorganism causing the infection.

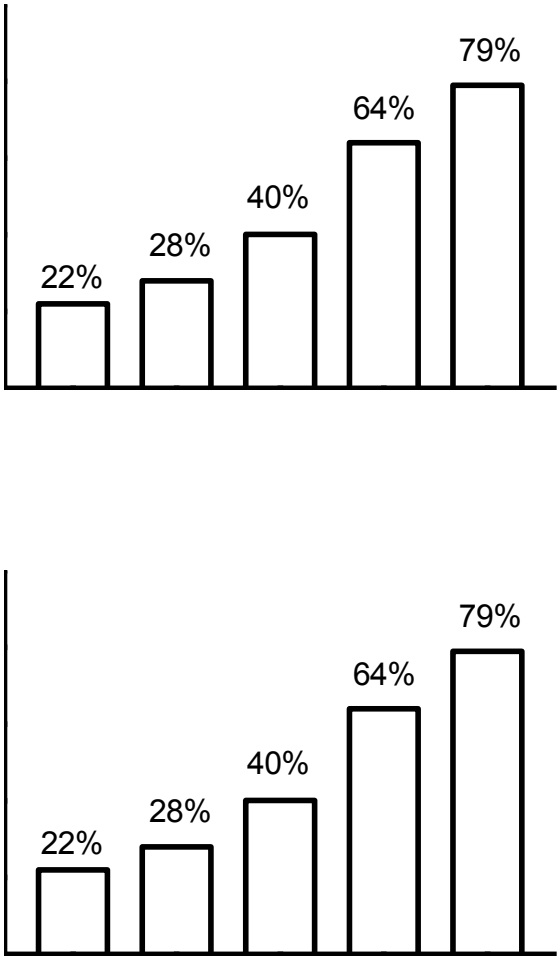

Figure 1. Preoperative risk score for DAIR failure (CRIME80).

[FP1] LATE ACUTE PROSTHETIC JOINT INFECTIONS; SHOULD THE IMPLANT BE REMOVED?

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Aim: Late acute prosthetic joint infections (PJI) treated with surgical debridement and implant retention (DAIR) have a high failure rate. The aim of our study was to evaluate treatment outcome in late acute PJIs treated with DAIR versus implant removal.

Method: In a large multicenter study, late acute PJIs were retrospectively evaluated. Failure was defined as: PJI related death or the need for prosthesis removal or suppressive antibiotic therapy because of persistent or recurrent signs of infection. Late acute PJI was defined as < 3 weeks of symptoms more than 3 months after the index surgery.

Results: A total of 445 patients were included, comprising 340 cases treated with DAIR and 105 cases treated with implant removal (19% one-stage revision (n=20), 74.3% two-stage revision (n=78) and 6.7% definitive implant removal (n=7). Overall treatment failure was 45.0% (153/340) in the implant retention group versus 24.8% (26/105) in the implant removal group (p < 0.001). This significant difference remained after 1:1 propensity-score matching for confounding preoperative variables. No difference in failure was observed between one- and two-stage revision (25.0% (5/20) versus 24.4% (19/78), respectively (p 0.95)). DAIR was an independent predictor for failure in the multivariate analysis (OR 2.7, p 0.006). A high preoperative risk score for DAIR failure defined by a CRIME80 score ≥3 which included

the exchange of the mobile components during DAIR as a protective factor, demonstrated a failure rate of 68.7% (57/83) in the DAIR group and a 16.7% failure rate (4/24) in the implant removal group ($p < 0.0001$). No significant difference in failure was observed with a CRIME80 score <3 (35.7% versus 23.9%, respectively (p 0.07).

Conclusions: Implant removal is associated with significantly better outcomes compared to debridement and implant retention in late acute PJIs with a high CRIME80 score and this should be taken into consideration when choosing the surgical strategy.

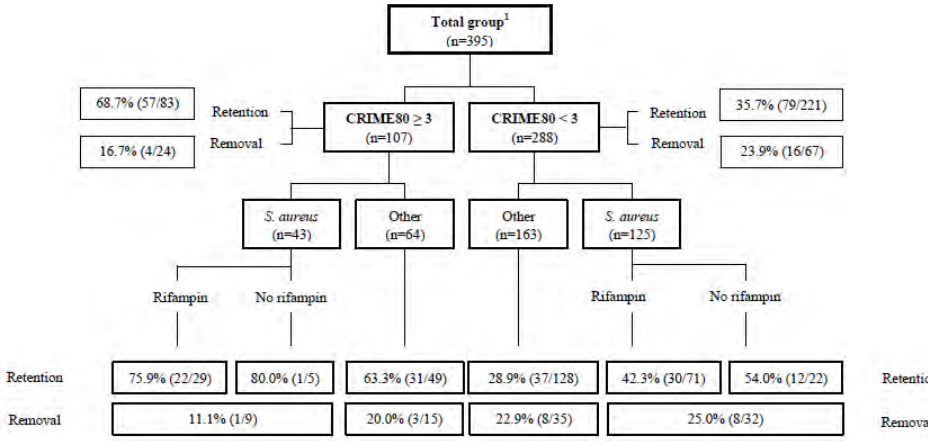

Figure 1. Failure rate late acute PJI according to the CRIME80 score. [1]Variables included in the preoperative CRIME80 risk score was complete in 395 out th 445 cases included in the study (88.8%). CRIME80 includes C-reactive protein and chronic obstructive pulmonary disease (C), rheumatoid arthritis (R), fractu as indication for the prosthesis (I), male gender (M), not exchanging the mobile components during DAIR (E), and age above 80 years as variables. For cases

[FP2] TACKLING EARLY PROSTHETIC JOINT INFECTION IN PRIMARY JOINT ARTHROPLASTY BY DEBRIDEMENT, ANTIBIOTICS AND IMPLANT RETENTION (DAIR)

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Aim: Prosthetic Joint Infection (PJI) remains one of the leading cause for revision arthroplasty.[1,2] Early recognition and appropriate initial treatment of early PJI with debridement, antibiotics and implant retention (DAIR) can eradicate infection on first attempt and prevent implant failure. We evaluated the outcome after one year of patients who were treated for an early PJI after primary total knee arthroplasty (TKA) or total hip arthroplasty (THA) with DAIR. Furthermore, we determined preoperative infection markers, microbiology, and treatment factors related to treatment failure after DAIR procedure.

Method: A retrospective cohort study was assembled with 91 patients undergoing DAIR after primary TKA or THP with a high suspicion of an early PJI. For all patients intraoperative cultures were obtained. Records were reviewed for demographic details, preoperative laboratory results, microbiological data, given treatment and postoperative follow-up. The primary outcome measure was infection-free implant survival at one year. Repeated DAIR was not considered as treatment failure.

Results: Following DAIR in early PJI the rate of infection-free implant survival was 83% (95% confidence intervals (CI) 79 to 91) at one year follow-up, including patients with multiple DAIR procedures. Univariate analysis indicate a higher failure rate in early PJI caused by *Enterococcus faecalis* (p=0.04). Multivariate analysis showed that a high C-reactive protein level (CRP >100) (odds ratio 7.5, 95% CI [1.4-39.7]) and multiple debridement procedures (≥2) (p=0.004, odds ratio 8.5, 95%CI [2.1-34.3]) were independently associated with treatment failure.

Conclusions: Significantly elevated preoperative serum inflammatory markers may indicate difficult-to-treat, fulminant infections. The winning team in the eradication of an early PJI on first attempt and prevent implant failure is adequate debridement and appropriate empiric antibiotics. To improve treatment success and prevent the need for multiple debridement procedures it is important to use the adequate debridement technique and to have knowledge about local bacterial resistance patterns. Inadequate use of debridement and/or antibiotics can contribute to treatment failure in early PJIs and consequently in saving the affected joint arthroplasty.

1. Bozic KJ. J Bone Joint Surg Am. 2009;91(1):128-33.

2. Bozic KJ. Clin Orthop Relat Res. 2010;468(1):45-51.

[FP3] PREDICTING FAILURE IN EARLY ACUTE PROSTHETIC JOINT INFECTION TREATED WITH DEBRIDEMENT, ANTIBIOTICS AND IMPLANT RETENTION: EXTERNAL VALIDATION OF THE KLIC SCORE

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Aim: Debridement, antibiotics and implant retention (DAIR) is a widely used treatment modality for early acute prosthetic joint infection (PJI). A preoperative risk score was previously designed for predicting DAIR failure, consisting of chronic renal failure (K), liver cirrhosis (L), index surgery (I), cemented prosthesis (C) and C-reactive protein >115mg/L (KLIC). The aim of this study was to validate the KLIC score in an external cohort.

Method: We retrospectively evaluated patients with early acute PJI treated with DAIR between 2006 and 2016 in three Dutch hospitals. Early acute PJI was defined as less than 21 days of symptoms and DAIR performed within 90 days after index surgery. Failure was defined as the need for 1) second DAIR, 2) implant removal, 3) suppressive antimicrobial treatment or 4) infection-related death within 60 days after debridement.

Results: A total of 386 patients were included. Failure occurred in 148 patients (38.3%). Patients with KLIC scores of ≤2, 2.5-3.5, 4-5, 5.5-6.5 and ≥7 had failure rates of 27.9%, 37.1%, 49.3%, 54.5% and 85.7% respectively (p<0.001, OR 1.33), in which one point increase in the KLIC score represents a 1.33 times higher risk of failure. The ROC curve showed an area under the curve of 0.64 (95% CI 0.59-0.69). A KLIC score higher than 6 points showed a specificity of 97.9%.

Conclusions: The KLIC score is a relatively good preoperative risk score for DAIR failure in patients with early acute PJI and appears to be most useful in clinical practice for patients with low or high KLIC scores.

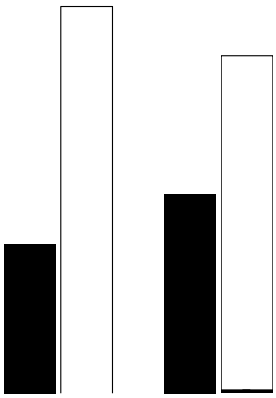

Figure 1: Percentage of failure after debridement per group of KLIC score

[FP4] STAPHYLOCOCCAL ACUTE POST-OPERATIVE PROSTHETIC JOINT INFECTION (PJI) TREATED WITH 'DAIR' (DEBRIDEMENT AND IMPLANT RETENTION) AND IMPACT OF RIFAMPIN: A RETROSPECTIVE COHORT STUDY IN FRANCE

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Aim: *S. aureus* and coagulase-negative staphylococci are the most frequent bacteria responsible for PJI. In patients with acute PJI (i.e. <1 month following the implantation), DAIR with exchange of removal components followed by a combination of antibiotics that includes rifampin (particularly rifampin+-fluoroquinolone) are recommended. Unfortunately, some patients could not receive rifampin due to drug-drug interaction or stopped it due to an adverse event. Finally, it was unclear if the dose and the duration of rifampin influenced the prognosis.

Method: We performed a retrospective cohort study in 4 hospitals and included patients with staphylococcal acute post-operative (< 1 month) PJI treated with DAIR in 2011-2016 period. Univariate and multivariate Cox analysis and Kaplan Meier curves were used to determine the risk factors for treatment failure (persistence of clinical signs, new surgery w/o persistence or superinfection, infection-related death).

Results: 79 patients were included (median age: 71 years [IQR 53-89]; 55 men [69.6 %]; median ASA score: 2 [IQR 2-3]). Bacterial cultures revealed 65 *S. aureus* (82.3 %) and 15 coagulase-negative staphylococci (19.0 %) infections, including 14 methicillin-resistant isolates (17.7 %). Among all isolates, only 2 (2.5 %) were resistant to rifampin and 16 (20.3 %) were resistant to fluoroquinolone. The median duration of antimicrobial therapy was 92 days (IQR 31-152). Only 59 patients received rifampin (74.7 %), and 35 (44.3 %) the combination rifampin + fluoroquinolone. Median duration of rifampin was 56.5 days (IQR 15.8-86.0) and median dose 14.6mg/kg/d (IQR 13.0-16.7). Forty patients (50.6 %) received rifampin in the first 2 weeks and 43 patients (54.4 %) received at least 2 weeks of rifampin. Six patients (7.6 %) developed an adverse event leading to rifampin interruption. During a median follow-up of 443 days (IQR 219.5-790.5), 21 patients (26.6 %) experienced a treatment failure including 12 persistence of the initial pathogen (57.1 %) and 9 superinfections (42.9 %). An ASA score >2 (OR 2.8; 95%CI 1.26-6.15), the use of rifampin (OR 0.4; 95% CI 0.71-0.95) and the duration of rifampin treatment (OR 0.83; 95%CI 0.75-0.92 per week of treatment) were significant determinants of the outcome (but not methicillin-resistance). Receiving >2 weeks of rifampin prevented the failure, but an introduction during the first 2 weeks did not influence the outcome.

Conclusions: In patients with staphylococcal acute PJI, the use of rifampin and its duration strongly influenced the prognosis. As 25% of patients could not receive rifampin, new drugs with anti-biofilm activity are required.

[FP5] IMMEDIATE POSTOPERATIVE START OF RIFAMPICIN IN PATIENTS WITH ACUTE STAPHYLOCOCCAL PJI TREATED WITH DAIR WAS NOT ASSOCIATED WITH DEVELOPMENT OF RIFAMPICIN RESISTANCE IN FAILURES

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Aim: There is a theoretical advantage for immediate postoperative start of rifampicin after debridement, antibiotics and implant retention (DAIR). Anti-biofilm treatment may be mostly needed during the first postoperative days in order to prevent new biofilm formation. However, there are concerns with regard to development of rifampicin resistance if rifampicin is started too early. Rifampicin monotherapy will rapidly result in rifampicin resistance, but this may not occur when prescribed as part of combination antimicrobial therapy and after thorough surgical debridement. We hypothesized that in this setting the probability of development of rifampicin resistance is very low. We evaluated the frequency of development of rifampicin resistance in patients with acute staphylococcal PJI who were treated with DAIR followed by immediate postoperative start of rifampicin in combination with a betalactam or glycopeptide.

Method: During 2003-2014, all patients with an acute staphylococcal PJI were treated with five days of high-dose rifampicin (600mg bid) in combination with at least 6 weeks of betalactam or glycopeptide antibiotics, both started immediately postoperative after DAIR. Clinical outcome and development of rifampicin resistance in patients who failed were monitored. Susceptibility testing for rifampicin was performed by Vitek 2 (Biomerieux). Until 2014, Clinical and Laboratory Standards Institute (CLSI) criteria for rifampicin resistance were applied (S ≤ 1), from 2014 EUCAST criteria (S ≤ 0.06) were applied.

Results: Forty-one patients with acute staphylococcal hip (22) of knee (19) PJI were included. Comorbidities were rheumatoid arthritis (22%), diabetes (10%), a tumor prosthesis due to malignancy (34%) and corticosteroid use (27%). Fifteen patients (37%) developed a failure after DAIR. Eight failures were caused by the same staphylococcal species as the initial PJI (six *Staphylococcus aureus*, two Coagulase-negative staphylococci). In all failures, rifampicin susceptibility of the isolate had not changed. One patient was started on chronic suppressive treatment (not including rifampicin) and had a prosthetic joint removal 18 months later. In this patient, one out of five positive cultures with *S. aureus* from the removed prosthesis showed a rifampicin resistant strain. In all failures, mean duration between the initial DAIR and failure was 208 days (range 7-636 days).

Conclusions: Immediate postoperative start of high-dose rifampicin in combination with betalactam or glycopeptide did not result in rifampicin resistant staphylococci among patient who had a failure with the same staphylococci. These results strongly indicate that immediate postoperative start of rifampicin is safe. Larger studies are needed to prove the clinical benefit of this strategy.

[FP6] CALPROTECTIN COST LESS AND IS AS ACCURATE AS ALPHA DEFENSIN IN EXCLUDING A CHRONIC PROSTHETIC JOINT INFECTION

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Aim: Diagnosing or excluding a chronic prosthetic joint infection (PJI) prior to revision surgery can be a clinical challenge. To enhance accuracy of diagnosis, several biomarkers were introduced in recent years, but most are either expensive or not available as a rapid test. We compared the diagnostic accuracy of leucocyte esterase (€0.20 per sample), calprotectin (€20 per sample) and alpha defensin (€200 per sample).

Method: We prospectively evaluated PJI patients with chronic pain with or without prosthetic loosening between 2017 and 2018. Synovial fluid was collected prior to revision surgery. Leucocyte esterase was measured using a reagent strip (2+ considered as positive), and calprotectin and alpha defensin were measured using a lateral flow immunoassay. Intraoperative cultures (5 periprosthetic tissue samples, synovial fluid and sonication fluid) incubated for 9 days, were used as gold standard. At least two positive cultures of low-grade microorganisms with the same antibiogram were required to diagnose PJI.

Results: A total of 19 patients were included (knee =11, hip =8). None of the patients were treated with antibiotics prior to revision surgery. A PJI was diagnosed in 8 patients (42.1%). The diagnostic accuracy of leucocyte esterase vs. calprotectin vs. alpha defensin was as follows; sensitivity 50.0% vs. 87.5% vs. 87.5%, specificity 81.8% vs. 90.9% vs. 100%, positive predictive value 60.0% vs. 87.5% vs. 100% and negative predictive value 75.0% vs. 90.9% vs. 91.6%, respectively. Both calprotectin and alpha defensin were false negative in one PJI caused by *Cutibacterium acnes*. The other two *C. acnes* PJIs were correctly diagnosed with both tests.

Conclusions: Calprotectin is as accurate as alpha defensin in excluding a chronic PJI at 10% of the costs. Future studies with a large number of patients are necessary to analyze its diagnostic accuracy in very low-grade infections, in particularly caused by *C. acnes*.

[FP7] IS LIFELONG ANTIBIOTIC SUPPRESSION SUCCESSFUL IN THE MANAGEMENT OF PROSTHETIC JOINT INFECTION

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Aim: Revision surgery and debridement and implant retention are recognised approaches for managing prosthetic joint infections (PJI) but may not always be indicated. If the patient is unable to have or declines surgery, prolonged suppressive antibiotic therapy (PSAT) is an option. This study aims to define outcomes of PSAT from a single unit.

Method: A retrospective study was performed. All cases of PJI involving the hip or knee between 2012 and 2017 were identified from our institutional database and cross referenced with patient notes. One hundred and seventy eight cases were identified. Of these, 23 (12.9%) (10 hips, 13 knees) were treated with PSAT. Infection was diagnosed based on the MSIS criteria in all cases and all cases were managed by a multidisciplinary team which included specialist microbiologists.

One case of long term antifungal therapy was additionally identified. Co-morbidity was assessed using the Charlson co-morbidity index.

Exacerbations of infection and need for further surgery were recorded.

Results: The mean age was 72 years (Range 35-93 years). The mean Charlson-score was 4.3 (range 1-7). Mean follow up was 24 months (Range 1-54 months). Antibiotics were commenced within 3 months of surgery in 20 cases and between 2 and 4 year following surgery in the remainder. Prolonged antibiotic therapy followed debridement and implant retention in 12 cases, single stage revision in 4 cases and 2 stage revisions in 3 cases. The average number of surgical procedures undergone by each patient prior to starting antibiotic suppression therapy was 1.8 (Range 1-4 procedures).

Staphylococcal species were isolated in 13 cases (MRSA 1, MSSA 5, Staph. Epidermidis 5, CONS 1, Staph Pasteuri 1). Escherichia Coli and Streptococci were isolated in 2 cases each. Four cases were due to polymicrobial infection. No organisms were identified in 2 cases. Candida Albicans was identified in 1 case.

All cases of infection were treated with prolonged oral antibiotics. Twenty patients (87%) received 6 weeks of intravenous antibiotics prior to commencing prolonged oral antibiotics.

Two patients experienced persistent symptoms and required amputation (both TKA). One immunocompromised patient required admission for sepsis related to their infected TKA.

The success rate of long term suppressive antibiotics was 87% (20/23) successful at an average 2 year follow up.

There was persistent wound discharge in 1 case (4.3%).

Conclusions: Prolonged suppressive antibiotic therapy is an effective option for management of PJI and related symptoms with a low incidence of complications in surgically resistant PJI.

[FP8] IS DEXAMETHASONE INFECTION SAFE IN TOTAL HIP AND TOTAL KNEE ARTHROPLASTY: RESULTS FROM 18 872 OPERATIONS

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Aim: Dexamethasone is often used as part of multimodal analgesia to prevent postoperative nausea and vomiting (PONV) and also to reduce postoperative pain. Because glucocorticoids have immunosuppressive and glucose-rising effects, the aim of current study was to examine if dexamethasone may be used safely in arthroplasty surgery.

Methods: All consecutive total primary and revision hip and knee arthroplasties performed in the Hospital District of Helsinki and Uusimaa, Peijas Hospital were analyzed (n=18 872). Emergency operations, for example total hip arthroplasties for femur fractures, were also included. Prospective surveillance for postoperative infections was performed. All infections meeting the Musculoskeletal Infection Society definition for prosthetic joint infection (PJI) were included.

Results: A total of 189 (1.0%) PJIs occurred: 0.8% after all primary arthroplasties and 1.9% after revision arthroplasties. The PJI rate after the emergency operations was 2.3 % (19/796). The PJI rate in the dexamethasone group was 1.1% (31/2 922) and in the non-dexamethasone group 1.0% (161/15 950), with no significant difference in the PJI incidence (P=0.773). The median time from the index operation to the infection was 16.0 (Q1–Q3 13.0–23.0) days. Total of 35 causative bacteria were cultured from the 31 PJI in dexamethasone group and 169 bacteria from the 161 PJI in non-dexamethasone group with no significant difference: *Staphylococcus aureus* (40.0% and 45.0%, respectively, P=1.000), *Staphylococcus epidermidis* (14.3% and 10.7%, P=0.375), other coagulase-negative staphylococci (11.4% and 11.8%, P=0.200), *Streptococcus agalactiae* (11.4% and 11.8%, P=0.695), *Streptococcus betahemolyticus G* (8.6% and 2.4%, P=0.081), other streptococci (0.0% and 4.1%, P=0.599), *Enterococcus faecalis* (2.9% and 5.3%, P=1.000), *Enterobacter cloacae* (2.9% and 3.6%, P=1.000), *Pseudomonas aeruginosa* (2.9% and 1.8%, P=0.502), and other bacteria (14.3% and 8.8%, P=0.544). Only one methicillin-resistant *Staphylococcus aureus* (MRSA) was detected in dexamethasone group. The proportion of polymicrobial PJIs was similar in both groups: 13.3% and 8.8%, respectively (p=0.495).

Conclusions: In our study material, the use of dexamethasone did not increase the incidence of postoperative PJI. The single 5-10 dose of dexamethasone may be safely used to prevent PONV and as part of multimodal analgesia on patients undergoing arthroplasty operation.

[FP9] AN ANTISTAPHYLOCOCCAL BACTERIOPHAGE LYSATE TO TREAT DRUG RESISTANT STAPHYLOCOCCUS AUREUS INVOLVED IN PROSTHETIC JOINT INFECTIONS: AN ALTERNATIVE STRATEGY

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Aim: Virulent bacteriophages are known to be an effective therapy against various human bacterial infections. The aims of the study are to evaluate i) the killing activity of an antistaphylococcal phage lysate (ASPL), available in the Czech Republic for topical application, against *Staphylococcal aureus* (Sa) strains isolated in orthopedic infections; ii) the antimicrobial activity of ASPL against biofilm-embedded cells of a methicillin-resistant Sa (MRSA) standard strain.

Method: The susceptibility of 25 MRSA and 18 methicillin-sensitive Sa (MSSA) strains to the ASPL was evaluated by spot assay. In addition, susceptibility of four laboratory MRSA strains, including ATCC 43300, ATCC 33591, Mu3 (MRSA/hetero vancomycin intermediate resistant Sa) and Mu50 (MRSA/vancomycin-resistant Sa) was also tested. The activity of ASPL against planktonic and biofilm-embedded MRSA ATCC 43300 was evaluated in real-time by isothermal microcalorimetry. The minimum heat inhibitory concentrations (MHIC) was defined as the lowest antimicrobial concentration leading to the lack of heat flow production after 24h for both planktonic and biofilm-embedded cells. The viability of bacterial cells was assessed by plating and colony counting. The minimum bactericidal concentration (MBC) was defined as the lowest antimicrobial concentration leading the reduction of 3 log CFU compared to the untreated control.

Results: Around 34 out of 43 (79%) Sa strains were susceptible to the ASPL, including 17 MRSA and 17 MSSA strains. Both Mu3 and Mu50 (vancomycin intermediate and resistant MRSA, respectively) strains were also susceptible. Microcalorimetric evaluation of the activity of ASPL against planktonic cells of MRSA ATCC 43300 revealed the MHIC and the MBC were 10^4 PFU/ml and 10^5 PFU/ml, respectively. ASPL tested at 10^5 PFU/ml was able to suppress the heat produced by biofilm bacterial cells, although this titer was not able to completely eradicate MRSA biofilm.

Conclusions: ASPL showed a broad host spectrum among MRSA and MSSA strains associated with infections on implants, including strains that are resistant to vancomycin as well. ASPL exhibits a lytic activity against planktonic and biofilm MRSA and a titer of phage higher than 10^5 PFU/ml is needed in order to achieve a complete eradication of MRSA biofilm. In conclusion, the antistaphylococcal phage lysate shows an excellent potential treatment of implant-related infections caused by Sa strains.

[FP10] GOOD OUTCOME OF ENTEROCOCCAL PJI - IMPORTANCE OF ANTIMICROBIAL TREATMENT

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Aim: Treatment of enterococcal periprosthetic joint infections (PJI) is challenging due to heterogeneous pathogenesis, non-standardized management strategies and lack of biofilm-active antibiotics. Previous studies report treatment success from 50-76%. We evaluated the characteristics and outcome of enterococcal PJI, in particular the influence of antimicrobial treatment regimens.

Method: Consecutive patients with enterococcal PJI treated at two specialized orthopaedic institutions were retrospectively included from 2010 to 2017. PJI was defined by the proposed European Bone and Joint Infection Society (EBJIS) criteria. Adequate antimicrobial treatment was considered when the antibiotic was appropiate for the treatment of enterococcal bone infections (activity, dose, oral bioavailability, bone penetration). The treatment success (defined as no relapse of enteroccal infection) and clinical success(i.e. infection-free status) was evaluated and compared using Fishers exact test.

Results: We included 75 episodes with enterococcal PJI, involving 41 hip, 30 knee, 2 elbow, 1 shoulder prosthesis. The median patient age was 76 years (range, 30-90 years), 48 (64%) were female. The infection occurred perioperatively in 61 episodes (81%), haematogenously in 13 (17%) and by contiguous spread in 1 case. Sinus tract was present in 16 patients (21%), predominantly in polymicrobial compared to monomicrobial infections (13 vs. 3 episodes, p= 0.01). Preoperative serum C-reactive protein level was elevated in 63/75 patients (84%) and synovial fluid leukocyte count was increased in 25/29 patients (86%). Enterococci grew in synovial fluid in 76%, in periprosthetic tissue in 78% and in sonication fluid in 73% of patients. Predominantly, *E. faecalis* was identified (n=64), followed by *E. faecium* (n=10) and *E. casseliflavus* (n=1); mixed infections were diagnosed in 38 patients (51%). Two-stage prosthesis exchange was performed in 44 (59%), debridement and retention in 13 (17%), resection arthroplasty in 11 (15%) and one-stage exchange in 10 patients (13%). Of 66 patients with available follow-up data (median, 31.8 months; range, 0.3-83.3 months), the treatment success was 85% (56/66), however, clinical success was only 68% (45/66). Treatment success was similar in monomicrobial and polymicrobial infections. Adequate antimicrobial treatment was associated with significant better outcome (91% vs. 38%, p=0.002). Treatment with fosfomycin (19/20, 95%) and combination therapy (45/50, 90%) was associated with better outcome, however, did not reach statistical significance (p >0.05).

Conclusions: The treatment outcome of enterococcal PJI was high (85%), however, a second episode of PJI caused by a new pathogen was common in the later course. Adequate antimicrobial treatment was the only significant factor associated with better treatment success.

[FP11] INTER-USER ASSESSMENT OF THE BACH CLASSIFICATION SYSTEM FOR LONG BONE OSTEOMYELITIS

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Aim: The B.A.C.H. system is a new classification for long bone osteomyelitis.[1]Antimicrobial availability, Soft tissue coverage and Host status. This is called the B.A.C.H. classification system. In this study, we aim to retrospectively validate this classification in a cohort of osteomyelitis cases. Methods We identified 100 patients who had received surgery for osteomyelitis between 2013\u20132015 in a single specialist centre. Each patient was classified retrospectively by two assessors who were not involved in the initial patient care. Osteomyelitis was confirmed in each patient by a validated composite protocol. Results All patients in this series could be classified using each of the B.A.C.H. variables. Seventy-four patients were categorised as B1, 13 as B2 and 13 as B3. Thirty-four patients revealed no growth of microorganisms (Ax It uses the four key inter-disciplinary components of osteomyelitis, namely, bone involvement, anti-microbial options, soft tissue status and host status. This study aims to assess the inter-observer reliability of using the B.A.C.H. classification system.

Method: We identified 20 patients who had a diagnosis of long bone osteomyelitis using a previously validated composite protocol.[2] For each patient, osteomyelitis history, past-medical history, clinical imaging (including radiology report), photographs of the affected limb and microbiology were presented to clinical observers on an online form. Fifteen observers, varying in clinical experience (training grades and consultants, with a variety of exposure to osteomyelitis) and specialty (orthopaedic surgery, infectious diseases and plastic surgery) were asked to rate the twenty cases of osteomyelitis. Before rating, an explanation of how to use the classification system was given to the observers, in a structured key. The responses were assessed by accuracy and Fleiss' kappa value (Fκ).

Results: All 15 observers completed classification of all 20 cases. The observers comprised 8 orthopaedic surgeons, 4 infectious disease physicians and 3 plastic surgeons. The observers had a variety of exposure to osteomyelitis ranging from less than one case per month to greater than one case per week. The results are shown in table 1.

Category	Percentage correct	Fκ value	Fκ interpretation[3]
Bone involvement	83.2%	0.54	Moderate agreement
Anti-microbial options	93.3%	0.82	Almost perfect agreement
Coverage of the soft tissues	96.0%	0.85	Almost perfect agreement
Host status	90.3%	0.79	Substantial agreement
Overall	**90.1%**	**0.75**	**Substantial agreement**

Table 1 – results of the inter-observer validation of the four categories of the B.A.C.H. classification system

Conclusions: The B.A.C.H. classification system for long bone osteomyelitis demonstrated a substantial agreement between observers according to the Fκ value. This was supported by having a large proportion of responses as being deemed correct when compared to the index answers. The bone involvement category had a moderate agreement and this could be due to inadequacies in the explanation of the classification system in the key, which will be improved and developed prior to dissemination of the classification system. Futhermore, the Fκ was not affected by clinical experience or clinical specialty, suggesting that B.A.C.H. is useful at all levels.

[1]Hotchen et al., 2017, Bone and Joint Journal: Orthopaedic Proceedings; ISSN (online): 2049-4416
[2]Sheehy et al., 2010, Journal of Infection; DOI: 10.1016/j.jinf.2010.03.006
[3]Landis and Koch, 1977, Biometrics

[FP12] INCIDENCE AND RISK FACTORS FOR INFECTION AFTER INTRAMEDULLARY NAILING OF FEMORAL AND TIBIAL DIAPHYSEAL FRACTURES: PROSPECTIVE STUDY

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Aim: Determine the incidence of surgical site infections (SSI) after intramedullary nailing (IN) of femoral and tibial diaphyseal fractures and evaluate possible risk factors.

Method: Prospective observational cohort study. SSI was defined according to CDC-NHSN criteria and surveillance period for the occurrence of infection was 12 months instead of the 90 days currently recommended. Incidence was calculated as the ratio between the number of patients with SSI and total number of patients. Analysis of potential risk factors included patients-related factors (age, gender, body mass index, active foci of infection, immunosuppressive conditions, ASA score, alcohol or illicit drug abuse, smoking, polytrauma, etiology of fracture, type of fracture if closed or open, classification of fracture according to Müller AO, Tcherne classification for closed fractures, Gustilo-Anderson classification and duration of bone exposure for open fractures, previous stay in other healthcare services, use of external fixator, previous surgical manipulation at same topography of fracture, use of blood products); environmental and surgical-related factors (surgical wound classification, duration of surgery, hair removal, intraoperative contamination, antimicrobial use, presence of drains, hypothermia or hypoxia in the perioperative period, type of IN used, reaming, need for muscle or skin flap repair, use of negative pressure therapy) and microbiota-related factors (presence of preoperative colonization by *Staphylococcus aureus* or *Acinetobacter baumannii*).

Results: 221 patients were included and completed the 12-month follow-up period. Incidence of SSI was 11.8% after 12-month follow-up, but would be 8.59% if used the 90-day vigilance period currently recommended. In the initial analysis by unadjusted logistic regression, following factors were associated SSI: Müller AO classification of the fracture morphology groups 2 or 3, previous use of external fixator, presence of drains, use of negative pressure therapy and need for muscle or skin flap repair. Preoperative colonization by *S. aureus* or *A. baumannii* was not associated with occurrence of infection. In the multiple logistic regression-adjusted analysis, only previous use of external fixator and need for muscle or skin flap repair remained associated with SSI.

Conclusions: Incidence of SSI associated with IN for femoral and tibial diaphyseal fractures was 11.8%, but currently recommended vigilance period would be less sensitive for SSI detection after fracture fixation. Previous use of external fixators and need for muscle or skin flap repair were factors associated with occurrence of IN related infection.

[FP13] RESULTS OF TIBIOTALOCALCANEAL ARTHRODESIS WITH RETROGRADE INTRAMEDULLARY NAILING IN POST-INFECTIOUS ANKLE OR PILON FRACTURES WITH SEVERE SOFT TISSUE DAMAGE

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Aim: The incidence of deep infections after internal fixation of ankle and lower leg fractures is estimated 1 to 2%. Hindfoot arthrodesis by retrograde intramedullary nailing (IMN) is a potential alternative to external fixation for post-infectious ankle destruction. The aim of this study was to evaluate the clinical results, complications and effects of soft tissue management with this treatment modality.

Method: This is a single-center retrospective review of routine hospital data from 21 patients (15 men, 6 women, median age 65 [range, 21 to 87] years) undergoing IMN arthrodesis of the hindfoot for post-traumatic infections between January 1st, 2012 and March 15, 2018. We observed four bimalleolar, eight trimalleolar, three pilon fractures, and six distal lower leg fractures. Six and three patients had sustained second- and third degree open fractures, respectively. Early- and late-onset surgical infections were observed in 8 and 13 cases. Four participants had diabetes mellitus, two arterial occlusive disease, and four had both. Six patients were smokers.

Results: Intraoperative cultures before implanting the nail revealed ***staphylococcus aureus*** in 12, ***staphylococcus epidermidis*** in five, and ***enterococcus faecalis*** in eight cases. After a median follow-up of 21 months, infection was considered cured in 19 / 21 subjects (90%, 95% confidence interval 70 – 99%). Soft tissue comminution required coverage with a suralis flap in five patients, and with a latissimus dorsi flap in another three. Mesh graft was necessary in 8 / 21 reconstructions.

Conclusions: Tibiotalocalcaneal fusion by IMN is an effective salvage procedure for post-traumatic ankle infections. Arthrodesis and definitive wound closure or plastic flap coverage can be performed as single-stage surgery. By resecting the prominent distal fibula, lateral soft tissue defects can be managed more easily. The small sample size prohibited a more detailed analysis of exposure variables, but 8 / 13 patients in this cohort had at least one known risk factor for infection and prolonged healing.

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[FP14] GETTING IT RIGHT FIRST TIME: THE IMPORTANCE OF A STRUCTURED TISSUE SAMPLING PROTOCOL FOR DIAGNOSING FRACTURE-RELATED INFECTIONS

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Aim: Fracture-related infection (FRI) is an important complication following surgical fracture management. Key to successful treatment is an accurate diagnosis. To this end, microbiological identification remains the gold standard. Although a structured approach towards sampling specimens for microbiology seems logical, there is no consensus on a culture protocol for FRI. The aim of this study is to evaluate the effect of a structured microbiology sampling protocol for fracture-related infections compared to ad-hoc culture sampling.

Method: We conducted a pre-/post-implementation cohort study that compared the effects of implementation of a structured FRI sampling protocol. The protocol included strict criteria for sampling and interpretation of tissue cultures for microbiology. All intraoperative samples from suspected or confirmed FRI were compared for culture results. Adherence to the protocol was described for the post-implementation cohort.

Results: In total 101 patients were included, 49 pre-implementation and 52 post-implementation. From these patients 175 intraoperative culture sets were obtained, 96 and 79 pre- and post-implementation respectively. Cultures from the pre-implementation cohort showed significantly more antibiotic use during culture sampling ($P = 0.002$). The post-implementation cohort showed a tendency more positive culture sets (69% vs. 63%, $P = 0.353$), with a significant difference in open wounds (86% vs. 67%, $P = 0.034$). In all post-implementation culture sets causative pathogens were cultured more than once per set, in contrast to pre-implementation ($P < 0.001$). Despite stricter tissue sampling and culture interpretation criteria, the number of polymicrobial infections was similar in both cohorts, approximately 29% of all culture sets and 44% of all positive culture sets. Significantly more polymicrobial cultures were found in early infections in the post-implementation cohort ($P = 0.048$). This indicates a better yield in the new protocol.

Conclusions: A standardised protocol for intraoperative sampling for bacterial identification in FRI is superior than an ad-hoc approach. This was the combined effect of no antibiotics around sampling, more tissue samples with the 'no touch-technique, increased awareness for both surgeon and microbiologist and stricter criteria for diagnosis. It resulted in more microbiologically confirmed infections and more certainty when identifying causative pathogens.

[FP15] AN EVIDENCE BASE FOR TISSUE SAMPLING AND CULTURE INTERPRETATION IN FRACTURE-RELATED INFECTION

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Aim: Current guidelines for the diagnosis of prosthetic joint infection (PJI) recommend collecting 4-5 independent tissue specimens, with isolation of indistinguishable organisms from two or more specimens. The same principle has been applied to other orthopaedic device-related infections (DRI) including fracture-related infections. However there are few published data validating this approach in DRI other than PJI. We evaluated the performance of different diagnostic cutoffs and varying numbers of tissue specimens for microbiological sampling in fracture-related infections.

Method: We used standard protocols for tissue sample collection and laboratory processing, and a standard clinical definition of fracture-related infection. We explored how tissue culture sensitivity and specificity varied with the number of tissue specimens obtained; and with the number of specimens from which an identical isolate was required (diagnostic cutoff). To model the effect of the number of specimens taken we randomly sampled *n* specimens from those obtained at each procedure, excluding procedures from which less than *n* specimens were collected, and calculated sensitivity and specificity based on this sample. For each value of *n* we repeated this process 100 times to estimate the mean sensitivity and specificity for *n* specimens.

Results: We analysed data for 246 cases of suspected fracture-related infection. 77 (31%) met the clinical definition of infection. A median of 4 independent tissue samples were obtained from each procedure (IQR 4-5). Culture sensitivity was highest and specificity lowest using a diagnostic cutoff of 1 specimen for isolation of an organism; specificity increased at the expense of sensitivity with diagnostic cutoffs of 2 or 3 specimens. Culture sensitivity increased as the number of tissue specimens obtained increased from 1 to 4. Although there was a corresponding decline in specificity with increasing numbers of tissue specimens obtained, this was negligible when a diagnostic cutoff of 2 or 3 specimens with identical organisms was used. Using a cutoff of 2 specimens with identical organisms, obtaining 4 specimens gave a sensitivity of 68% (55-78%) and a specificity of 95% (86-99%). Small numbers prevented meaningful analysis of the diagnostic performance of five or more specimens.

Conclusions: These data are analogous to findings in prosthetic joint infections, and suggest similar principles may be applied to tissue sampling and culture interpretation in other orthopaedic DRI including fracture-related infection. A larger study is underway to evaluate the performance of greater numbers of tissue specimens.

[FP16] IMPACT OF THE DURATION OF PERIOPERATIVE ANTIMICROBIAL PROPHYLAXIS AND RENAL CLEARANCE ON THE DEVELOPMENT OF FRACTURE-RELATED INFECTION

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Aim: Duration of perioperative antimicrobial prophylaxis (PAP) remains controversial in prevention of fracture-related infection (FRI) – with rates up to 30% - in open fracture (OF) management. Objectives were to investigate the impact of the PAP duration exclusively in or related to long bone OF trauma patients and the influence of augmented renal clearance (ARC), a known phenomenon in trauma patients, as PAP consists of predominantly renally eliminated antibiotics.

Method: Trauma patients with operatively treated OF, admitted between January 2003 and January 2017 at the University Hospitals Leuven, were retrospectively evaluated. FRI was defined following the criteria of the consensus definition of FRI. A logistic regression model was conducted with FRI as outcome. Results were considered statistically significant when $p < 0.05$.

Results: Forty (8%) from the 502 patients developed a FRI, with 20% FRIs in Gustilo-Anderson (GA) III OFs. Higher GA grade and polytrauma were independently associated with the occurrence of FRI. The heterogeneity in OF management, especially with regard to the applied PAP regimens and duration, was striking and consequently hampering the investigation on the impact of PAP duration. To overcome this issue, a subgroup analysis was performed in patients treated with the two PAP regimens as defined in the hospitals' guidelines – i.e. cefazolin, with metronidazole and tobramycine when extensive contamination was present -, revealing flap coverage and relative duration of augmented renal ARC as independently associated factors.

Conclusions: For the first time, a definition based on diagnostic criteria was used to objectively include patients with a FRI. In order to support clinicians in establishing strategies to prevent FRI in long bone OFs, further prospective large randomized controlled trials with clearly predefined PAP regimens are needed to provide reliable recommendations regarding the impact of duration of PAP and ARC.

[FP17] PROSTHETIC JOINT INFECTIONS AFTER HIP FRACTURES

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Aim: Prosthetic joint infections (PJI) are devastating complications after hip arthroplasty and infection rates varies internationally between 0.76% to 1.24%. Hemi-arthroplasty (HA) is the gold standard treatment for dislocated femoral neck fractures**.** Recently, total hip arthroplasty (THA) has been suggested to generate even better outcomes. However, little is known about PJIs after hip fractures. The purpose of this study was to investigate PJIs after femoral neck fracture in a population-based sample.

Methods: Clinical databases were harvested for all THA or HA procedures done for the treatment of femoral neck fractures at our hospital district (HUS) of 1.6 million inhabitants. Altogether, 3693 arthroplasty procedures for hip fractures were performed between 2011 to 2015. The original patient records of each case were reviewed. Complication(s) leading to readmission(s), the microbe(s), and the treatment protocol of each infection was recorded until the closing date (31.12.2016). The definition of PJI according to Musculosceletal Infection Society modified at the International Consensus meeting was used.

Results: We detected 111 infections (10 THAs;101 HAs):42 superficial infections (1.1%) and 69 PJIs (1.9%). The PJI rate after THA was 3.7% (8/219) and 1.8% after HA (61/3474) (p=0.04;OR 2.12, 95%CI 1.00-4.49). Most PJIs in THA group (6/8) were treated by debridement, antimicrobials, and implant retention (DAIR) and two by 2-stage exchange. In the HA group the DAIR was the first surgical treatment for 51 PJIs (84%). Other treatment options used were girdlestone (n=3), one-stage exchange (n=2), lavation (n=2), and conservative treatment (n=3). The bacteria cultured at THA group were: *Staphylococcus epidermidis* (n=4), *Staphylococcus aureus* (n=3), *Streptococcus agalactiae* (n=2), and *Staphylococcus haemolyticus* and at the HA group *Staphylococcus aureus* (n=25, including 1 MRSA), *Staphylococcus epidermidis* (n=11), other coagulase negative staphylococci (n=7), *Pseudomonas aeruginosa* (n=6), *Enterococcus faecalis* (n=6), *Escherichia coli* (n=2), and streptococci (n=2). Multiple bacteria were cultured from seven PJIs. The causative microbe was unknown in five PJIs.

Conclusion: THA patients had higher rate of PJIs compared to HA, however, the small sample size of the THA group may limit the statistical power of this study. The PJIs after hip fractures were usually treated by DAIR, which is also main PJI treatment after elective THAs. The overall PJI rate was higher among hip fracture than after elective THAs in the literature. The existing trend of treating more dislocated hip fractures with THA may thus lead to increased rated of PJIs in the future.

[FP18] THE USE OF SEGMENTAL ANTIBIOTIC MEGA-SPACERS PROVIDE STABLE ENVIRONMENTS FOR STAGED PREIMPLANTATION FOLLOWING LARGE TUMOR AND TUMOR-LIKE DEFECTS AT THE HIP AND KNEE

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Aim: The purpose of this study was to report on outcomes after stabilization of large skeletal defects following radical debridement of hip or knee infections and staged reimplantation using segmental antibiotic mega-spacers.

Method: From 1998-2018, 39 patients (18 male, 21 female) were treated for musculoskeletal infections at the hip (14) or knee (25). Patients were treated for infection after a procedure related to oncology (20), arthroplasty (16), or trauma (3). Following debridement, defects were stabilized with antibiotic impregnated PMMA and intramedullary nails. All patients underwent a standardized protocol: 6 weeks of intravenous antibiotics followed by 6 weeks of oral antibiotics guided by intraoperative cultures. After a 6-week holiday of antibiotics, repeat intraoperative cultures and inflammatory markers were analysed for infection resolution. Success was defined by reimplantation without additional infection-related complications or requirement of suppressive antibiotics at latest follow-up.

Results: Mean age was 50.5±19.4 years. Mean defect size was 20.4cm. Mean time from surgery until infection was 34.5 months, with 74% of patients presenting with infection greater than one year after their most recent surgery. Mean follow-up was 110±68 months. Most common organisms of infection were Staphylococcus Epidermidis (11) and Staphylococcus Aureus (10). Mean defect size was significantly different among oncology (28±8 cm), trauma (19±5 cm) and arthroplasty (12±6 cm) patients ($p<0.0001$), though outcomes were comparable. Two patients with antibiotic spacers have not underwent attempted reimplantation – one patient with clinical and laboratory signs of resolved infection; one patient with recent spacer placement. One patient died of oncologic disease shortly after spacer placement. These three patients were excluded from outcomes analysis. Twenty-nine (81%) patients were successfully re-implanted with a segmental endoprosthesis. Eight patients required an additional procedure prior to infection resolution, including additional antibiotic spacer and debridement due to sustained inflammatory markers and clinical signs of infection (5), antibiotic spacer exchange due to mechanical failure (2), and polyethylene exchange 9 months after reimplantation (1). Two patients have remained on chronic suppressive antibiotics, but have retained their limb, prosthesis, and pain-free function. Four (11%) patients ultimately required an amputation for infection control (3 above knee amputations; 1 hip disarticulation).

Conclusions: Following radical debridement for infection, staged management of large segmental defects at the hip and knee with antibiotic cement and temporary intramedullary stabilization results in an 81% success-rate of limb salvage with infection control.

[FP19] RESULT OF REVISION SURGERY FOR INFECTED TOTAL KNEE ARTHROPLASTY. DO SURGICAL STRATEGIES MATTER?

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Background: Periprosthetic joint infection (PJI) after knee arthroplasty surgery remains a serious complication. Yet, there is no international consensus on the surgical treatment of PJI. The purpose was to assess the prosthesis survival rates, risk of re-revision, and mortality rate following the different surgical strategies (1-stage or 2-stage implant revision, and irrigation and debridement (IAD) with implant retention) used to treat PJI.

Methods: The study was based on 653 total knee arthroplasties (TKAs) revised due to PJI in the period 1994 to 2016. Kaplan-Meier (KM) and multiple Cox regression analyses were performed to assess the survival rate of these revisions and the risk of re-revisions. We also studied the mortality rates at 90 days and 1 year after revision for PJI.

Results: Of the 653 revision TKAs; 329, 81, and 243 revisions were performed with IAD, 1-stage, and 2-stage revision procedures, respectively. During the follow-up period, 19%, 12.3% and 11.5% of the IAD, 1-stage, and 2-stage revision cases were re-revised due to PJI, respectively. With any reasons of re-revision as end-point the 5 year KM survival of the index revision procedure was 76%, 82%, and 84% after IAD, 1-stage, and 2-stage revision, respectively. Similarly, the 5-year KM survival with a re-revision for infection as end-point was 79%, 88%, and 87% after IAD, 1-stage, and 2-stage revision, respectively. There were no statistically significant differences between 1-stage and 2-stage revision for re-revision of any reasons (RR=1.6; 95% CI: 0.8-3.1) nor did we find a difference for re-revision due to deep infection (RR=1.4; 95% CI: 0.6-3.1) as end-point. In an age-stratified analysis, however, the risk of re-revision for any causes was 4 times increased after 1-stage revision compared to 2-stage revision in patients over 70 years of age (RR=4.2, 95% CI: 1.3-13.7) but the risk was similar for deep infection as end-point. Age had no statistically significant effect on the risk of re-revision for knees revised with the IAD procedure. The 90-days and 1-year mortality rate after revision for PJI were 2.1% and 3.6% after IAD, 1.2% and 1.2% after 1-stage revision, and 0.4% and 1.6% after 2-stage revision and there were no statistically significant differences in mortality rate according to revision procedure.

Conclusion: IAD had good results compared to earlier published studies. Despite that 1-stage revisions had a 4 times higher risk for re-revision compared to 2-stage revisions in older patients, the overall outcomes after 1-stage and 2-stage revision were similar

[FP20] VALUE OF RADIOLOGICAL SIGNS FOR THE DIAGNOSIS OF INTERNAL FIXATION-ASSOCIATED INFECTION: RESULTS FROM A PROSPECTIVE COHORT STUDY

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Aim: Radiologic signs such as radiolucent lines around the implant, hardware fracture or displacement and periosteal reaction have been considered suggestive of implant-associated infection. The goal of this study is to assess the correlation of these signs with confirmed internal fixation-associated infection evaluated in a prospective cohort.

Method: We evaluated the radiologic appearance of preoperative standard x-ray images in 421 surgeries performed in 416 patients with internal fixation device in place (56.8% male, mean age 53 ± 17 years). This prospective study was performed in a large single center for musculoskeletal surgery from 2013-2017. Infection was suspected preoperatively in only 23.8% of the surgeries. The most common indications for surgeries in which infection was not suspected were nonunion (89 cases) and symptomatic hardware (70 cases). All removed implants were sent to sonication for biofilm removal and detection. In addition, several peri-implant tissue samples were collected. Radiographs were analyzed in a blinded fashion for signs of radiolucent lines around the implant before removal, hardware fracture or displacement, and soft periosteal reactions suggestive of infection. Diagnosis was established according to the criteria of Metsemakers et al. Chi-square tests were performed to compare the presence of infection with radiological signs of infection.

Results: Radiologic signs suggestive for infection were uncommon, including radiolucent lines in 48 cases (11.4%); hardware breakage in 54 cases (12.8%); hardware displacement in 45 cases (10.7%); periosteal reaction in 30 cases (7.1%). Infection was confirmed in 27.6% of the surgeries, and radiological signs of infection were only marginally more common in this group. Only the presence of radiolucent lines (p = 0.47; OR = 1.86 [95% CI 1.00 – 3.38]) and periosteal reaction (p = 0.15; OR = 2.48 [1.17 – 5.26]) were significantly associated with confirmed infection. Sensitivity of radiolucency: sensitivity and periosteal reaction were low (16,4% and 12,4%, respectively), while specificity remained acceptable (90.5%and 94.8%, respectively).

Conclusions: Radiologic signs of infection are uncommon, even in the context of a confirmed infection. Radiolucency surrounding the implant and the presence of a soft periosteal reaction were significantly associated with the presence of infection, though sensitivity of the signs remained very low.

[FP21] THE GASTROCNEMIUS FLAP IN THE MANAGEMENT OF INFECTED KNEE PROSTHESES: EXPERIENCE OF 115 CASES OVER 21 YEARS IN A SINGLE CENTRE

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Aim: A number of orthopaedic strategies have been described for limb salvage following periprosethic joint infection (PJI). However, this is often only possible with concomitant soft tissue reconstruction in the form of flap coverage. The purpose of this study was to determine the long-term clinical outcome of patients who underwent pedicled gastrocnemius flap coverage as part of their treatment for knee PJI.

Method: We performed a retrospective review of all patients undergoing gastrocnemius muscle transfer with split thickness skin grafting as part of their treatment for knee PJI at a tertiary referral centre between 1994 and 2015. Data recorded included patient characteristics, orthopaedic procedure, microbiology result and antimicrobial management. Outcome measures included flap failure, infection recurrence, amputation, functional outcome (Oxford knee score; OKS) and mortality.

Results: In total, 115 consecutive patients (39% female) with a mean age of 74.4 years (range 44-100) were followed up for an average of 5.5 years (range 119 days – 19.7 years). There were no reported cases of flap failure. Gastrocnemius flaps were most commonly performed at the time of the first stage of a two-stage revision (41%), or during debridement and implant retention (DAIR) (27%). 10% were performed at the second stage of a two-stage procedure and 4% were performed during a single stage revision. Of 96 positive deep specimen cultures, 43 (45%) showed mixed growth and 47 (49%) grew coagulase-negative staphylococcus (with or without other microorganisms). The infection recurrence rate was 32%. Limb salvage was achieved in 88% of cases. 12% of patients required life-long suppressive antibiotic therapy. 55 knees were followed up for five years or more, with a survival (not deceased, not amputated) of 64%. 37 knees were followed up for 10 years or more, with a survival of 32%. In living patients who did not have an amputation, the mean OKS was 25.8 (n=36; range 7-47).

Conclusion: This study represents the largest series to date of infected knee prostheses treated with gastrocnemius flap coverage. A multidisciplinary approach to complex PJI surgery is recommended, involving infectious disease physicians and the orthoplastic team. We also recommend a low threshold for requesting plastic surgery input. In our experience, this technique is safe, with no flap failure, and has enabled limb salvage for the majority (88%) of patients with infected knee prostheses and insufficient soft tissue envelope.

[FP22] MANAGEMENT OF INFECTED SEGMENTAL TIBIAL DEFECTS WITH SIMULTANEOUS ILIZAROV BONE RECONSTRUCTION AND FREE MUSCLE FLAPS

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Aim: Simultaneous use of Ilizarov techniques with transfer of free muscle flaps is not current standard practice. This may be due to concerns about duration of surgery, clearance of infection, potential flap failure or coordination of surgical teams. We investigated this combined technique in a consecutive series of complex tibial infections.

Method: A single centre, consecutive series of 45 patients (mean age 48 years; range 19-85) were treated with a single stage operation to apply an Ilizarov frame for bone reconstruction and a free muscle flap for soft-tissue cover.

All patients had a segmental bone defect in the tibia, after excision of infected bone and soft-tissue defects which could not be closed directly or with local flaps. We recorded comorbidities, Cierny-Mader and Weber-Cech classification, the Ilizarov method used, flap type, follow-up duration, time to union and complications.

Results: 26 patients had osteomyelitis and 19 had infected non-union. Staphylococci were cultured in 25 cases and 17 had polymicrobial infections. Ilizarov monofocal compression was used in 14, monofocal distraction in 15, bifocal compression/distraction in 8, and bone transport in 8. 8/45 had an additional ankle fusion, 7/45 had an angular deformity corrected at the same time and 24 also had local antibiotic carriers inserted. Median time in frame was 5 months (3-14).

38 gracilis, 7 latissimus dorsi and 1 rectus abdominus flaps were used. One flap failed within 48 hours and was revised (flap failure rate 2.17%). There were no later flap complications. Flaps were not affected by distraction or bone transport.

Mean follow-up was 23 months (10-89). 44/45 (97.8%) achieved bony union. Recurrence of infection occurred in 3 patients (6.7%). Secondary surgery was required to secure union with good alignment in 8 patients (17.8%; docking site surgery in 6, IM nailing in 2) and in 3 patients for infection recurrence. All were infection free at final follow-up.

Conclusions: Simultaneous Ilizarov reconstruction with free muscle flap transfer is safe and effective in treating segmental infected tibial defects, and is not associated with an increased flap failure rate. It shortens overall time spent in treatment, with fewer operations per patient. However, initial theatre time is long and a committed multidisciplinary team is required to achieve good results.

[FP23] PEDICULATED SURALIS FLAP FOR CLOSURE OF SOFT TISSUE DEFECTS ASSOCIATED WITH INFECTION OF THE LOWER LEG

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Aim: Soft tissue defects of the lower leg can be closed - following the reconstructive ladder - with a pediculated fasciocutaneous suralis flap, but a free flap is gold standard in most of the cases. Aim of the study was to evaluate complications, risk factors for failure and the reasonableness of this procedure.

Method: 91 patients (92 flaps, 70 males, 21 females) with a mean Age of 55 years (16 to 87) were included in the study. The patients had mean four surgical procedures before the flap, the follow-up was mean 407 days. 70 patients were classified ASA I or ASA II.

Results: There were many complications, mostly wound healing Problems or hematoma. Only 40% of the patients received no Revision surgery, 71% of the flaps reached healing with Maximum two revisions (22% with one, 9% with two revisions, respectively). Necrectomy and new meshgraft were main reasons for Revision. Long term complications were swelling or disturbance of sensitivity. We lost seven flaps, eight free flaps were necessary. Three amputations were performed, but only one because of the lost flap.

Conclusions: All patients with lost flaps showed relevant comorbidities. 71% of the flaps healed with Maximum two revisions and the overall flap loss rate was 6%. The Advantages of this flap are short surgery time without the need of a microvascular anastomosis and a relatively simple surgical technique. The flap loss rate of 6% seems to be acceptable and, however, the flap is a good Option and an important step of the reconstructive ladder for soft tissue defect closure of the lower leg.

[FP24] CURRENT PRACTICES IN THE MANAGMENT OF OPEN FRACTURES: A WORLWIDE SURVEY AMONG ORTHOPAEDIC TRAUMA SURGEONS

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Aim: Infection rates after management of open fractures are still high. Existing guidelines regarding prevention of this complication are inhomogeneous. A survey directed to orthopaedic trauma surgeons worldwide aims to give an overview of current practices in the management of open fractures.

Method: An international group of trauma surgeons and infection specialists with experience in the field of musculoskeletal infections developed a questionnaire that was distributed via email to all AOTrauma members worldwide. Descriptive statistical analysis was performed.

Results: 1197 orthopaedic trauma surgeons answered the survey (response rate: 4,9% of all opened emails). Cephalosporins are the most commonly used antibiotics for systemic prophylaxis in open fractures (cefazolin: 51,46% cefuroxime: 23,6%, ceftriaxone: 14,54%). In Gustilo type III open fractures gentamicin (49,12%) and metronidazole (33,58%) are often added. 86% (n=1033) reported to give the first dosage of systemic antibiotics in the emergency department as soon as the patient arrives. Only 3% (n=34) reported pre-hospital administration at the scene of the accident or during transport to the hospital. While most respondents administer antibiotics over 24h in type I open fractures (34%, n=405), for type II open fractures the most often mentioned duration is 72h (26%, n=306). For type III a 7 days course was most often performed (38%, n=448). Overall, there is a tendency to longer durations with increasing severity. However, a vast majority agreed that the optimal duration is not well defined in the literature (71%, n=849).

Concerning the timing from injury to the first debridement, still the 'six hour rule' is wide spread among respondents (47%, n=565), but also longer durations are regarded as tolerable (12h: 16%, n=186 and 24h: 18% n=220). The most often used solutions for wound irrigation contain regular saline (89%, n=1065), povidone-iodine (35% n=420), hydrogen peroxide (29% n=343) and chlorhexidine (14%, n=172). Low pressure for irrigation is most often used (5-10psi, "bulb syringe": 54,97%, n=658), followed by very low pressure (1 to 2 psi, "gravity flow": 30%, n=361). Only 14,87% (n=178) use high pressure (>20psi,"Jet-Lavage"). The amount of irrigation fluid has a bimodal distribution with two peaks at 4-6 liters (24%, n=286) and at 8-10 liters (24%, n=282).

Conclusions: Results from our survey give an overview of current practices and identify certain aspects in the management of open fractures where treatment protocols are very heterogenous and guidelines not well accepted. These controversies demand for further research in this field to provide better evidence.

[FP25] MANAGEMENT OF CRITICAL-SIZED BONE DEFECTS IN TREATMENT OF COMPLEX FRACTURE-RELATED INFECTIONS; A SYSTEMATIC REVIEW AND POOLED ANALYSIS

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Aim: Over the past decades, critical-sized bone defects in complex Fracture-Related Infection (FRI) have been treated by different protocols with different success rates. The purpose of this systematic review was to determine the available treatment strategies, their individual success rates and other outcome parameters regarding critical-sized bone defects used from 1990 to 2017.

Method: A systematic literature search was done on treatment and outcome of complex FRI. Treatment strategies were bone transport, induced membrane technique, vascularized bone graft, and cancellous bone grafts. Studies describing bone defects of 1 cm or greater were included. Outcomes included bone healing and infection eradication after study protocol and recurrence of FRI and number of amputations at the end of study-period. Results were determined for the overall population and for each of the different treatment strategies. Pooled proportions and weighted means (for continuous data) were determined using Medcalc and Excel.

Results: Forty-one studies were included, describing 1,203 patients of which the tibia was affected in 79%. Mean age was 40 years (range 6-80), with the overall population being predominantly male (80%). Mean duration of infection was 16 months (range 1-624) and mean follow-up lasted 57 months (range 5-113). Five studies (12%) described treatment by vascularized grafts, 16 (41%) by the use of cancellous grafts, 6 (15%) by induced membrane technique, and 14 (34%) by bone transport. A total of 790 grafts were used of which 46% were vascularized and 38% were cancellous bone. After initial protocolized treatment, FRI was cured in 85% (95% CI 82-89) of all cases, increasing to 95% (95% CI 92-98) at the end of the total study. Recurrence of infection was seen in 8% (95%CI 5-11), and amputation in 2% (95% CI 2-3). Final outcomes overlapped across treatments, although there were differences in mean bone defect size.

Conclusions: This is the first extensive review of bone defect treatment protocols for FRI. The data did not allow a reliable comparison across treatments. The results should thus be interpreted with care due to the retrospective design of most studies, the lack of clear classification systems, incomplete data reports, underreporting of adverse outcomes, and heterogeneity in patient series. A consensus on classification, treatment protocols, and outcome is needed to improve reliability of future studies.

[FP26] COMPARISON OF ILIZAROV ACUTE SHORTENING AND RELENGTHENING WITH BONE TRANSPORT FOR TREATING INFECTED SEGMENTAL TIBIAL BONE DEFECTS

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Aim: Infected segmental defects are one of the most feared complications of open tibial fractures. This may be due to prolonged treatment time, permanent functional deficits and high reinfection and non-union rates. Distraction osteogenesis techniques such as Ilizarov acute shortening with bifocal relengthening (ASR) and bone transport (BT) are effective surgical treatment options in the tibia. The aim of this study was to compare ASL with bone transport in a consecutive series of complex tibial infected non-unions and osteomyelitis, for the reconstruction of segmental defects created at surgical resection of the infection.

Method: In this single centre series, all patients with a segmental defect (>2cm) of the tibia after excision of infected non-union or osteomyelitis were eligible for inclusion. Based on clinical features, bone reconstruction was achieved with either ASR or BT using an Ilizarov fixator. We recorded the external fixation time (months), the external fixation index (EFI), comorbidities, Cierny-Mader or Weber-Cech classification, follow-up duration, time to union, number of operations and complications.

Results: Overall, 43 patients with an infected tibial segmental defect were included. An ASR was performed in 19 patients with a median age of 40 years (range: 19 – 66 years). In this group, the median bone defect size was three cm (range: 2 – 5 cm); and the median frame time eight months (range: 5 - 16 months). BT was performed in 24 patients with a median age of 44 years (range: 21 – 70 years). The median bone defect size was six cm (range: 3 – 10 cm), and the median frame time ten months (range: 7 – 17 months). The EFI in the ASR group and the BT group measured 2.2 months/cm (range: 1.3 – 5.4 months/cm) and 1.9 months/cm (range: 0.8 – 2.8 months/cm), respectively. The comparison between the EFI of the ASL group and the BT group showed no statistically significant difference (p=0.147). Five patients of the ASR group (7 surgeries) and 19 patients of the BT group (23 surgeries) needed further unplanned surgery (p=0.001). Docking site surgery was significantly more frequent in BT; 66.7%, versus ASL; 5.3% (p=0.0001).

Conclusion: Acute shortening/relengthening and bone transport are both safe and effective distraction osteogenesis techniques for the treatment of infected tibial non-unions. They share similar frame times per centimetre of defect. However, ASR demonstrated a statistically significant lower rate of unplanned surgeries.

[FP27] OVERVIEW OF ORTHOPEDIC-IMPLANT ASSOCIATED INFECTION DUE GRAM-NEGATIVE BACILLI AND THE IMPACT OF ACINETOBACTER BAUMANNI MUTIDRUG RESISTANCE IN A BRAZILIAN CENTER

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Aim: Orthopedic implant related surgical site infection (SSI) is a severe complication which represents an important challenge concerning to its treatment. Therefore, gram-negative orthopedic infections have recently become a global concern.

Method: Retrospective study through searching of the SCIH (infection control service) database, concerning to the year 2016 and 2017. Cases selected were those of implant placement clean surgeries (osteosynthesis or prosthetic placement) which evolved with SSI and Gram-negative bacterial growth in bone tissue or periprosthetic cultures.

Results: During 2016 and 2017, 6150 clean surgeries with orthopedic implant placement were performed; 140 fulfilled SSI criteria (83 cases of open fracture reduction, 44 of hip arthroplasty, 13 of knee arthroplasty). Main agent of infections was Staphylococcus aureus (32,47%) mostly of them methicillin-sensitive (69,20%). However, Gram-negative bacteria were responsible for 64,95% of infections. (Klebsiella pneumoniae 12.8%; Acinetobacter baumannii and Enterobacter ssp 11.96%; Pseudomonas aeruginosa 9.40%) Among them, 100% Enterobacter ssp. were sensitive to carbapenems and 75% to ciprofloxacin. Klebsiella pneumoniae showed sensitivity to carbapenems in 85.7%, Pseudomonas aeruginosa showed sensitivity in 85.7% to carbapenems and 100% to ciprofloxacin. Acinetobacter baumannii showed the least favorable profile amongst Gram-negatives since only 12.5% of strains were sensitive to carbapenems, 28.6% to Ampicilin-sulbactam, 22.2% to ciprofloxacin, while showing 100% sensitivity to polymyxins. 14 patients in whom Acinetobacter baumannii was isolated were predominantly elderly (median 70 years), most of them have underlying/chronic diseases (71.42%) such as diabetes, arterial hypertension, alcoholism, smoking and heart failure. None presented sepsis related to this infection, but four of them died as result of hospitalization related complications (28,60% mortality rate). Among these deaths, 3 were related to total hip arthroplasty, and one to knee arthroplasty. One patient died as result of external causes. Among the survivors, five showed remission/cure. The follow up was lost in 4 patients.

Conclusions: SSI caused by carbepenem-resistant Acinetobacter baumannii represents considerable impact on morbi-mortality in patients who undergo surgery with placement of orthopedic implants.

References:

1-Hsieh PH, Lee MS, Hsu KY, Change YH, Shih NH, Ueng SW, Gram-Negative Prosthetic Joint Infections. Risk Factors and Outcome of Treatment Clin Infect Dis. 2009; 49(7):1036-43

[FP28] STAPHYLOCOCCUS AUREUS INFECTIONS AFTER ORTHOPEDIC SURGERY: INCIDENCE, MORTALITY AND DIRECT COSTS IN GERMANY

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Aim: Surgical site infections caused by *Staphylococcus aureus (S. aureus)* are associated with considerable clinical and economic burden. Studies assessing this burden in Germany have been limited to specific institutions, selected patient groups or not specific to *S. aureus* infections (SAI). This study was undertaken to further understand the burden of SAI following orthopedic surgeries in Germany.

Method: All patients with at least one spine, endoprosthetic hip or knee surgery between 2012 and 2015 captured in the AOK PLUS claims database were included in this analysis. SAI were identified using *S. aureus*-specific ICD-10 codes following surgery. Exclusion criteria included: younger than 18, SAI in the 90 days preceding index, any surgery in the 180 days preceding index, surgery at the same body location as index in the preceding 365 days, or more than one surgery of interest during index hospitalization.

Cumulative incidence and incidence density were used to assess SAI. Mortality, healthcare resource utilization and costs were compared between SAI and non-SAI group during the 1year follow-up post index surgery. Multivariate analyses were conducted while controlling for sex, age, Charlson Comorbidity Index (CCI), location of surgery, length of index hospitalization, recent fractures, other bacterial infections during index hospitalization and outpatient prescriptions for antibiotics in the year pre-index.

Results: In total, 74,327 patients were included who underwent a knee (21,285), hip (29,429), or spine surgery (23,613). Mean age was 69.6 years, 61.6% were female and the mean CCI was 2.3.

The SAI incidence post-orthopedic surgery was 20.2 cases per 1,000 patient-years within 1 year of index hospitalization; the cumulative incidence was 1.9%. Knee surgeries were associated with lower SAI risk compared to hip surgeries (HR=0.8; p=0.024), whereas spine surgeries did not differ significantly. Compared to non-SAI group, the SAI group had on average 4.4 times the number of hospitalizations (3.1 vs. 0.7) and 7.7 times the number of hospital days (53.5 vs. 6.9), excluding the index hospitalization (p-values<0.001). One year post-orthopedic mortality was 22.38% in the SAI and 5.31% in the non-SAI group (p<0.001). The total medical costs were significantly different between SAI and non-SAI groups (42,834€ vs. 13,781€; p<0.001). Adjusting for confounders, the SAI group had nearly 2 times the all-cause direct healthcare costs (exp(b)=1.9; p<0.001); and 2.5 times the risk of death (OR=2.5; p<0.001) compared to the non-SAI group.

Conclusions: *S. aureus* infection risk after orthopedic surgeries persists and is associated with significant economic burden and risk of mortality.

[FP29] SPINAL IMPLANT-ASSOCIATED INFECTIONS: RESULTS FROM A 3-YEAR PROSPECTIVE COHORT STUDY

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Aim: Spinal implant-associated infections (SIAI) require combined surgical and antimicrobial treatment and prolonged hospital stay. We evaluated the clinical, laboratory, microbiological and radiological characteristics and treatment approaches in patients with SIAI.

Method: Consecutive adult patients with SIAI treated between 2015 and 2017 were prosepctively included. SIAI was defined by: (i) significant microbial growth from intraoperative tissue or sonication fluid, (ii) intraoperative purulence, secondary wound dehiscence or implant on view, (iii) radiographic evidence of infection and fever (>38°C) without other recognized cause, increasing back pain or neurologic impairment, (iv) peri-implant tissue inflammation in histopathology.

Results: A total of 60 patients were included, median age was 66 years (range, 28-91 years), 29 (48%) were males. The most common reason for spinal stabilization was spinal canal stenosis in 20 patients (33%) followed by vertebral degenerative disease in 14 (23%). 31 patients (52%) had one or more previous spine surgeries (range, 1-4 interventions). The anatomic site of spinal instrumentation was lumbar/sacral in 26 (43%), cervical in 23 patients (38%), thoracic in 11 (18%). The median number of fused segments was 5 (range, 1-14). Clinical manifestations included wound healing disturbance in 41 patients (68%), increasing back pain in 15 (25%), neurologic impairment in 12 patients (20%) and fever in 14 (23%). Serum CRP was abnormal (>10mg/l) in 46/59 patients (78%). Most (n=54) infections were postsurgical, 5 were hematogenous and 1 was contiguous. Imaging showed epidural, intraspinal or paravertebral abscess in 21/42 patients (50%), implant failure in 9 (21%) and implant loosening in 3 cases (7%). Monomicrobial infection was observed in 41 (68%), polymicrobial in 16 (27%) patients and culture-negative infection in 3 episodes (5%). Predominant causative pathogens were *S. aureus* (n=19), coagulase-negative staphylococci (n=18) and gram-negative rods (n=16). Surgery was performed in all patients including debridement and implant retention in 39 patients (65%), partial implant exchange in 10 (17%) and complete exchange in 11 (18%). Antimicrobial treatment included biofilm-active substances in 52 patients (87%). The median duration of antimicrobial therapy was 11,7 weeks (range, 6-12 weeks). 14 patients (23%) recieved suppressive therapy for a median duration of 9 months (range 3-12 months).

Conclusions: Most SIAI were seen in lumbar/sacral segments and wound healing disturbance and increasing back pain were the most common manifestations. In 95% the causative pathogen was isolated, predominantly staphylococci. In half of the episodes, abscesses were present. All patients underwent surgery and biofilm-active antibiotics were administered in 87%.

[FP30] IMPROVED INFECTION AND FUNCTIONAL OUTCOME WITH A CONCERTED SURGICAL AND ANTIMICROBIAL TREATMENT CONCEPT: ANALYSIS OF 127 CASES OF INFECTIONS AFTER INTERNAL FIXATION

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Aim: Data of optimal management of infections after internal fixation (IIF) is scarce and long-term follow-up results often lack. We analyzed characteristics of infections after intramedullary (IIIF) and extramedullary long bone fixation (IEIF) and evaluated their infection and functional outcome.

Method: Consecutive patients with IIF diagnosed at our institution from 01/2010-10/2017 were retrospectively included. Infection was defined as visible purulence, sinus tract, microbial growth in ≥2 independent samples or positive histopathology. The outcome was compared before and after implementation of a comprehensive surgical and antimicrobial treatment algorithm in 04/2013.

Results: Of 127 patients, infection involved lower extremity in 111 patients (87%). Median age was 53 years (range, 19-89 years), 70% were men. Fixation was performed with intramedullary nail in 47 (37%) and with extramedullary osteosynthesis (plates, screws, pins) in 80 patients (63%). At infection diagnosis, the implant was in situ in 96 patients (76%), whereas 31 patients (24%) had residual osteomyelitis after implant removal. The time from bone fixation to infection was longer in IIIF than IEIF (25 vs. 7 months, p=0.027). Pain was reported in 55 patients (43%) and local infection signs in 96 patients (75%), including sinus tract in 46 patients, more commonly reported after IIIF than IEIF (49% vs. 29%, p=0.035). Infections were monomicrobial in 85 (67%), polymicrobial in 18 (14%) and culture-negative in 23 patients (18%). Most common pathogens were *S. aureus* (43%), coagulase-negative staphylococci (28%) and gram-negative rods (22%). Débridement (with device retention, if present) was performed in 40, device removal in 43, one-stage exchange in 16 and two-stage exchange in 20 patients. One patient had no surgery and 7 patients underwent limb amputation. 43 patients (34%) were treated before implementation of the interdisciplinary treatment concept and 84 patients (66%) afterwards. Among 111 patients with available follow-up (median, 5.2 months; range, 0.2-86 months), in 78 cases (70%) infection eradication was achieved (similar in IIIF and IEIF). However, overall infection and functional outcome was only 48% (53 patients). After implementation of the treatment algorithm, the infection outcome improved from 56% to 79% (p=0.03) and the overall success from 33% to 56% (p=0.016).

Conclusions: Approximately half of infections after IIF failed in terms of infection eradication or restoration of function. After implementation of standardized surgical and antibiotic treatment concept, infection and functional outcome improved significantly. No significant differences between IIIF and IEIF was observed in terms of infection and functional success.

[FP31] SEPTIC KNEE ARTHRITIS AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION (ACLR): A SERIES OF 74 CASES AMONG 9858 PATIENTS

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Aim: The aim of our study was to identify pathogens involved in septic knee arthritis after ACLR and to describe clinical features, treatment and outcome of infected patients.

Methods: We conducted a retrospective observational study including all patients with ACLR infection in 3 orthopedic centers sharing the same infectious disease specialists.

Results: During a seven-year period (2011-2017) we identified 74 infected patients among 9858 patients who had ACLR (incidence rate = 0.0075). Fourteen patients had polymicrobial infection. We identified 89 pathogens. Twenty four patients (34.4 %) were infected with *S. aureus* (27% of all isolates) (only one oxacillin-resistant strain). *C. acnes* was the second most frequent pathogen, identified in 14 patients (18.9%) (15.7% of all isolates). *S. lugdunensis* was identified in 9 patients (12.2%) (10.1% of all isolates). *S. caprae* was as frequent as *S. epidermidis* identified in 8 patients each (10.8%) (9 % of all isolates for each). No strain of *S. lugdunensis* and *S. caprae* was resistant to oxacillin, levofloxacin or rifampicin. Ten patients infected by *C. acnes*, 8 infected by *S. lugdunensis*, and 7 infected by *S. caprae* had an early acute infection. In all cases but one an arthroscopic lavage was performed, in 14 cases two lavages were required and in 4, 3 lavages. All patients infected by a strain susceptible to levofloxacin and rifampicin, including those with *C. acnes*, *S. caprae* and *S. lugdunensis* infection, were treated with an oral combination of levofloxacin and rifampicin, after a couple of days of IV empirical treatment with vancomycin and a broad spectrum beta-lactam. The median duration of treatment was 6 weeks. Seventy one patients were considered cured.

Conclusions: To our knowledge this is the largest reported series of infection after ACLR. *S. aureus* is the main pathogen (27% of all strains). *C. acnes, S. lugdunensis and S. caprae* accounted for almost 35% of pathogens and 38% of infections. A conservative strategy consisting in arthroscopic lavage(s) and a 6-week treatment with levofloxacin and rifampicin was effective.

[FP32] IN VITRO GRANULOMA FORMATION IN RESPONSE TO CUTIBACTERIUM ACNES INFECTIONS: DIFFERENT IMMUNE BEHAVIORS DEPENDING ON PHYLOTYPES

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Aim: *Cutibacterium acnes* is involved in chronic/low-grade pathologies such as prosthetic joint infection (PJI) or sarcoidosis. During these diseases, granulomatous structures are frequently observed. In this study, we induced a physiological granulomatous reaction in response to different well-characterized clinical *C. acnes* isolates in order to investigate the cellular process during the granulomatous formation.

Method: An acne *C. acnes* ATCC6919 isolate (clonal complex (CC) 18, phylotype IA1), a PJI *C. acnes* BL clinical isolate (CC36, phylotype IB) and a sarcoidosis *C. acnes* S8 strain (CC28, phylotype IA_2) were included and co-culture with PBMC. Cellular aggregation was followed daily using light microscopy. At various time points of incubation (day 3 and day 7), granuloma structures were processed for microscopic observation, colony forming unit enumeration after Triton X100 lysis to release the internalized bacteria (bacterial load within the granulomas), as well as for flow cytometric analysis (detection of CD4, CD8 and NK lymphocytes).

Results: All *C. acnes* isolates generated granulomatous structures in our experimental conditions. The bacterial burden was better controlled by granulomas induced by sarcoidosis *C. acnes* isolate. PJI *C. acnes* isolate, belonging to CC36, promoted the recruitment of $CD8^+$ lymphocytes inside the granuloma. At the opposite, acne and sarcoidosis *C. acnes* isolates, belonging, respectively, to phylotype IA_1/CC18 and phylotype IA_2/CC28 generated a higher number of granuloma and promoted the recruitment of $CD4^+$ lymphocytes inside the granuloma.

Conclusions: Our results provide new arguments supporting the role of *C. acnes* in the development of infections and new explanations concerning the mechanisms underlying PJI due to *C. acnes*.

This model appears to be a possible alternative assay to animal models for studying the immune response to *C. acnes* infection.

[FP33] POSITIVE INTRAOPERATIVE CULTURES AT REIMPLANTATION OF A TWO-STAGE EXCHANGE FOR PROSTHETIC JOINT INFECTION, WHAT DO THEY TEACH US?

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Aim: A two-stage exchange of an infected prosthetic joint (PJI) is considered the most effective surgical treatment of chronic PJIs, particularly in North America. However, reinfection rates are unacceptably high (10-20%). This could be the consequence of a persistent infection or a new infection introduced during the first or second stage of the exchange arthroplasty. We aimed to determine: i) the prevalence of positive cultures at reimplantation, ii) whether there is an association between positive cultures at reimplantation and reinfection during follow-up, and iii) if there is a microbiological correlation between primary infections, reimplantations and reinfections.

Method: We retrospectively evaluated all two-stage exchange procedures performed at two academic centers between 2000 and 2015. Primary culture-negative PJIs and cases in whom no intraoperative cultures were obtained during reimplantation were excluded from the analysis. One or more positive intraoperative cultures during reimplantation were considered positive for infection. Reinfection was defined as the need for additional surgical intervention after reimplantation or the need for antibiotic suppressive therapy due to persistent clinical signs of infection.

Results: A total of 424 cases were included in the final analysis with a mean follow-up of 48 months (SD 37). Eighty-eight cases (20.8%) had positive cultures during reimplantation (second stage) of which 68.1% (n=60) grew a different microorganism than during the first stage of the procedure. The percentage of positive cultures during reimplantation was higher for hips than for knees (26.5% vs 17.1%, p 0.02). For the total group, the reinfection rate during follow-up was 18.4% (78/424), which was 29.5% for the positive-culture group versus 15.5% for the culture-negative group at reimplantation (p=0.002). A positive culture during reimplantation was an independent risk factor for reinfection during follow-up in the multivariate analysis (OR 2.2 (95% CI 1.2 – 3.8), p 0.007). Reinfection was caused by a different microorganism than the primary infection (first stage) in 64.1% of cases (50/78).

Conclusions: There is a very high rate of positive cultures at reimplantation, which are mostly attributed to a different microorganism than the primary infection and is associated with a worse outcome. These results stress the importance of developing treatment strategies for this particular population.

[FP34] UNEXPECTED POSITIVE CULTURE IN TOTAL HIP ARTHROPLASTY REVISION INCREASES THE RE-REVISION RISK. A NATIONAL REGISTER STUDY

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Aim: Aseptic loosening is the leading cause of revision of total hip arthroplasty (THA). It is well recognized that an occult infection is the underlying cause of some aseptic revisions. Intraoperative cultures are central to the diagnosis of prosthetic joint infection (PJI). However, the diagnostic and prognostic value of unexpected positive intraoperative cultures remains unclear.

The aim was to study whether first-time aseptic revision of a total hip arthroplasty with unexpected bacterial growth in cultures of intraoperatively taken biopsies have an increased risk of secondary revision due to all causes and increased risk of PJI revision, specifically.

Method: Cases reported as first-time aseptic loosening revisions to the Danish Hip Arthroplasty Register (DHR) performed during January 1st, 2010, to May 15th, 2016, were included.

DHR data were merged with the Danish Microbiology Database, which contains data from all intraoperatively obtained cultures in Denmark. Included first-time revisions were grouped based on the number of positive cultures growing the same bacteria genus: ≥2, 1 and 0 cultures. Revisions were followed until secondary revision, death, or end of follow-up period after one year. Relative risk for secondary revision due to all causes and PJI was estimated.

Results: We included 2,305 first-time aseptic revisions. Unexpected growth was found in 282 (12%) of which 170 (60%) cases showed growth of the same bacteria in only one culture. Coagulase-negative staphylococcus accounted for 121 (71%).

Secondary revision was performed in 163 (7%) cases, with PJI being the indication for revision in 43 (26%) cases.

The relative risk of secondary revision was significantly higher for cases of one positive culture growing the same bacteria compared to culture negative cases, both for revision due to all causes; 1.73 (95%CI 1.07; 2.80) and PJI exclusively; 2.63 (1.16; 5.96). Cases of 2 or more biopsies culturing the same bacteria had a relative risk of all cause revision of 1.52 (0.82; 2.80).

Conclusions: First-time aseptic loosening THA revisions with unexpected growth in only one biopsy culture had an increased risk of secondary revision, both due to all causes and PJI. Our findings indicate that some cases of unexpected growth of bacteria should likely be regarded as clinically significant and not sample contamination, underlining the need for more awareness and better strategies when treating patients with unexpected positive intraoperative cultures. The improved diagnosis of occult PJI in clinically aseptic THA is of great importance for future care of this large and growing patient group.

[FP35] D-LACTATE, A BACTERIAL SPECIFIC MARKER FOR THE DIAGNOSIS OF PROSTHETIC JOINT INFECTION AND SEPTIC ARTHRITIS.

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Aim: To assess the analytical performance and to establish the cut-off of synovial fluid D-lactate concentration for the diagnosis of prosthetic joint infection (PJI) and septic arthritis (SA) using commercial kits provided by two manufacturers (A and B).

Method: We prospectively included patients with native or prosthetic joints undergoing synovial fluid aspiration as routine diagnostic procedure. Among 224 patients with prosthetic joints, 137 patients had aseptic loosening (AL) and 87 were diagnosed with PJI. Among 71 patients with native joints, 39 were diagnosed with osteoarthrosis (OA) and 32 with SA.

Results: Kits for the measurement D-lactate provided by the manufacturer A.

Patients with prosthetic joints: The mean D-lactate concentration was significantly higher in patients with PJI than with AL (2.33 vs 0.77 mMol, respectively; p<0.0001). The optimal D-lactate cut off was 1.2 mmol/l (sensitivity = 97.7%, specificity = 83.9%, PPV = 79.4%, NPV = 98.3%; AUC = 0.99).

Patients with native joints: We found significantly higher concentration of D-lactate in patients with SA compared to OA (2.27 vs 0.46 mMol, respectively; p<0.0001). The optimal D-lactate cut off was 1.2 mmol/l (sensitivity = 93.8%, specificity = 94.9%, PPV = 93.7%, NPV = 94.9%; AUC = 0.99).

Kits for the measurement D-lactate provided by the manufacturer B.

Patients with prosthetic joints: The difference between concentration of D-lactate in patients with PJI and AL was also significant (mean, 2.5 vs 0.04 mmol/L, respectively; p<0,0001). The optimal D-lactate cut off was 0.5 mmol/L (sensitivity = 94.7%, specificity = 92,0%, PPV = 85.7%, NPV = 97.1%; AUC = 0.99).

Patients with native joints: Significantly higher concentration of D-lactate in patients with SA in comparison with OA (mean, 2.0 vs 0.28 mmol/L, respectively; p<0.0001). The optimal D-lactate cut off was 0.5 mmol/L (sensitivity = 100%, specificity = 92.0%, PPV = 81.8%, NPV = 100%; AUC = 0.99)

Conclusions: The synovial fluid D-lactate test shows high analytical performance and diagnostic capabilities in the diagnosis of PJI and SA. The optimal cut-off for the diagnosis of infection differ between manufactures. Synovial fluid D-lactate is reliable bacterial-specific marker for diagnosis of PJI and SA.

[FP36] RELIABILITY OF INTRA-OPERATIVE FROZEN SECTION STUDY IN REVISION OF INFECTED HIP ARTHOPLASTY

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Aim: To assess the effectiveness of role of frozen section in revision arthroplasty.

Method: 21 patients with infected hip arthroplasties were operated in the form of one or two-staged revision hip arthroplasties. A frozen section was obtained intra-operatively and >5 PMN's/HPF was considered as a positive indicator of infection. Fig 1 llustrating frozen section image . If the frozen section was reported negative (≤5 PMN's/HPF), the revision prosthesis was implanted after a thorough debridement and a wash. If the frozen section was reported as positive, after the debridement a non-articulating antibiotic loaded cement spacer was implanted for 8 weeks, supplemented with 3 weeks of intravenous antibiotics and 3 weeks of oral antibiotics. This was followed by an antibiotic free interval of 2 weeks. The patient was taken up for a revision surgery once the frozen section study was negative (≤5 PMN's/HPF). The patients were followed up for minimum of 1 year to a maximum of 2 years after the revision for any evidence of infection (assessed clinically and serologically, radiologically).

Results: 15 patients had a positive frozen section (>5PMN's/HPF) in the first stage and were treated with prosthesis removal and cement spacer insertion for 8 weeks. In the 2nd stage, out of 15 patients, 14 underwent revision arthroplasty, while 1 patient underwent reapplication of the cement spacer. As per the follow up of ESR & CRP values, clinically and radiologically no patients had any evidence of infection. The average follow up was 17.04 months (range 12-24 months). 1 patient had persistently raised ESR (34mm/hr) which may be attributable to other causes Frozen section analysis of PMN's per high power field had 100% specificity in our patients in detecting periprosthetic joint infection.

Conclusions: Intraoperative frozen section study is a reliable indicator in predicting a diagnosis of PJI with good accuracy in ruling out this diagnosis. Frozen section study should thus be considered a relevant part of the challenging diagnostic work-up for patients undergoing revision hip arthroplasty.

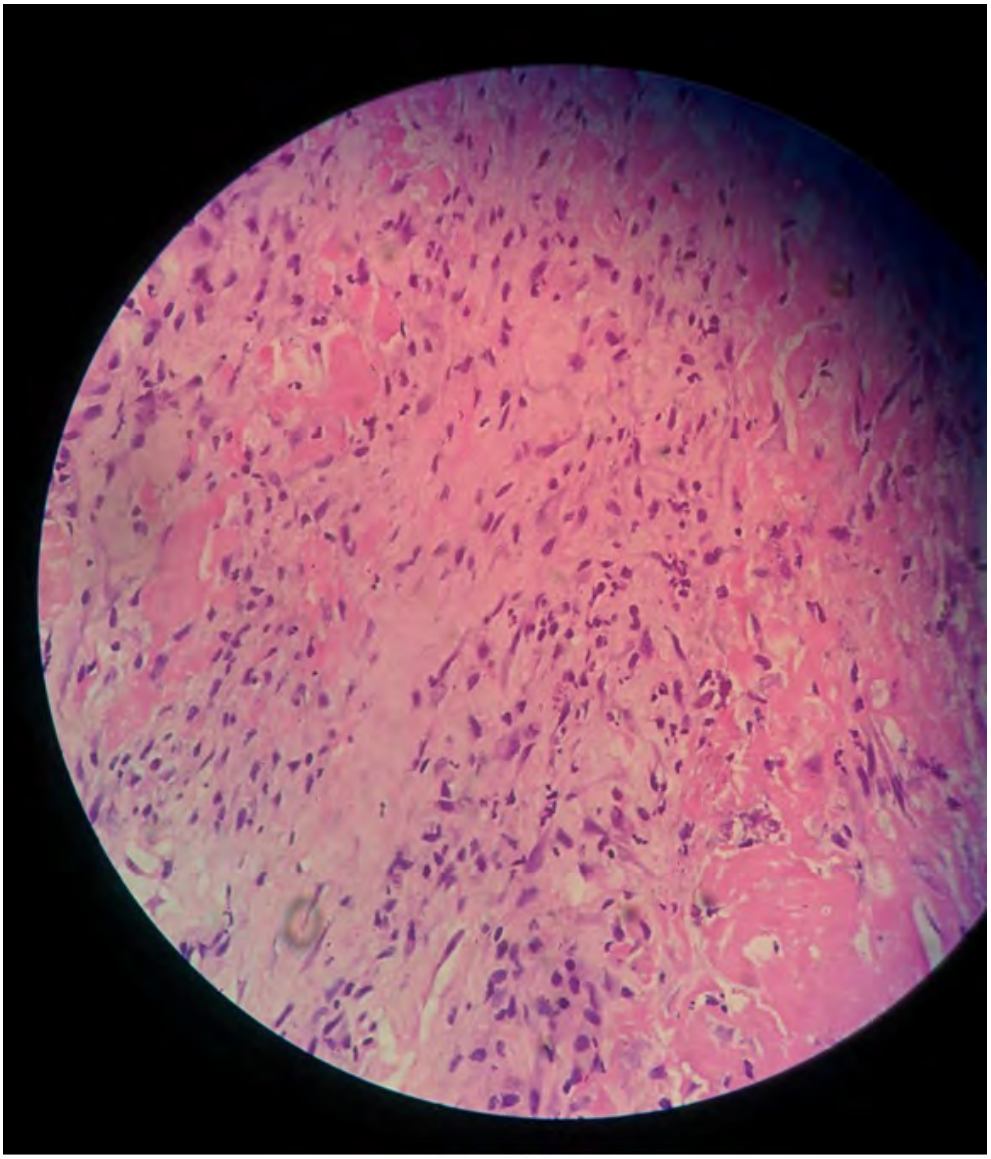

Fig.1 Illustrating Frozen section biopsy specimen viewed under high power microscopic field picture assessing for Polymorphonuclear cells

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[FP37] OPTIMIZED DECISION ALGORITHM FOR THE MICROBIOLOGICAL DIAGNOSIS OF OSTEO-ARTICULAR INFECTIONS IN ADULTS USING JOINT FLUIDS SAMPLES: A PROSPECTIVE STUDY IN TWO FRENCH HOSPITALS INCLUDING 423 SYNOVIAL FLUIDS

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Aims: Microbiological diagnosis of bone and joint infections (BJIs) is pivotal. However, no consensus exists about the best choice for techniques to be used and the best indications for molecular methods. Our objectives were: *(i)* to compare the performance of various microbiological diagnostic methods (cultural and molecular) on synovial fluid specimens and *(ii)* to select an algorithm for optimizing the diagnosis of BJIs in adults.

Methods: This prospective multicentric study (in Lyon and Saint-Etienne, France) included 423 joint fluid samples, collected from 333 adult patients (median age 69 years) suspected for BJI on the basis of medical history and clinical symptoms. For each inclusion, joint fluid and blood culture were collected concomitantly. The synovial fluid was also inoculated into blood culture bottles. Cytology, culture (using 5 solid media and an enrichment broth, incubated for 15 days), universal 16S rRNA PCR and PCR targeting *Staphylococcus* spp, *S.aureus*, *Streptococcus* spp, *S.pneumoniae*, *Kingella kingae*, *Borrelia burgdorferi* and *Propionibacterium acnes* were systematically performed on synovial fluid.

Results: Prosthetic materials were present in 65.0% of the cases and 31.7% of the patients had received antibiotics in the 15 days before puncture. Out of 423 joint fluids, 265 (62.6%) were positive by at least one diagnostic technique (cultural or molecular): 219 mono- and 46 poly-microbial, for a total of 322 bacteria. Identified bacteria were staphylococci in 54.0%, streptococci-enterococci in 15.2%, Gram-negative bacilli in 14.0%, anaerobic species in 10.9% and other bacteria in 5.9% of cases. Comparing the individual performance of each cultural technique, blood culture bottles showed the highest rate of positivity (detecting 61.4 and 58.4% of the bacteria, for the paediatric and anaerobic bottles, respectively) but cannot be performed alone and require to be combined with solid media. The 16S rDNA PCR was positive in only 49.2% of the cases whereas higher detection was obtained with specific PCR. Blood cultures performed concomitantly with joint puncture were positive in only 9.7% of the cases.

Conclusions: In order to simplify the culture procedures and to precise the place of PCR for synovial fluid, we propose the following algorithm: joint fluids should be inoculated onto 3 solid media (blood and chocolate agars for 2 days, anaerobic blood agar for 10 days), associated with inoculation into blood culture bottles for 10 days. If culture remains negative, 16S rDNA PCR and/or *Staphylococcus* PCR should be added. Applying this algorithm on our cohort, 93.6% of the bacteria would have been detected.

[FP38] THE FATE OF BIOPSY NEGATIVE AND SONICATION POSITIVE CULTURES FOLLOWING REVISION OF TOTAL HIP AND KNEE ARTHROPLASTIES

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Aim: What is the fate of revision total joint arthroplasty, when conventional tissue sample culture (TSC) is negative and sonication fluid culture (SFC) is positive, in terms of re-revision?

Method: We prospectively analyzed explanted prosthetic materials from 211 consecutive cases of total hip and knee arthroplasty revision surgery performed on any indication during a one year period. We used a sonication apparatus and protocol that was previously described [Borens et al, 2013. J Orthop Res]. Sampling of five periprosthetic tissue biopsies was performed according to the local protocol and incubated for 5 days. In our non-interventional study design, clinicians were blinded to the results from sonication-culture, which were not used for the subsequent treatment strategy.

In cases with suspected deep infection, thorough debridement was performed during revision surgery, and routine antibiotic treatment was dicloxacillin for 6-8 weeks. Patients were routinely seen in the outpatient clinic after 3 and 12 months, where clinical examination and any antibiotic treatment were documented. Minimum follow-up was 1 year. This cohort study is reported according to the STROBE guidelines.

Results: Microbial findings in TSC and SFC were similar in 41/211 cases. Additional 11/211 cases were identified with positive SFC, despite negative in conventional culture. Of these, 8/11 cases with suspected prosthetic joint infection (PJI) a strategy of revision and empirical antibiotic therapy was completed. Another 3/11 cases with suspected aseptic failure, partial 1-stage revisions were performed with no subsequent antibiotic therapy.

Re-revisions were necessary in 5/11 cases of expected PJI, and 2/11 of these ended up with permanent Girdlestone status. A strategy of antibiotic suppression was implemented in 1/11 case. Another 1/11 patient diseased in circulatory failure 4 days after 2nd stage operation. In 3/11 cases the painful joint prosthesis is still unsolved after 1 year, and only 1/11 case had an asymptomatic prosthesis at follow-up after 1 year. Culture results of the subsequent revisions in this small cohort shows several links to the microbiological findings in SFC.

Conclusions: We identified 11/211 revisions of total joint arthroplasty, where conventional TSC was negative and SFC was positive. The fate of these cases included re-revision in 5/11. From a clinical perspective, patients with additional microbial findings by SFC had a discouraging prognosis and may represent true positive findings that have to be taken into consideration in the infection treatment.

[FP39] INCIDENCE OF SURGICAL SITE INFECTION AFTER PRIMARY HIP AND KNEE ARTHROPLASTY IN RHEUMATIC PATIENTS WITH SPECIAL REFERENCE TO ANTI-RHEUMATIC TREATMENT.

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Aim: Reveal the rate of surgical site infection (SSI) after hip and knee arthroplasty in patients with inflammatory rheumatic disease and analyze if the infection rate was correlated to the given anti-rheumatic treatment. The background is that since 2006 rheumatoid patients operated at the orthopaedic department at Skåne University hospital, Lund, Sweden, have continued treatment with TNF-alpha inhibitors during the perioperative period.

Method: During 2006 to 2015 505 planned primary hip and knee arthroplasties were performed on 403 patients (236 hip arthroplasties and 239 knee arthroplasties). Data on age, sex, diagnosis, BMI, operation time, ASA-classification, treatment with cDMARDs (conventional disease modifying anti-rheumatic drugs) and bDMARDs (biological disease modifying anti-rheumatic drugs), and use of prednisolone was collected. The primary outcome variable was prosthetic joint infection (PJI) within 1 year from surgery with a secondary outcome variable being superficial SSI.

Results*:* In 77.2% (n=390) of the cases the patient medicated with 1 to 3 DMARDs perioperatively. In 30.9% (n=156) of the cases one of the DMARDs was a TNF-alpha inhibitor. The rate of PJI was 2.2% (n=11). The overall rate of infection, including superficial infections, was 4.8% (n=24). In 7 cases of the PJI the patient medicated with 1 to 3 DMARDs. Only in 1 case of PJI (knee) the patient medicate perioperatively with a TNF-alpha inhibitor, in this case etanercept (Enbrel).

Conclusions: We could not find that continuing treatment with TNF-inhibitors perioperatively led to a higher incidence of PJI or SSI than generally would be expected in a group of rheumatoid patients. Based on these results there is no need to discontinue treatment with TNF-inhibitors when performing arthroplasty surgery.

[FP40] CLINICAL AND MICROBIOLOGICAL CHARACTERISTICS OF EARLY ACUTE PROSTHETIC JOINT INFECTION IN SEVERELY OBESE PATIENTS

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Aim: Obese patients are not only more likely to receive total joint arthroplasty, but are also more prone to postoperative complications. The most severe complication is a prosthetic joint infection (PJI), occurring two to four times more often in severely obese patients (BMI ≥ 35kg/m^2) compared to non-obese patients. This higher risk for PJI may be attributed to higher glucose levels in case of diabetes mellitus, diminished wound healing or inadequate antibiotic prophylaxis. To ultimately improve the prevention measures for this specific patient category, we aimed to describe the clinical and microbiological characteristics of early acute PJI in severely obese patients.

Method: We retrospectively evaluated patients with early acute PJI of the hip and knee treated with DAIR between 2006 and 2016 in three Dutch hospitals. According to protocol, cefazolin was administered as antibiotic prophylaxis during arthroplasty and adjusted to bodyweight. PJI was diagnosed using the criteria described by the Musculoskeletal Infection Society. Early acute PJI was defined as less than 21 days of symptoms and a DAIR performed within 90 days after index surgery. Several clinical and microbiological variables were collected and analyzed. Severe obesity was defined as a BMI ≥ 35kg/m^2.

Results: A total of 356 patients were analyzed, including 73 severely obese patients (20.5%). Compared to patients with a BMI < 35kg/m^2, severely obese patients were relatively young (69 years vs 74 years, p=0.001), female (75.3% vs 56.9%, p=0.005), with PJI of the knee (35.6% vs 20.8%, p=0.025) and arthroplasty indicated for osteoarthritis (87.7% vs 63.3%, p=0.001). They had higher incidences of diabetes mellitus (34.2% vs 18.7%, p=0.005) and hypertension (74.0% vs 59.0%, p=0.021). Severely obese patients had more often polymicrobial infections (67.4% vs 45.7%, p=0.009) and higher rates of infection with *Enterococcus* species (37.0% vs 15.8%, p=0.002) and Gram-negative rods, such as *Proteus* species (17.4% vs 2.3%, p<0.001). This finding was most prominent in hips, comprising Gram-negative PJIs in 32.6% of severely obese patients compared to 18.1% in non-severely obese patients (p=0.030). There were no differences in the number of infections due to *Staphylococcus aureus* or *Staphylococcus epidermidis*.

Conclusions: Our results demonstrate that severely obese patients with early acute PJI have higher rates of polymicrobial infections with involvement of Gram-negative rods and enterococci, especially in the hip region. Our data stress the importance of improving preventive strategies in this specific patient category, which may entail extension of antibiotic prophylaxis to a broader Gram-negative and Gram-positive coverage.

[FP41] TREATMENT OF PROSTHETIC-JOINT INFECTIONS: SUCCESS RATE OVER THE LAST 10 YEARS

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Aim: There is a constant increase of total joint arthroplasties to improve the quality of life of an aging population. Prosthetic-joint infections are rare, with an incidence of 1-2%, but they represent serious complications in terms of morbidity and mortality. Different therapeutic options exist, but their management is still poorly standardized because of the lack of data from randomized trials. The aim of this retrospective study is to assess the infection eradication success rate, over the last ten years, using different patient adapted treatment options.

Method: Patients having a prosthetic-joint infection at Lausanne University Hospital (Switzerland) between 2006 and 2016 were included. The success rate depending on age, type of prosthesis, type of infection and type of surgical procedure was analyzed.

Results: 444 patients (61% hips, 37% knees) were identified with a median age of 70 years. The success rate was 93% for two-stage exchange, 78% for one-stage exchange and 75% for debridement with retention of the prosthesis. The failure rate was higher for knee prosthetic-joint infections (27%) than hip infections (13%). Furthermore, chronic and in elderly prosthetic-joint infections seemed to have a worse prognosis.

Conclusions: The infection eradication depends on age, type of prosthesis, type of infection and type of surgical procedure, with three times less failure in two-stage exchange surgery.

[FP42] SEPTIC REVISION TOTAL KNEE ARTHROPLASTY: TREATMENT OF EXTENDED BONE DEFECTS USING METAPHYSEAL SLEEVES

Mathias Glehr[1], Sebastian Klim[1], Florian Amerstorfer[1], Gerwin Bernhardt[1], Patrick Sadoghi[1], Gerald Gruber[1], Andreas Leithner[1], Roman Radl[1]

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Aim: Bone loss is a severe problem in septic revision total knee arthroplasty (RTKA). The use of porous coated metaphyseal sleeves is a promising treatment option for extended bone defects. The currently published mid-term results remain limited and no study has been focused exclusively on septic cases. Our aim was to determine the implant survivorship (with special focus on osseointegration) and the clinical and radiological mid-term outcome of metaphyseal sleeve fixation in septic RTKA surgery (minimum follow-up of 2 years).

Method: Between January 2005 and September 2015, 57 patients underwent septic RTKA surgery using metaphyseal sleeves. In 56 patients (98,2 %) who underwent a total of 69 two stage revision procedures, clinical and radiological follow-up examinations were conducted. One patient (1,8 %) was lost to follow-up. The examinations included the American Knee Society Score (KSS), the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), the SF-36 Health survey as well as radiographic measurement to determine if successful osseointegration had been achieved.

Results: Thirteen knees (18.8%) had to be re-revised at the time of follow-up (mean 5.3 years, min. 2 – max. 11.2), all due to reinfection (Figure 1). We did not encounter any cases of aseptic loosening. The mean range of motion (92° ± 21°), SSS (7 ± 2), KSS (76 ± 19), WOMAC (70 ± 20), SF-36 MCS (55 ± 14) and SF-36 PCS (35 ± 9) have shown satisfying results.

Conclusions: Metaphyseal sleeves have shown very promising mid-term results regarding clinical scores, osseointegration, and aseptic loosening. Our results are the first analysing the performance of metaphyseal sleeves in exclusively septic cases and show that they are a reliable fixation option in septic RTKA patients with severe bone loss.

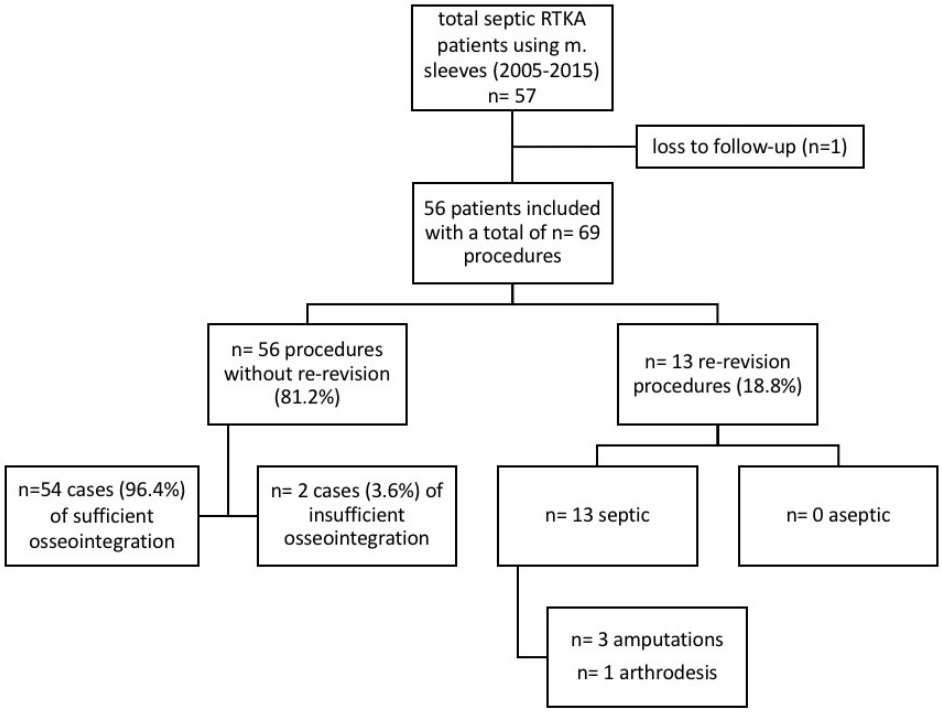

Figure 1. Flow-chart showing patients included in the study, re-revision rates (including indications) as well as the insufficient osseointegration rate in patients without re-revision.

[FP43] A MOBILE APP FOR POSTOPERATIVE WOUND CARE AFTER JOINT ARTHROPLASTY: PERCEIVED USEFULNESS AND EASE OF USE

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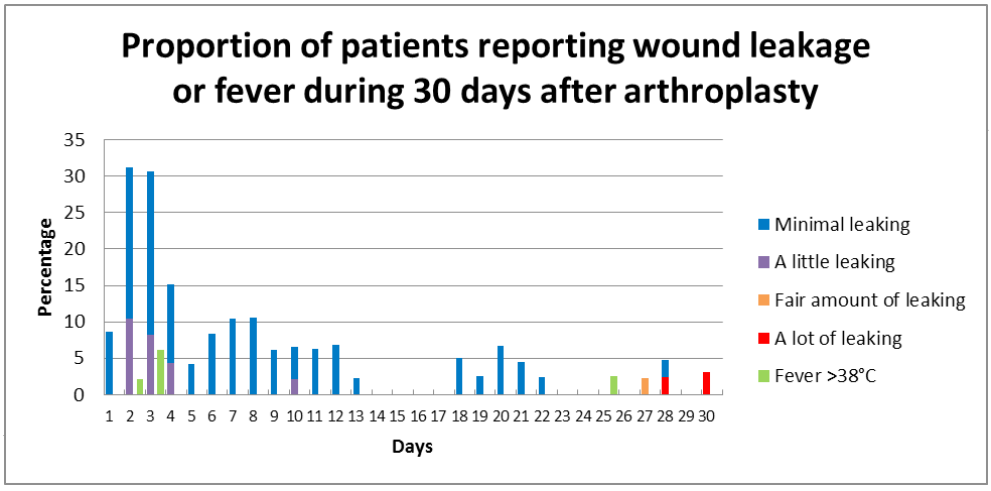
Aim: Early discharge of patients after joint arthroplasty leaves patients responsible for monitoring their postoperative wound by themselves. This might result in a delayed presentation of postoperative complications. The use of a mobile woundcare app by patients after arthroplasty might result in (1) earlier report of complications, (2) an increase in patient satisfaction and (3) insight in the incidence and duration of postoperative wound leakage. Therefore, the ease of use and perceived usefulness of using a postoperative mobile woundcare app in patients after joint arthroplasty was investigated.

Method: A cohort study was conducted in 2017 in 2 Dutch Hospitals. Eligible cases were all consecutive patients that received an arthroplasty and who owned a smartphone. During the first 30 postoperative days, patients filled in daily reviews of their wound and took a photo of the wound. Based on the review, an underlying algorithm calculated daily a score that prompted a mobile alert if needed, which advised patients to contact the hospital. Patients filled in a form on day 30 and day 90 in order to document occurrence of any postoperative wound complication. On day 15 and 30, patients were requested to fill in a questionnaire evaluating the perceived usefulness and the ease of use of the App.



[FP44] VANCOMYCIN ELUTION FROM A BIPHASIC BONE SUBSTITUTE: ANTIBIOTIC CONCENTRATIONS MEASURED IN DRAINAGE FLUID, SERUM AND URINE OVER 4 WEEKS.

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Aim: *In vivo* studies have shown a preventive and curative effect of using an injectable vancomycin containing biphasic ceramic in an osteomyelitis model. No clinical long term pharmacokinetic release study has been reported. Inadequate concentration in target tissues results in treatment failure and selection pressure for antibiotic-resistant organisms.

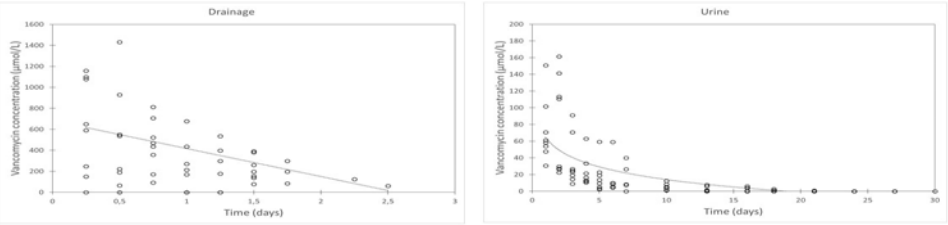
Our hypothesis was that vancomycin in the first week would reach high local concentrations but with low systemic levels.

Method: 9 patients (6 women, 3 men) with trochanteric hip fractures classified as A1 and A2 according to the AO-classification all had internal fixations. The mean age was 75.3 years (± S.D. 12.3 years, range 44-84y). An injectable ceramic with hydroxyapatite embedded in a calcium sulphate matrix containing 66mg vancomycin per mL augmented the fixation. A mean of 9.7 mL (± S.D. 0.7 mL, range 8-10mL) was used. The elution of vancomycin was followed by collecting drain fluid, blood (4 days) and urine (4 weeks)

Results: The concentration of antibiotics in the drain showed an important burst during the first 12h after surgery, with a mean value of 709.9 µmol/L (± S.D. 383.9), which decreased linearly to a mean value of 60.9 µmol/L at 2.5 days. In the urine, the vancomycin concentration reached 68.9 µmol/L (± S.D. 34.4) during the first day, which was decreased logarithmic over the first two weeks to reach zero at 20 days (see Figure). The systemic concentration of vancomycin was constantly low, not exceeding 2.6 µmol/L.

Conclusions: This is the first long term pharmacokinetic study reporting vancomycin release from a biphasic injectable ceramic bone substitute. The study shows initial high targeted local vancomycin levels (wound drainage), sustained and complete release at three weeks (verified by the urine concentrations), and systemic concentrations well below toxic levels. This system should be useful in preventing and treating bone infection.

Vancomycin elution from a biphasic ceramic bone substitute



[FP45] SINGLE-DOSE BONE PHARMACOKINETICS OF VANCOMYCIN IN A PORCINE IMPLANT-ASSOCIATED OSTEOMYELITIS MODEL

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Aim: The increasing incidence of orthopaedic ***methicillin-resistant Staphylococcus aureus*** (MRSA) infections represents a significant therapeutic challenge. Being effective against MRSA, the role of vancomycin may become more important in the orthopaedic setting in the years to come. Nonetheless, vancomycin bone and soft tissue penetration during infection remains unclear. We assessed the effect of a traumatically induced, implant-associated acute osteomyelitis on vancomycin bone penetration in a porcine model.

Method: In eight pigs, implant-associated osteomyelitis was induced on day 0, using a ***Staphylococcus aureus*** strain. Following administration of 1,000 mg of vancomycin on day 5, vancomycin concentrations were obtained with microdialysis for eight hours in the implant bone cavity, in cancellous bone adjacent to the implant cavity, in subcutaneous adipose tissue (SCT) adjacent to the implant cavity, and in healthy cancellous bone and healthy SCT in the contralateral leg. Venous blood samples were also obtained. The extent of infection and inflammation was evaluated by post-mortem computed tomography scans, C-reactive protein serum levels and cultures of blood and swabs.

Results: In relation to all the implant cavities, bone destruction was found. Ranging from 0.20 to 0.74, tissue penetration, expressed as the ratio of tissue to plasma area under the concentration-time curve from 0 to the last measured value, was incomplete for all compartments except for healthy SCT. The lowest penetration was found in the implant cavity.

Conclusions: ***Staphylococcus aureus*** implant-associated osteomyelitis was found to reduce vancomycin bone penetration, especially in the implant cavity. These findings suggest that it may be unsafe to rely solely on vancomycin therapy when treating acute osteomyelitis. Particularly when metaphyseal cavities are present, surgical debridement seems necessary.

[FP46] NOT ALL CERAMIC ANTIBIOTIC CARRIERS ARE THE SAME. OUTCOMES FOR TWO DIFFERENT LOCAL ANTIBIOTIC CARRIERS IN THE MANAGEMENT OF CHRONIC OSTEOMYELITIS.

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Aims: Dead space management is an important element in the surgical management of chronic osteomyelitis and can be addressed with the use of a biodegradable local antibiotic carrier. We present the clinical and radiographic outcomes in two different biodegradable antibiotic carriers used in the management of chronic osteomyelitis.

Method: A single centre series reviewed between 2006-2017. The initial cohort (2006-2010) of 180 cases (Group A) had a calcium sulphate carrier containing tobramycin (Osteoset® T, Wright Medical). The second cohort (2013-1017) of 162 cases (Group B) had a biphasic calcium sulphate, nano-crystalline hydroxyapatite carrier containing gentamicin (Cerament™ G, Bonesupport AB).

All cases were Cierny-Mader Grade III and IV and had a minimum of one-year clinical follow-up.

Clinical outcomes reviewed included infection recurrence rate, wound leak, and subsequent fracture involving the treated segment. All cases with a minimum one-year radiographic follow-up were reviewed and bone void filling was assessed as percentage filling on the final follow-up radiograph to the nearest five percent increment.

Results: Mean follow-up in Group A was 4.2 years (range 1.3–10.5 years) and in Group B it was 1.8 years (1-4.7 years). Group A had a significantly higher rate of infection recurrence (19/180 (10.6%) Vs. 7/163 (4.4%) p=0.030), wound leak (33/180 (18.3.%) Vs. 16/162 (9.9%) p=0.026) and subsequent fracture rate (11/180 (6.1%) Vs. 3/162 (1.9%) p=0.047) compared to Group B.

Of the cases with a minimum of one-year radiographic follow-up Group A had 96 cases (mean follow-up 3.3 years, range 1.0-10.5 years) and Group B had 137 cases (mean follow-up 1.6 years, range 1.0-4.7 years). The mean bone void healing in Group B was significantly better than Group A (74.0% Vs. 41.7%, p <0.00001).

Conclusions: Cerament™ G has significantly better bone healing compared to a calcium sulphate carrier and was associated with a lower rate of recurrent infection, wound leak and subsequent fracture risk.

[FP47] RADIOLOGICAL AND CLINICAL OUTCOMES IN THE MEDIUM-TERM OF THE USE OF AN ANTIBIOTIC BONE SUBSTITUTE IN THE DIABETIC FOOT

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Aim: The aim of this work was to evaluate, via foot and ankle TC scans, the outcomes of the use of a bone substitute (CERAMENT|™G) and the growth of native bone in the treatment of osteomyelitis (OM) of the diabetic foot.

Method: In nine patients from July 2014 to December 2016 we used a Calcium Sulphate Hemihydrate + Hydroxyapatite + Gentamicin Sulfate (CSH + HA + GS) compound to fill resected bone voids following surgical intervention in OM diabetic foot cases. Of these nine patients, three were female and six were male and their ages were between 49 and 72 years. Four patients had hindfoot involvement and underwent partial calcanectomy. Two patients presented a rocker-bottom Charcot foot pattern III according to Sanders and Frykberg's classification and were treated with esostectomy of the symptomatic bony prominence of the midfoot. One patient presented OM of the 3°, 4° and 5° metatarsal bones. One patient underwent partial resection of the midfoot and hindfoot with arthrodesis stabilised by an internal-external hybrid fixator. One patient with a Charcot foot pattern IV-V underwent partial talectomy and calcanectomy with arthrodesis stabilised by an internal-external hybrid fixator. In all these patients - after removal of the infected bone - we applied 10 to 20 ml CSH + HA + GS filling the residual spaces with the aim of stabilising the remaining bone fragments. The uniqueness of this product is that it induces native bone growth, while the synthetic bone disappears and antibiotic is released into the surrounding tissues. In March 2018, the above nine patients underwent foot and ankle TC scans to evaluate bone growth.

Results: The first four patients showed new bone formation in the calcaneus. Two patients with previous midfoot destruction showed chaotic but stable bone formation. The patient with metatarsal OM showed partial bone healing with residual pseudoarthrosis. Both the two patients who underwent arthrodesis with hybrid fixators showed a plantigrade and stable foot even though a heel wound is still present in one of the patients. All patients except this one are now wearing suitable shoes as post-operative wounds have healed. The patient still with the heel wound is walking with an aircast brace.

Conclusion: The TC scans have shown new bone formation sufficient to stabilise the foot and allow ambulation. In particular, very good results come from the filling of the calcaneus, probably due to the anatomy of the bone itself.

[FP48] IN VITRO ANTIBACTERIAL ACTIVITY OF BIOACTIVE GLASS S53P4 ON MULTIRESISTANT PATHOGENS CAUSING OSTEOMYELITIS AND PROSTHETIC JOINT INFECTION

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Aim: We aimed to compare the in vitro antibacterial activity of Bioactive Glass (BAG) S53P4, which is a compound showing local antibacterial activity, to that of antibiotic-loaded polymethylmethacrylate (PMMA) against multidrug resistant bacteria from osteomyelitis (OM) and prosthetic joint infection (PJI) isolates.

Method: We studied convenience samples of multidrug resistant (MDR) microorganisms obtained from patients presenting OM and prosthetic joint infection (PJI). Mixtures containing tryptic soy broth (TSB) and inert glass beads (2mm), BAG-S53P4 granules (0.5-0.8mm and <45 mm) and Gentamicin or Vancomycin-loaded PMMA beads were inoculated with methicillin-resistant Staphylococcus aureus (MRSA) and methicillin-resistant coagulase-negative Staphylococcus (MR-CoNS), Pseudomonas aeruginosa or Klebsiella pneumoniae isolates. Glass beads (2.0mm) were used as a control. Antibacterial activity was evaluated by means of time-kill curve, through seeding the strains on blood agar plates, and subsequently performing colony counts after 24, 48, 72, 96, 120 and 168 hours of incubation. Differences between groups were evaluated by means of two-way analysis of variance (ANOVA) and Bonferroni's t test.

Results: Inhibition of bacterial growth started soon after 48 hours of incubation, reached zero CFU/ml between 120 and 168 hours of incubation for both antibiotic-loaded PMMA and BAG S53P4 groups, in comparison with inert glass ($p < 0.05$). No difference regarding time-kill curves between antibiotic-loaded PMMA and BAG S53P4 was observed. Moreover, despite no difference was observed between both Vancomycin - or Gentamicin-loaded PMMA and BAG groups, there was statistical difference between the effectiveness of all treatments (BAG included) against gram-positive cocci and gram-negative bacilli, the latter of which requiring longer time frames for the cultures to yield no bacterial growth.

Conclusions: BAG S53P4 presented antibacterial properties as much as antibiotic-loaded PMMA for MDR bacteria producing OM and PJI, although presenting differences between its effectiveness against different bacterial groups.

[FP49] TREATMENT OF CHRONIC OSTEOMYELITIS WITH AN ABSORBABLE GENTAMYCIN-LOADED BIOCOMPOSITE, A RETROSPECTIVE CONSECUTIVE SERIES OF 97 CASES.

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Aim: Chronic osteomyelitis (OM) is usually treated with surgical excision of infected bone and subsequent dead space management to prevent local recurrence. We report outcome after antibiotic loaded biocomposite (ALB)[1] for management of infected bone defects.

Method: We report a consecutive series of 97 patients with chronic OM treated at one institution by a multidisciplinary team, using a single-stage revision protocol inspired by a recently published study[2].

The treatment protocol includes surgical debridement, tissue sampling, dead-space management using the ALB, stabilization and empirical antibiotic therapy adjusted based on culturing. Closure was performed directly, with a local flap, a free flap or secondarily.

This series includes all patients operated using the ALB at our institution, since its implementation 26 months ago. The senior author (HG) performed 65 (67%) of the operations. The remaining procedures were performed by 14 different surgeons.

Results: Mean age was 66.2 years (26 to 92). In 41 patients, OM followed an overlying soft-tissue infection, 30 followed surgical management of a closed fracture in the affected bone, 18 followed elective surgical procedures in the area, 5 followed open fractures of the affected bone, 2 were spontaneous following bacteremia and 1 patient had previously been diagnosed with OM in the affected bone.

Seventy one (73,2%) of the included patients had systemic comorbidities (Cierny-Mader Class B hosts), thirty eight were diabetics, twenty-three were active smokers and twenty-five had a past history of smoking, fourteen consumed alcohol in quantities constituting alcohol abuse and 9 had a previous history of alcohol abuse.

Patients were followed-up by chart review for a mean of 5.8 months (0 to 25). Twelve patients required a soft-tissue revision after a mean time of 2.2 months (0 to 12). Eleven patients required bone revision after a mean time of 3.4 months (0 to 10) where the ALB was re-applied in nine cases. Six patients required amputation after a mean time of 3.2 months (0 to 12). Two patients died after a 1 and 5 months respectively. Seventy patients (73%) had no adverse advents following surgery.

Conclusions: An acceptable outcome was obtained considering a heterogeneous population with a high comorbidity rate and considerable smoking and alcohol abuse.

References:

1.Cerament|G, Bonesupport AB, SE.
2. McNally MA, *Bone Joint J*. 2016;98(9):1289–1296.

[FP50] ROLE OF BACTERIAL COLONIZATION OF SPACERS IN TWO-STAGE ARTHROPLASTY REVISION SURGERY

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Aim: In two-stage replacements for septic loosening, some studies have suggested that associate bacterial colonization of spacers had a worse result in relation to the control of the infection and a higher rate of complications after the implantation of the definitive prosthesis.

The aim of our study was to determine the reoperation rate of patients undergoing two-stage revision surgery according to the results of spacer sonication.

Method: A retrospective observational study was conducted in which 56 hip or knee spacers implanted at our center from 2010 to 2017 were analysed. Patients were grouped into three categories:

A- Patients with positive spacer sonication fluid culture, with or without positive cultures from the rest of the samples.
B- Patients with negative spacer sonication culture and negative second-stage intraoperative cultures.
C- Patients with negative spacer sonication culture but positive cultures of the rest of intraoperative samples.

Results: Of the 56 patients analysed, 11 were included in group A, 32 in group B and 13 in group C. The reoperation rate was 36%, 34% and 54% respectively. Reoperation rate due to infection was 9%, 25% and 46% respectively. In only two cases (both in group C), the reoperation was caused by infection by a previously isolated microorganism.

Spacers were colonized in all cases by low virulence microorganisms (*coagulase negative staphylococci, P. acnes or Candida*). Within group A, six patients also had other positive cultures.

Conclusions: In our study, bacterial colonization of the spacer is not associated with a higher rate of reoperations in the short-medium term. The group of patients with positive cultures in the second stage surgery was the one with the highest rate of reoperations.

[FP51] PREVENTION OF CALCANEAL FRACTURE SYNTHESIS INFECTION USING BONE SUBSTITUTE ELUTING ANTIBIOTIC

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Aim: The optimal treatment of displaced intra-articular calcaneal fractures (DIACF) remains controversial. The operative treatment group has better anatomical recovery, functional outcome scores and less pain than non operative treatment patients, but it may lead to a higher incidence of complications, such as delayed wound healing and surgical site infections. The aim of this study was to analyze the prophylactic effect using a biphasic bone substitute (BS) eluting antibiotic on calcaneal implant-related infections.

Methods: We conducted a retrospective non-randomized review of all patients with DIACF (type Sanders 2, 3, 4) from 2009 to 2017; 103 calcaneal fractures of 90 patients (13 bilaterally) were treated with plates. All cases received the same systemic antibiotic prophylaxis; BS was used on more complex cases with large bone defect and BS was added with antibiotic on higher risk patients. We collected data including complications: major (deep infections, osteomyelitis) and minor complications (wound dehiscence, superficial infection). We considered the absence of deep infections after 6 months. We compared statistically the outcomes of 3 operative groups: the first was treated with plates only (A), the second with plates and BS (B) and the third with plates added with BS eluting antibiotic (vancomicine or gentamicine) (C).

Results: We examined 99 cases (group A: n33, B: n52, C: n14), 4 patients were lost; the mean age was 47,8 years (range 18–83 years). Minimal follow up was 6 months (range: 6 – 42 months).

We have observed 7 (7%) implant-related infection (A:4, 12,1%; B:3, 5,7%), 2 (2%) superficial infection (B:2, 3,8%), 13 (13,1%) wound healing defects (A:8, 24,2%; B:3, 5,7%; C:2, 14,2%).

We found a relevant reduction of the rates in the group C regarding the major complications without a statistic evidence.

Conclusion: The three groups are uneven; particularly the group C has a high concentration of more severe risk patients. The low number of cases in the group C, which limited the statistic evidence, represents a second limit. The absence of major infection on group C found in this study, needs larger data to confirm this result. The open surgery has an intrinsic rate of skin complications but the use of BS eluting local antibiotic is an additional tool to manage difficult complex fractures and to prevent implanted-related infection, inhibiting bacterial colonization and biofilm protection, particularly in those patients that have suffered from a minor complication, which could lead to a deep infection.

[FP52] HISTOLOGICAL ASSESSMENT OF BONE REMODELLING WITHIN A BIOABSORBABLE BONE SUBSTITUTE IN CHRONIC OSTEOMYLEITIS

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Aim: This study describes the histologic changes seen with a gentamicin-eluting synthetic bone graft substitute (BGS)(1) in managing bone defects after resection of chronic osteomyelitis (cOM).

Method*:* 154 patients with mean follow-up of 21.8 months (12-56) underwent treatment of cOM with an antibiotic-loaded BGS for defect filling..

Nine patients had subsequent surgery, not related to infection recurrence, allowing biopsy of the implanted material. These biopsies were harvested between 19 days and two years after implantation, allowing a description of the material's remodelling over time. Samples were fixed in formalin and stained with haematoxylin-eosin. Immunohistochemistry, using an indirect immunoperoxidase technique, identified the osteocyte markers Dentine Matrix Protein-1 (DMP-1) and Podoplanin, the macrophage/osteoclast marker CD68, and the macrophage marker CD14.

Results: The material was actively remodelled and was osteoconductive. There was evidence of osteoblast recruitment, leading to osteoid and intramembranous formation of woven and lamellar bone on the material's surface, seen most prominently in areas of well-vascularised fibrous tissue. Osteocytes in woven bone expressed the markers DMP-1 and Podoplanin. No cartilage or endochondral ossification was seen.

There was a prominent (CD14+/ CD68+) macrophage response to the BSG and macrophages within reparative cellular and collagenous fibrous tissue.

In biopsies taken between 4 and 5 months, there were bone trabeculae containing BGS of mainly woven but partly lamellar type. Giant cells on the surface of newly formed mineralised osteoid and woven bone expressed an osteoclast phenotype (CD68+/CD14-).

In later biopsies (up to 2 years), larger bone trabeculae were seen more frequently within well-vascularised reparative fibrous tissue. The BGS was replaced with predominantly lamellar bone. .

One biopsy was taken from an extraosseous leak of BGS into the soft tissues, behind the distal tibia.. The histology showed a heavy macrophage infiltrate, but notably no evidence of osteoid or bone formation in the material or surrounding soft tissues

Conclusion: There was clear evidence that this BGS is osteoconductive with first osteoid then woven and lamellar bone being formed. DMP-1 and podoplanin-expressing osteocytes present in woven and lamellar bone demonstrate osteoclastic bone remodelling. Increased lamellar bone was noted in later samples and bone formation was most prominent in well-vascularised areas. There was on-going remodelling of the material beyond one year. The BGS did not ossify in soft tissue. The hydroxyapatite scaffold in this material is probably responsible for its high osteoconductivity and potential to be transformed into bone.

1 (CERAMENT™|G, BONESUPPORT, Lund, Sweden)

[FP53] ANTIBIOTIC LOADED CALCIUM SULPHATE HYDROXY APATITE BIO COMPOSITE IN DIABETIC FOOT SURGERY

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Aim: The primary aim of multidisciplinary management of diabetic foot disease is limb savage. Difficulty in eradication of infection with systemic antibiotics and obliteration of dead space created by debridement, are two major stumbling blocks in achieving this. . Antibiotic loaded bio composites help achieve both these objectives. The aim of this study is to report the early results of antibiotic loaded bio composites in diabetic foot disease

Method: We present early results of 16 patients with diabetic foot disease and osteomyelitis in whom we used antibiotic loaded bio composite (CERAMENT G Bone Support, Lund, Sweden) for local antibiotic delivery and dead space eradication. A multidisciplinary team managed all patients. We performed magnetic resonance and vascular imaging preoperatively and adhered to a strict protocol involving debridement, culture specific systemic antibiotics and dead space obliteration with antibiotic loaded bio composite. The wound was managed with negative pressure wound therapy and all patients were kept non-weight bearing with a plaster back slab or walking boot. Skin cover where required was undertaken by our plastic surgeons.

Results: According to the Cierny –Mader Classification 1 patient was type 1, 4 were defined as type 2, 7 were type 3 and 4 were type 4. Seven patients were classed as type B hosts and 9 were type A hosts. At a mean follow up of 38 weeks (26-60) we achieved infection clearance in 14 patients (88%). 10 (63%) wounds healed by secondary intention, 2 had split skin graft, and 1 had primary closure. 2 patients were still on negative pressure wound therapy at final follow-up, one of which has got clearance of infection. One patient is having regular dressings in the community. We had 2 patients who had below knee amputation, one due to significant vascular disease and the other at patient request.

Conclusions: A multidisciplinary approach and a strict protocol including augmented debridement and Cerament G injection are effective for treatment of chronic osteomyelitis in diabetic foot disease. The early results with this bio composite antibiotic combination are encouraging.

[FP54] HYPERCALCAEMIA IN THE MANAGEMENT OF BONE AND JOINT INFECTION: A COMPARISON OF 2 ANTIBIOTIC DELIVERY SYSTEMS

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Aim: Antibiotic-eluting calcium compounds can be used to deliver antibiotics in the management of prosthetic joint infection (PJI). Described omplications include wound drainage, heterotopic ossification(HO) as well as hypercalcaemia which is potentially life threatening.

The aim of this study is to assess the incidence of hypercalcaemia and other complications between two calcium based antibiotic delivery systems.

Method: A retrospective study was performed. Thirty two patients treated with Stimulan or Cerament Calcium based antibiotic delivery system between August 2014 to January 2017 were included.

Seven patients received Cerament, 21 cases received Stimulan and one patient received both.

The volume used as well as pre- and post-operative serum calcium were recorded as well as any wound related complications and radiologic changes suggestive of heterotopic ossification. The postoperative serum adjusted Calcium were taken weekly during the initial post operative period.

Patients with overactive parathyroid disease and pre-existing renal disease were excluded.

Results: Stimulan group (n=22, Mean volume 39.2ml)

Mean pre-operative serum calcium was 2.48mmol/l. At 1 and 2 weeks post-surgery mean levels were 2.51 and 2.47mmol/l (patients receiving <40ml), and 2.47 and 2.50mmol/l (patients receiving >40ml - 9 cases) respectively.

There was no significant difference between pre/post-operative levels at 1 (p=0.97) or 2 weeks (p=0.91) and no difference between those treated with <40ml or >40ml of Stimulan at 1 or 2 weeks (p=0.91)

Cerament group (n=8, Mean volume 9.4ml)

Mean pre-operative serum calcium was 2.42mmol/l. Mean post-operative levels at 1 and 2 weeks post-surgery were 2.44mmol/l (p=0.92) and 2.37mmol/l (p=0.61) respectively.

One patient had prolonged wound discharge and required re operation. No HO was encountered.

Conclusions: Our results suggest that hypercalcaemia and other complications are uncommon with the use calcium based antibiotic delivery systems and that calcium based antibiotic delivery systems are safe in the treatment of PJI.

[FP55] PREOPERATIVE ORAL ANTIBIOTIC USE AND THE RISK OF PERIPROSTHETIC JOINT INFECTION AFTER PRIMARY KNEE OR HIP REPLACEMENT

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Aim: Patients use antibiotics for various reasons before elective joint replacement surgery, but it is not known how common this is. The aim of this study was to investigate patients' use of oral antibiotics before elective joint replacement surgery and how this affects the risk for periprosthetic joint infection (PJI) in a one-year follow-up.

Method: Patients with a primary hip or knee replacement performed in a tertiary care hospital between September 2002 and December 2013 were identified (23 171 joint replacements, 10 200 hips and 12 971 knees). Information on oral antibiotics purchased within 90 days before the operation was gathered from a national database. The occurrence of a PJI, identified by prospective infection surveillance, in a one-year follow-up was the primary outcome. The occurrence of any surgical site infection was analyzed as a secondary outcome. The association between antibiotic use and subsequent infection was examined using a multivariable logistic regression model that included information on the operated joint, age, gender, body mass index and patients' chronic diseases (according to medication data).

Results: During the one-year follow-up, 158 (0.68%) PJIs were identified. 4 106 (18%) of the joint replacement operations were preceded by one or more courses of oral antibiotics. The most commonly prescribed group of antibiotics was 1st generation cephalosporins. The incidence of PJI for patients with preoperative oral antibiotic use was 0.29% (12/4 106), compared to 0.77% (146/19 065) in patients without preoperative antibiotics. A preoperative oral antibiotic course decreased the risk for subsequent PJI both in the univariate (OR 0.38, 95% CI 0.21 – 0.69) and multivariable model (OR 0.40, 95% CI 0.22–0.73). When superficial infection cases were included in the analysis, preoperative antibiotic use did not affect the overall risk for surgical site infection.

Conclusions: The use of oral antibiotics before elective joint replacement surgery is common and is associated with a lower risk for subsequent PJI. Further studies are needed in order to confirm this finding and to evaluate factors affecting this result. Meanwhile, the indiscriminate use of antibiotics before elective joint replacement surgery cannot be recommended, even though the treatment of active infections remains important in the prevention of surgical site infections.

[FP56] CANDIDA PERIPROSTHETIC JOINT INFECTION: A CASE SERIES

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Aim: Optimal strategies for surgical and antimicrobial management of *Candida* periprosthetic joint infections (PJI) are unclear. We present a retrospective case series of patients diagnosed with PJI caused by *Candida* spp.

Method: Patients treated at our institution with *Candida* PJI from 01/2017 to 04/2018 were retrospectively included with isolation of *Candida* spp. in synovial fluid, intraoperative tissue or sonication fluid culture. PJI was defined by the proposed European Bone and Joint Infection Society (EBJIS) criteria. Treatment failure was defined as relapse or persistence of infection.

Results: We included 9 patients (4 men and 5 women, mean age 75 years) involving 4 knee and 5 hip joint prosthesis. Risk factors for *Candida* PJI were prior PJI (n=4), diabetes mellitus (n=3), chronic kidney disease (n=3), obesity (n=3), negative-pressure wound therapy (n=3), rheumatoid arthritis (n=1) and chronic decubitus (n=1). Two patients had no risk factors for *Candida* PJI identified. Infection was acquired postoperatively (n=7), hematogenously (n=1) or contiguously through communicating vesico-articular sinus (n=1). The causative pathogen was *C. albicans* in 5, *C. parapsilosis* in 3, *C. tropicalis* in 1 patient, isolated from periprosthetic tissue samples (n=7), sonication fluid (n=3) and blood cultures (n=2); bacterial co-pathogens were isolated in 8 patients. Histopathological analysis revealed low-grade inflammation in all 6 patients, in whom it was performed. All patients were treated with oral fluconazole for 3 months, two initially received intravenous caspofungin and three received suppression with oral fluconazole for additional 9 months (total treatment 12 months). Liposomal amphotericin B (300-700 mg per 40 g bone cement) was admixed to spacer cement in 3 patients. Debridement and prosthesis retention was performed in one patient with tumor prosthesis after bone resection due to osteochondrosarcoma. In the remaining 8 patients the prosthesis was removed, with one-stage reimplantation in 1 patient and two-stage reimplantation in 3 patients (after 6 weeks, 3 months and 7 months); two patients are currently awaiting reimplantation, one died due to reason not related to PJI and another underwent knee arthrodesis. Among 5 patients with prosthesis in place, relapse occurred in one patient with prosthesis retention. Another patient experienced new PJI of the exchanged prosthesis caused by *Staphylococcus aureus*.

Conclusions: All *Candida* PJI presented as chronic infection with low-grade inflammation. Treatment with prostheses retention failed, whereas in 4 patients who underwent two-stage exchange and long-term antifungal suppression, no relapse or persistence of infection was observed. All patients received oral fluconazole for ≥3 months.

[FP57] THE FATE OF PERIPROSTHETIC JOINT INFECTION IN PATIENT WITH MULTIPLE PROSTHETIC JOINT

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Aim: As the populations of patients who have multiple prosthetic joints increase these years, the fate of a single joint periprosthetic joint infection in these patients is still unknown. Risk factors leading to a subsequent infection in another prosthetic joint are unclear. Our goal is to identify the risk factors of developing a subsequent infection in another prosthetic joint and describe the organism profile to the second prosthetic infection.

Method: We performed a retrospective cohort study of all PJI cases underwent surgical intervention at our institute, a tertiary care referral center over 11 years, during January 2006 to December 2016. We identified 96 patients with periprosthetic joint infection who had another prosthetic joint in place at the time of presentation. The comorbidity, number of prosthetic joints, date and type of each arthroplasty, times of recurrent infection at each prosthetic joint with subsequent debridement or 2-stage resection arthroplasty, organisms from every infection episode, the outcome of each periprosthetic joint infection in these patients were analyzed.

Results: During January 2006 to May 2017, we retrospective collected 294 PJI cases (159 hips, 135 knees) in our institute. Patients with single prosthetic joint were excluded and finally 96 patients were included. Of the 96 patients, 19 (19.79%) developed a periprosthetic joint infection in a second joint. The type of organism was the same as the first infection in 12 (63.16%) of 19 patients. The time to developing a second infection averaged 2.16 years (range, 0-9.3 years). The risk factors leading to a subsequent infection in another prosthetic joint are albumin level (< 3.5 mg/dl), long-term steroid usage (> 5mg/day, > 3 months), history of necrotizing fasciitis, history of invasive dental procedure (> Grade IV procedure), 3-stage resection arthroplasty or more, and PJI caused by vacomycin-resistent enterococcus (VRE).

Conclusions: A PJI might predispose patients to subsequent PJI in another prosthesis. Patients and surgeons must be aware of the risk factors contribute to this devastating complication. Most organisms in the second PJI are identical to the first one, and we believe the bacteremia may be the pathogenesis, but need further proved. The preventive policy may be needed in the future for this population who has multiple prosthetic joints.

[FP58] COMPLICATIONS OF RESECTION ARTHROPLASTY DURING TWO-STAGE REVISION FOR PERIPROSTHETIC HIP INFECTION

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Aim: Two stage revision is the most commonly used surgical treatment strategy for periprosthetic hip infections (PHI). The aim of our study was to assess the intra- and postoperative complications during and after two stage revision using resection arthroplasty between ex- and reimplantation.

Method: In this retrospective cohort study, all patients treated with a two stage revision using resection arthroplasty for PHI were included from 2008 to 2014. During the first stage, the prosthesis was removed resulting in a resection arthroplasty without the use a PMMA spacer. During second stage, (cemented or uncemented) reimplantation of the hip prosthesis was performed. The cohort was stratified into two groups according to the length of prosthesis-free interval (≤10 weeks and >10 weeks). Data on complications during explantation, prosthesis-free interval, reimplantation, and after reimplantation was collected. The overall complication rate between both groups was compared using the chi-squared test. The revision-free and infection-free survival was estimated using Kaplan-Meier survival analysis.

Results: Overall, 93 patients with hip PJI treated with two-stage revision performing resection arthroplasty were included, 49 had a prosthesis-free interval of ≤10 weeks, and 44 an interval of >10 weeks. A total of 146 complications was documented in the cohort. Patients were followed-up for a mean duration of 42.7 months, range: 13.1 – 104.6 months. Blood loss during reimplantation [n=25], blood loss during explantation [n=23], persistent infection during prosthesis-free interval [n=16], leg length discrepancy [n=13], and reinfection [n=9] were the most common complications. No complication showed a statistically significant difference between both groups except for wound healing disorder after reimplantation, which was more often reported in the group with > 10 weeks interval (p=0.009). A statistically significant increase of periprosthetic bone fractures (p=0.05), blood loss (p=0.039), and total number of complications (p=0.008) was seen with increasing acetabular bone defects (after Paprosky). Infection-free survival rate at 24 months was 93.9% (95% CI: 87.2 – 100) in the group with ≤10 weeks interval and 85.9% (95% CI: 75.4 – 96.4) with an interval of > 10weeks.

Conclusions: After two years of follow-up, the infection-free survival rate using resection arthroplasty during two stage revision for PHI was higher in the group with ≤10 weeks interval compared to the group with >10 weeks interval. The most common complications during and after a two stage revision using resection arthroplasty were blood loss during the two surgeries, persistent infection during the prosthesis-free interval, leg length discrepancy, and reinfection.

[FP59] POOR OUTCOME OF GRAM-NEGATIVE PERIPROSTHETIC JOINT INFECTION: RESULTS FROM A 7-YEAR COHORT STUDY

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Aim: Gram-negative aerobic bacteria account for 10%-17% of periprosthetic joint infection (PJI). Due to its biofilm-activity, ciprofloxacin plays a key role in the treatment of gram-negative PJI. However, data about treatment outcome of these infections are conflicting. With this retrospective study we aim at evaluating characteristics and outcome of gram-negative PJI.

Method: We retrospectively included consecutive patients with gram-negative PJI treated at our institution from 01/2013 to 03/2018. Diagnosis of PJI was defined by the proposed European Bone and Joint Infection Society (EBJIS) criteria. Growth of gram-negative aerobic bacteria was required in synovial fluid, periprosthetic tissue or sonication fluid. Clinical success (infection-free status) was defined as fulfillment of all of the following criteria: (i) unremarkable surgical site and no subsequent surgery (ii) no PJI related mortality and (iii) no long-term antimicrobial suppression therapy of >6 months.

Results: A total of 76 patients with gram-negative PJI involving 45 hips, 26 knees, 3 elbows and 2 shoulders were analyzed. The median patient age was 76 years (range, 41-92 years). The route of infection was perioperative in 52 cases, hematogenous in 17 cases and contiguous in 5 cases. The most common isolated pathogens were *Escherichia coli* (n=31), *Klebsiella* species (n=17), *Proteus* species (n=13), *Enterobacter* species (n=11) and *Pseudomonas aeruginosa* (n=9). Ciprofloxacin resistance was detected in 20 of 90 (23%) gram-negative pathogens. 21 patients were treated with two-stage revision, 17 with prosthesis retention, 16 with permanent prosthesis removal, 14 with multi-stage exchange and 6 with one-stage revision. In 55 of 71 (77%) patients, ciprofloxacin was included in the treatment regimen. Median follow-up was 10.8 months (range, 1.6-60.7 months) and infection was eradicated in 29 of 47 patients (62%). Among 18 failures, 13 (72%) experienced a new PJI due to another pathogen (n=11) or had negative cultures (n=2), one patient died. The failures occurred after a median of 13.3 months (range, 3.9-28.8 months). All 4 patients with relapse caused by the same pathogen were resistant to ciprofloxacin. Ciprofloxacin-resistance was associated with worse outcome compared to ciprofloxacin-susceptible bacteria (5/13 (38%) vs. 23/33 (70%), p=0.09).

Conclusions: The overall outcome of gram-negative PJI was poor (62%). However, most infections were caused by a new pathogen or were culture-negative and occurred after 13.3 months. Ciprofloxacin resistance of the causative pathogen was associated with treatment failure. The reason for the high rate of new PJI is unclear and should be meticulously investigated to improve the outcome.

[FP60] PREVALENCE AND CHARACTERISTICS OF UNEXPECTED DIAGNOSIS OF INFECTION IN REVISION SURGERIES FOLLOWING INTERNAL FIXATION: RESULTS FROM A PROSPECTIVE COHORT STUDY

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Aim: Unexpected positive infections are distinct entity in prosthetic revision surgery. The prevalence and characteristics of unexpected positive cultures in internal fixation are however less established. The aim of this study was to describe the prevalence and characteristics of unexpected diagnosis of infection in a prospective cohort of revision surgeries following internal fixation.

Method: We reviewed the microbiological results following 356 surgeries that included partial or complete removal of internal fixation, performed in 328 patients (49.7% male, mean age 53 ± 17 years), in which infection was not initially suspected. This prospective study was performed in a large single center for musculoskeletal surgery from 2013-2017. The implants most commonly removed were plate and screw systems (238 cases, 66,9%), followed by intramedullary nails (62 cases, 17,4%) and screws (43 cases, 12.1%). The main indications for surgery were nonunion (89 cases, 25%) and symptomatic hardware (70 cases, 19,7%). All removed implants were sonicated, and tissue cultures were obtained depending on the surgeon's criteria. Diagnosis of infection was established by the presence of 2 or more positive tissue cultures (1 with a highly virulent microorganism), or ≥ 50 colony-forming units found in the sonication fluid.

Results: Infection was confirmed in 47 cases (13,2%); diagnosis was obtained with tissue cultures in 5 cases (1.4%), sonication in 14 cases (3.9%) and a combination of both sonication and tissue samples in 28 cases (7.9%). In another 24 cases (6.7%), ≥ 50 CFU of low-virulence microorganisms were isolated in the sonication fluid, but no tissue samples were available to confirm the diagnosis. Low-virulent microorganisms such as Propionibacterium acnes (22 cases / 46.8%) or coagulase-negative Staphycoccci (13 cases, 27.7%) were most commonly isolated. Sonication was key for the diagnosis of 61.7% of unexpected-positive surgeries. Nearly half of the patients received a new implant (internal fixation in 40.4%; arthroplasty in 6.4%), but only 34% of the patients were treated with antibiotics on discharge.

Conclusions: Unexpected diagnosis of infection occurs in approximately 13% of revision surgeries following internal fixation, most commonly due to low-virulent microorganisms. Sonication was key for the diagnosis of the majority of these infections. The clinical relevance of these infections remains unclear, though the insertion of new implants raises concern. We recommend sonication of all internal fixation devices removed, especially if new implants are inserted in the revision surgery.

[FP61] SYNOVIAL VERSUS SERUM PTX3 FOR THE DIAGNOSIS OF PERIPROSTHETIC JOINT INFECTION: A SINGLE-CENTER PROSPECTIVE DIAGNOSTIC STUDY.

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Aim: Diagnosis of periprosthetic joint infection (PJI) is challenging given the limitations of available diagnostic tests. Recently, several studies have shown a role of the long pentraxin PTX3 as a biomarker in inflammatory diseases and infections. This single-center prospective diagnostic study evaluated the diagnostic ability of synovial fluid and serum PTX3 for the infection of total hip arthroplasty (THA) and total knee arthroplasty (TKA).

Method: Consecutive patients undergoing revision surgery for painful THA or TKA were enrolled. Patients with antibiotic therapy suspended for less than 2 weeks prior to surgery and patients eligible for metal-on-metal implant revision or spacer removal and prosthesis re-implantation were excluded. Quantitative assessment of synovial fluid and serum PTX3 was performed with ELISA method. Musculoskeletal Infection Society (MSIS) criteria were used as reference standard for diagnosis of PJI. Continuous data values were compared for statistical significance with univariate unpaired, 2-tailed Student's t-tests. Receiver operating characteristic (ROC) curve analyses was performed to assess the ability of serum and synovial fluid PTX3 concentration to determine the presence of PJI. Youden's J statistic was used to determine optimum threshold values for the diagnosis of infection. Sensitivity (Se), specificity (Sp), positive (PPV) and negative (NPV) predictive values, positive (LR+) and negative (LR-) likelihood ratio, area under the ROC curve (AUC) were calculated.

Results: One-hundred fifteen patients (M:F=49:66) with a mean age of 62 years (40-79) underwent revision of THA (n=99) or TKA (n=16). According with MSIS criteria, 18 cases were categorized as septic and 97 as aseptic revisions.The average synovial fluid concentration of PTX3 was significantly higher in patients with PJI compared to patients undergoing aseptic revision (24,3 ng/dL vs 3,64 ng/dL; P=0.002). There was no significant difference in terms of serum concentration of PTX3 between the two groups. Synovial fluid PTX3 demonstrated an AUC of 0.96 (95%IC 0.89-0.98) with Se 94%, Sp 90%, PPV 67%, NPV 100%, LR+ 9.4 and LR- 0.06 for a threshold value of 4.5 ng/dL. Serum PTX3 demonstrated an AUC of 0.70 (95%IC 0.51-0.87) with Se 72%, Sp 67%, PPV 30%, NPV 93%, LR+ 2.2 and LR- 0.42 for a threshold value of 4.5 ng/dL.

Conclusions: In patients undergoing revision surgery for painful THA or TKA, synovial PTX3 demonstrated a strong diagnostic ability for PJI. Synovial PTX3 could represent a more useful biomarker for detection of PJI compared with serum PTX3.

[FP62] ROLE OF JOINT ASPIRATION PRIOR TO RE-IMPLANTATION IN PATIENTS WITH A CEMENT SPACER IN PLACE

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Aim: The effectiveness of mandatory joint aspiration prior to re-implantation in patients with a cement spacer already in place is unclear.

The aim of this study was to evaluate the role of culturing articular fluid obtained by joint aspiration prior to re-implantation in patients who underwent a two stage septic revision.

Method: A retrospective observational study was conducted, assessing51 patients that underwent a two stage septic hip or knee revision from 2010 to 2017.

According to the results of intraoperative cultures, after the first stage revision each patient was treated with an antibiotic protocol for 6-8 weeks. Following two weeks without antibiotics, a culture of synovial fluid was obtained. Synovial fluid was obtained by direct joint aspiration in cases of knee spacers by and by joint aspiration guided by fluoroscopy in the theatre room in cases of hip spacers. Synovial fluid was transferred into a Vacutainer ACD® flask. Samples were processed and analysed in the microbiology laboratory. Gram stains were performed and the sample was subsequently transferred into a BacALERT bottle (bioMérieux, France) and incubated in a BacALERT instrument for seven days.

Results of these cultures were recorded and compared with cultures obtained during re-implantation surgery.

Results: Of the 51 patients analysed, 9 were excluded because joint aspiration was not performed or the samples were not correctly processed. The remaining 42 patients (21 hip and 21 knee spacers) were included in the final analysis. In 40 cases, the culture of synovial fluid was negative while in the remaining two cases (hip spacers) no analysis was possible due to dry aspiration. In 5 of the patients, two or more intraoperative synovial fluid cultures taken during the re-implantation surgery were positive.

Conclusions: Although in theory, synovial fluid culture may provide useful information regarding the infection status of the joint, in our study, we found no evidence to support mandatory joint aspiration prior to re-implantation in patients with a cement spacer in place.

[FP63] BIOFILM PREVENTION OF CARBAPENEM-RESISTANT ENTEROBACTERIACEAE (CRE) AND VANCOMYCIN RESISTANT ENTEROCOCCI (VRE) BY ANTIBIOTIC-LOADED CALCIUM SULFATE BEADS (ABLCB) IN VITRO.

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Aim: Carbapenem-resistant Enterobacteriaceae (CRE) and vancomycin resistant Enterococci (VRE) have emerged as multi-drug resistant Gram-negative pathogens associated with Periprosthetic Joint Infections (PJI). In this study, we evaluated the efficacy of antibiotic-loaded calcium sulfate beads (ABLCB) to inhibit bacterial growth, biofilm formation and eradicate preformed biofilms of ***K. pneumoniae*** and ***E. faecalis***.

Method: Three strains of ***K. pneumoniae*** (carbapenem resistant BAA1705, New Delhi metallo-beta-lactamase producing BAA2146 [NDM-1], a carbapenemase producing BAA2524) and a vancomycin resistant strain of ***E. faecalis*** (ATCC51299) were used. 4.8mm diameter ABLCBs (Stimulan Rapid Cure, Biocomposites) were loaded with vancomycin (VAN) & gentamicin (GEN) at 500 and 240 mg/10cc pack or VAN & rifampicin (RIF) at 1000 and 600 mg/10cc pack respectively and placed onto tryptic soy agar (TSA) plates spread with each of the four strains independently and incubated for 24 hours at 37°C. The beads were transferred daily onto fresh TSA medium spread with the test cultures. The zone of inhibition was recorded until no inhibition was observed. Biofilm prevention efficacy was investigated in 6 well plates. Bacterial cells ($5x10^5$ CFU/mL in tryptic soy broth) were treated with ABLCBs. Media was removed and challenged with bacteria daily for 7 days. CFU counts were taken after 1, 2, 3 and 7 days. For biofilm killing, ABLCB were added to 3 day formed biofilms in 6 well plates. CFU counts were estimated at 1, 3 and 7 days with daily media exchange.

Results: ABLCB demonstrated effective initial eluting concentrations depending on the strains. The NDM-1 strain of ***K. pneumoniae*** had lower sensitivity than other strains towards VAN & RIF and resistant towards VAN & GEN. ***E. faecalis*** was sensitive to both combinations. For repeat challenges, ABLCBs prevented colonisation and reduced biofilm formation, except for the NDM-1 strain which grew in the presence of VAN & GEN. Preformed biofilms were more difficult to reduce with antibiotics than in the prevention assay. Biofilm growth was observed at 1 week of contact with ABLCBs, despite negative cultures at earlier time points for ***K. pneumoniae*** and ***E. faecalis***. However, there was a significant killing (2-3 logs, $P<0.05$) of biofilm bacteria with all antibiotic combinations compared to unloaded beads.

Conclusions: This study provides evidence that local release of antibiotics from ABLCBs may be useful in the treatment of multidrug resistant strains of ***K. pneumoniae*** and ***E. faecalis*** (CRE and VRE) associated with PJIs. ***In-vitro*** results do not necessarily correlate to clinical results.

[FP64] EXTREME HIGH LOCAL INTRA-OPERATIVE GENTAMICIN CONCENTRATIONS ARE NEEDED TO PREVENT BIOFILM FORMATION IN-VIVO

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Aim: To investigate the local intra-operative concentration of gentamicin needed to prevent biofilm formation in a porcine model of implant-associated osteomyelitis.

Method: In total 24 pigs were allocated to six groups. Group A (n=6) was inoculated with saline. Groups B (n=6), C (n=3), D (n=3), E (n=3) and F (n=4) were inoculated with 10 µL saline containing 10^4 CFU of *Staphylococcus aureus*, however, different minimal inhibitory concentrations (MIC) of gentamicin were added to the inoculum of Groups C(160xMIC), D(1600xMIC), E(16000xMIC) and F(160000xMIC). The inoculums were injected into a pre-drilled implant cavity proximally in the right tibial bone. Following inoculation, a steel implant (2 x 15 mm) was placed in the cavity. The pigs were euthanized after five days. The implants were sonicated and swabs were taken from the implant cavity for microbiological evaluation. The peri-implant tissue was analyzed by histopathology including estimation of neutrophil infiltration.

Results: The microbiological samples from Group A pigs were sterile. All implants and implant cavities of pigs inoculated with bacteria and bacteria + 160 or 1.600xMIC were positive for ***S. aureus***. In each of the Groups E (16000xMIC) and F (160000xMIC) only one animal was found positive and 1/3 and 3/4 of the implants were sterile after sonication, respectively. All positive swabs were confirmed to be same ***spa***-type as used for inoculation. By adding Groups C + D (<10000xMIC) and Groups E + F (>10000xMIC) a strong significant decrease (one-way ANOVA, ***P*** value = 0.001) of implant attached bacteria was only seen between the high MIC values and Group B (bacteria only). The histological examination demonstrated that 1600, 16000 and 160000 x MIC resulted in a peri-implant tissue reaction, including neutrophil estimation, comparable to saline inoculated animals. Patho-morphologically, it was not possible to distinguish between pigs inoculated with bacteria and bacteria + 160xMIC as both groups had a strong inflammatory response and an equal estimation of neutrophils.

Discussion: The antibiotic susceptibility for prevention of an in vivo biofilm infection is influenced by body fluids, host immune response, extracellular host proteins like fibrin, tissue necrosis and development of an anaerobic environment. With the present in-vivo setup, we have demonstrated that local intra-operative gentamicin might be given in concentrations of more than 10000 times the MIC value in order to prevent biofilm formation by planktonic bacteria. Our study supports that biofilm susceptibility testing performed in-vitro is yet still unreliable for prediction of prophylactic and therapeutic success.

[FP65] SIMULTANEOUS AND SEQUENTIAL APPLICATIONS OF PHAGES AND CIPROFLOXACIN IN KILLING MIXED-SPECIES BIOFILM OF PSEUDOMONAS AERUGINOSA AND STAPHYLOCOCCUS AUREUS

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Aim: *Staphylococcus aureus* and *Pseudomonas aeruginosa* are ubiquitous pathogens often found together in polymicrobial, biofilm-associated infections. The mixed-species biofilm are significantly more resistant to antimicrobial treatment and are associated with failures. Bacteriophages present a promising alternative to treat biofilm-related infections due to their rapid bactericidal activity on multi-drug resistant bacteria. In this study, we assess the simultaneous or sequential application of phages and ciprofloxacin on the mixed-species biofilm *in vitro*.

Method: Ciprofloxacin was tested alone and in combination with Pyo-bacteriophage cocktail against *P.aeurginosa* ATCC 27853 and MRSA ATCC 43300 mixed-species biofilm. In order to evaluate the effect of combined treatment on biofilm-embedded cells, mature biofilms were grown on porous glass beads with MRSA (10^6 CFU/ml) and *P.aeruginosa* (10^3 CFU/ml) and incubated for 24h at 37° C in LB broth. The beads were then washed and placed in fresh LB in the presence of sub-eradicating titers/concentrations of phages and ciprofloxacin (corresponding to 1/4, 1/8, 1/16, 1/32, 1/64, 1/128 x $MBEC_{biofilm}$), respectively, simultaneous or in order (pretreated with phages for 3-6-12-24 hours) at 37°C. In all cases, heat flow produced by the viable cells still embedded in the biofilm was measured for 48 hours by isothermal microcalorimetry

Results: Simultaneous or sequential treatment with pyo-bacteriophage (10^5 and 10^6 PFU/ml) and ciprofloxacin, producing a synergistic effect resulting in the complete eradication of the biofilm was evaluated. When sub-eradicating concentrations of ciprofloxacin together with sub-eradicating titers of phages simultaneously used to treat mixed-species biofilm, a delay and/or reduction of heat flow produced by bacteria was observed. The same effect was seen when mix-biofilm was pre-treated with phages for 3 hours and 24 hours, respectively. However, antibiotic introduction after 6 and 12 hours resulted in a high synergistic eradicating effect with pyo-bacteriophage. The concentration of ciprofloxacin decreased dramatically from >512 µg/ml to < 16 µg/ml.

Conclusions: While MBEC of ciprofloxacin against mixed-species biofilm of *Pseudomonas aeruginosa* and *Staphylococcus aureus* was above drug concentrations reachable in clinical practice, the co-administration with bacteriophage strongly reduced the antibiotic doses needed to eradicate biofilm. There is a specific time delay in antibiotic introduction to reach the eradication of mix-species biofilm. These results have implications for optimal combined treatment approaches.

[FP66] COMPARISON OF SONICATION AND CHEMICAL METHODS FOR THE BIOFILM DETECTION, INCLUDING CHELATING AND REDUCING AGENTS

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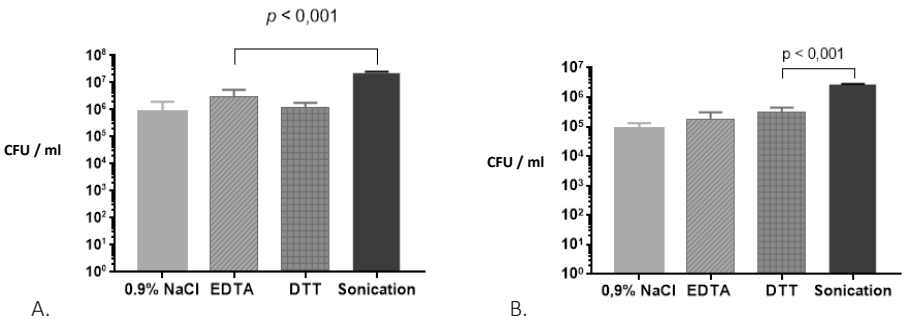
Aim: To compare the performance of sonication and chemical methods (EDTA and DTT) for biofilm removal from artificial surface.

Method: In vitro a mature biofilms of *Staphylococcus epidermidis* (ATCC 35984) and *P. aeruginosa* ATCC®53278) were grown on porous glass beads for 3 days in inoculated brain heart infusion broth (BHI). After biofilm formation, beads were exposed to 0.9% NaCl (control), sonication (40 kHz, 1 min, 0.2 W/cm^2), EDTA (25 mM/15 min) and DTT (1 g/L/15 min). Quantitative and qualitative biofilm analysis were performed with viable counts (CFU/ml) and microcalorimetry using time to detection (TTD), defined as the time from insertion of the ampoule into the calorimeter until the exponentially rising of heat flow signal exceeded 100 µW, which is inversely proportional to the amount of remaining bacterial biofilm on the beads. All experiments were performed in triplicate.

Results: Mean colony counts obtained after treatment *S. epidermidis* biofilms with EDTA and DTT was similar to those after 0.9% NaCl (control) – 6.3, 6.1 and 6.0 log CFU/mL, respectively. Sonication detected significantly higher CFU counts with 7.5 log ($p<0.05$). Concordant results were detected with microcalorimetry: significantly less ($p<0.05$) biofilm after treatment with sonication compared to EDTA and DTT (12 h vs 6h and 6h, respectively). The same results were observed when *P. aeruginosa* biofilms were treated. Mean colony counts dislodged after treatment with EDTA and DTT was similar to those after 0.9% NaCl (control) – 5.2, 5.3 and 5.0 log CFU/mL, respectively. Sonication detected significantly higher CFU counts with 6.5 log ($p<0.05$). Microcalorimetry reviled concordant results: significantly less ($p<0.05$) biofilm after treatment with sonication in comparison with EDTA and DTT (11 h vs 6h and 6h, respectively), Fig. 1 (A, B).

Fig.1 CFU count of dislodged *S. epidermidis* (A) and *P. aeruginosa* (B) using different methods.



Conclusions: Chemical methods showed no difference in biofilm dislodging compared to normal saline. Sonication is superior to chemical methods (DTT or EDTA) for biofilm detection. Sonication may be improved by combination of two or more chemical dislodgement methods.

[FP67] SPECIFIC ANTIBIOFILM PROPERTIES OF BACTERIOPHAGE SB-1 MAKE IT SUITABLE FOR THE THERAPY OF PROSTHETIC JOINT INFECTIONS DUE TO STAPHYLOCOCCUS AUREUS: BIOFILM MATRIX DEGRADATION AND PERSISTER CELLS KILLING

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Aim: Aim of this study was to evaluate the ability of Sb-1 to enhance the antibiotic activity (tested in combination) degrading the biofilm matrix (impairing the freely diffusion of antimicrobials) and specifically targeting "persister" cells (biofilm sub-population tolerant to most antibiotics and responsible for the infection recalcitrance) of methicillin-resistant *Staphylococcus aureus*.

Method: MRSA ATCC 43300 24h-old biofilm was treated for 18h with Sb-1 titers (from 10^4 to 10^6 pfu/ml). Biofilm matrix was evaluated by confocal laser scanning microscopy after staining with wheat germ agglutinin conjugate with Alexafluor488 (WGA488) to label exopolysaccharide matrix and Syto 85 to label bacterial cells. Persister status was induced using two different protocols: i) by exposing stationary phase *S. aureus* to 400 µg/ml carbonyl cyanide m-chlorophenylhydrazone (CCCP) in PBS for 3h at 37°C and ii) by treatment of 24h old biofilm with 512 µg/ml ciprofloxacin for further 24h at 37°C. Then, induced persister cells and non-induced controls (10^6 CFU/ml) were treated with 10^4 PFU/ml and 10^7 PFU/ml Sb-1 for 3h, followed by CFU counting. Alternatively, bacteria were washed and incubated in fresh BHI medium for the resumption of normal growth and the bacterial growth assessed after further 24 hours.

Results: Sb-1 showed a dose-dependent reduction of exopolysaccharide components of MRSA biofilm matrix at sub-inhibiting phage titers. With 10^6 PFU/ml Sb-1, no fluorescent signal related to WGA488 was detected, although bacterial viability was not impaired. Higher Sb-1 titer (10^7 PFU/ml) determined a strong reduction (ranging between 2.5 - 5 log CFU/ml) of persister cells. By contrast, in presence of 10^4 PFU/ml Sb-1, no reduction was observed in persister cells. However, persister cells pre-treated with 10^4 pfu/ml Sb-1 were completely killed when bacteria were inoculated after phage treatment in fresh medium, reverting to a normal-growing phenotype.

Conclusions: Due to its ability to degrade the MRSA exopolysaccharide matrix at sub-inhibitory concentrations and kill persister cells, directly at higher titers or indirectly with lower titers, Sb-1 phage is a valid therapeutic option to be used alone or in combination with current antibiotics for the successful eradication of methicillin resistant *S. aureus* biofilm associated with prosthetic joint infections.

[FP68] STAPHYLOCOCCUS AUREUS BONE AND JOINT INFECTION : COMPARISON OF RIFAMYCIN INTRAOSTEOBLASTIC ACTIVITY AND IMPACT ON INTRACELLULAR EMERGENCE OF SMALL COLONY VARIANTS.

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Aim: Leading etiology of Bone and Join infections (BJI), *Staphylococcus aureus* (SA) is responsible for difficult-to-treat infections mainly because of three persistence factors: (i) biofilm formation, (ii) persistence within bone cells and (iii) switch to the small colony variant (SCV) phenotype. The impact of rifampin on these mechanisms gave it a prominent place in orthopedic device-associated BJI. However, resistance emergence, intolerance and drug interactions cause significant concerns. In this context, other rifamycins – namely rifapentine and rifabutin – have poorly been evaluated, particularly toward their ability to eradicate biofilm-embedded and intracellular reservoirs of SA.

Method: This study aimed at comparing the intracellular activities of and SCV induction by rifampin, rifabutin and rifapentine in an *in vitro* model of osteoblast infection. Four concentrations were tested (0.1xMIC, MIC, 10xMIC, 100xMIC) against three SA strains (6850 and two clinical isolates involved in recurrent BJI)

Results: Each rifamycin had a similar intracellular activity, decreasing by 50% the intracellular inoculum from a concentration equal to MIC. Rifabutin was more efficient at low concentrations, with a reduction of 19.9% at 0.1MIC. At all concentrations, a 1.5-fold increase in cellular viability was observed for all molecules. A dose-dependent induction of intracellular SCVs was observed, which was significantly lower for rifabutin than rifampicin at 10MIC ($p<0.0001$).

Conclusions: Each rifamycin was efficient to eradicate intraosteoblastic SA reservoir, one bacterial phenotype in recurrent's BJI. Rifabutin was more efficient at low concentration, suggesting an important intracellular accumulation. This can be explained by its oil/water coefficient of partition 100 time superior than other rifamycins. Using rifabutin at lower concentration, limiting adverses effect and the emergence of SCVs, could be an interesting therapeutic alternative in BJI's treatment. The comparison of rifamycin ability to eradicate biofilm-embedded SA, another chronicity and relapse factor, is an ongoing work.

[FP69] DELAYED AND INCOMPLETE PENETRATION OF VANCOMYCIN TO PORCINE INTERVERTEBRAL DISC AND VERTEBRAL CANCELLOUS BONE

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Aim: Vancomycin may be an important drug for intravenous perioperative antimicrobial prophylaxis in spine surgery. The antimicrobial effect relies not only on its activity against the invading bacteria, but also on sufficient target site penetration. The present study aimed to assess single-dose vancomycin pharmacokinetics in the intervertebral disc, the vertebral cancellous bone, and subcutaneous adipose tissue using microdialysis in a porcine model mimicking a perioperative situation.

Method: Eight female pigs received 1,000 mg of vancomycin intravenously as a single dose over 100 minutes. Microdialysis was used to obtain vancomycin concentrations in the intervertebral disc, vertebral cancellous bone, and subcutaneous adipose tissue over 8 hours. Venous blood samples were also obtained and used as a reference.

Results: Vancomycin tissue penetration (95% confidence interval), expressed as the ratio of tissue to plasma area under the concentration-time curve from 0 to the last measured value, was 0.60 (0.48-0.72) for subcutaneous adipose tissue, 0.46 (0.40-0.53) for vertebral cancellous bone, and 0.24 (0.17-0.31) for the intervertebral disc. The penetration of vancomycin from plasma to the tissues was delayed, and an approximately three-times longer elimination rate was observed in the intervertebral disc in comparison to all the other compartments ($p<0.001$).

Conclusions: Vancomycin penetration into the intervertebral disc and vertebral cancellous bone was found to be both delayed and incomplete. Accordingly, preoperative administration of 1,000 mg of vancomycin may not result in adequate target site concentrations during spine surgery.

[FP70] COLONIZATION OF ORTHOPEDIC IMPLANTS IN CHILDREN, PRELIMINARY REPORT

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Aim: There is controversy about the need of remove implants removal in pediatric patients. One of the potential disadvantages of not doing it is potential infection. Since the orthopaedic implants (O.I.) are handled under an aseptic protocol, the expected results are the absence of germs in those devices. However, the risk of contamination and potential infection cannot be ruled out.

For these reason we wanted to determinate the percentage of colonization in the O.I. removed from pediatric patients of the H.G.G.B. in Concepción, Chile.

Method: Prospective observational study. The population consisted of 137 patients with previous osteosynthesis. 10 patients were excluded who had extruded material. The sample consisted of 127 patients in whom 331 implants were removed. The analysis unit was the cultures of the O.I. removed with aseptic techniques. The data was analyzed by descriptive statistics

Results: 19% (63) of the removed material was colonized;

The percentage of positive cultures according to type of material in decreasing order was: Cannulated screws (22.9%), Kirschner wires (20.3%), TENS (7.4%) and plate (6.7%). The first and third are titanium materials, while the second and fourth are made of steel.

The relationship according to type of limb was: 20.5% of the O.I. of the lower extremity and 15.2% of the upper limb.

The relationship according to type of patient was: 24% in elective patients and 13.8% in emergency patients.

The main germs grown in decreasing order were: Staphylococcus epidermidis (69.1%), S. Haemolitycus (9.1%), S. Hominis (7.3%), S. Capiti (5.5%).

Conclusions: The colonization of O.I. removed from pediatric patients is higher than the infections reported in adults. It is striking that colonized material from elective patients is superior to emergency patients. It also highlights that titanium has almost the same colonization level than steel. These results provide evidence to consider the removal of O.I. from pediatric patients, particularly in patients with lower extremity devices.

[FP71] FISH-BASED DETECTION AND IDENTIFICATION OF BACTERIA IN ORTHOPEDIC IMPLANT-ASSOCIATED INFECTIONS

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Aim: Here we describe a cohort study to determine the performance of a commercially available Fluorescence In Situ Hybridization (FISH)-kit on samples of 65 consecutive patients suspected of orthopedic implant associated infections (IAI). Culture is routinely used and has a high specificity and sensitivity but requires days to more than a week for slow growing bacteria. FISH results are available within 45-60 minutes and thus specific treatment can start immediately. In addition, previous antibiotic therapy may hinder culture while bacteria may still be detected by FISH.

Method: The hemoFISH-kit from Miacom diagnostics (Dusseldorf, Germany) was used on a total of 82 joint aspirates, sonication fluids and tissue samples of 65 consecutive patients to detect and identify possible microorganisms. This FISH-kit contains a universal 16S rRNA probe and species-specific probes for bacteria commonly encountered in blood infections. FISH and culture were compared to the clinical definition of IAI. These definitions were based on the criteria described by Pro-Implant Foundation criteria for IAI after fracture fixation or prosthetic joint infection. If no criteria were described in the literature for a specific IAI then MSIS criteria were used.

Results: FISH and culture was done in 33 plain tissue samples, 43 sonication fluid samples and 6 joint aspirates of 65 patients. Results are shown in table 1.

In clinical infections FISH provided earlier results in 7 and 2 extra for culture-negative. In 5 IAI-negative cases FISH was false-positive.

Table 1: Sensitivity and Specificity of FISH and culture on all samples compared to the defenition of infection

Clinical infection:		**Yes** (n=28)		**No** (n=54)		
		Culture		Culture		
		+	-	+	-	
FISH	+	7	2	2	3	**PPV** FISH: 0,64 Culture: 0,64
	-	11	8	8	41	**NPV** FISH: 0,72 Culture: 0,81
		Sensitivity FISH: 0,32 Culture: 0,64		**Specificity** FISH: 0,91 Culture: 0,81		

Conclusions: Faster diagnosis by FISH is appealing, however with a PPV of 64% the hemoFISH-kit is not accurate enough for clinical use. Also, blood and orthopedic infections have different common pathogens, therefor FISH could not identify all of the bacterial strains due to a lack of specific probes. An orthopedic FISH-kit could solve this problem.

[FP72] HIGH DIAGNOSTIC ACCURACY OF WHITE BLOOD CELL SCINTIGRAPHY FOR FRACTURE RELATED INFECTIONS: RESULTS OF A LARGE RETROSPECTIVE SINGLE-CENTER STUDY

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Aim: White blood cell (WBC) scintigraphy for diagnosing fracture-related infections (FRIs) has only been investigated in small patient series. Aims of this study were (1) to establish the accuracy of WBC scintigraphy for diagnosing FRIs, and (2) to investigate whether the duration of the time interval between surgery and WBC scintigraphy influences its accuracy.

Method: 192 consecutive WBC scintigraphies with ^{99m}Tc-HMPAO-labelled autologous leucocytes performed for suspected peripheral FRI were included. The goldstandard was based on the outcome of microbiological investigation in case of surgery, or - when these were not available - on clinical follow-up of at least six months. The discriminative ability of the imaging modalities was quantified by several measures of diagnostic accuracy. A multivariable logistic regression analysis was performed to identify predictive variables of a false-positive or false-negative WBC scintigraphy test result.

Results: WBC scintigraphy had a sensitivity of 0.79, a specificity of 0.97, a positive predicting value of 0.91, a negative predicting value of 0.93 and a diagnostic accuracy of 0.92 for detecting an FRI in the peripheral skeleton. The duration of the interval between surgery and the WBC scintigraphy did not influence its diagnostic accuracy; neither did concomitant use of antibiotics or NSAIDs. There were 11 patients with a false-negative (FN) WBC scintigraphy, the majority of these patients (n = 9, 82%) suffered from an infected nonunion. Four patients had a false-positive (FP) WBC scintigraphy.

Conclusions: WBC scintigraphy showed a high diagnostic accuracy (0.92) for detecting FRIs in the peripheral skeleton. Duration of the time interval between surgery for the initial injury and the WBC did not influence the results which indicate that WBC scintigraphy is accurate shortly after surgery.

[FP73] REPETITIVE EXTRAGENIC PALINDROMIC PCR (REP-PCR) VERSUS CONVENTIONAL MICROBIOLOGICAL TECHNIQUES IN THE DIAGNOSIS OF COAGULASE-NEGATIVE STAPHYLOCOCCUS INFECTION IN ORTHOPEDIC SURGERY

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Aim: To determine whether rep-PCR genotyping can improve the diagnosis of coagulase-negative staphylococci(CoNS)bone and joint infection relative to the standard method based on phenotypic identification.

Method: Observational study comparing diagnostic tests (January 2011-March 2015),including all orthopaedic surgery patients with clinically suspected infection and ≥2 surgical specimens culture-positive for CoNS. Data collection included epidemiologic and clinical information,current clinical signs of suspected infection,and microbiological information.Each CoNS strain was analyzed by both methods (phenotyping, VITEK and API;and genotyping, rep-PCR). In accordance with current IDSA guidelines,-CoNS strains identified as identical in ≥2 samples within the same surgical episode were considered pathogenic. The results of the two techniques were compared and statistically analyzed.

Results: 255 CoNS isolates from 52 surgical episodes with suspected infection in 42 patients (55% male, mean age 61.5±20.6 years) were included. The patients' Charlson comorbidity index was 0.7±1.1. Implanted material was present in 79% of episodes and the surgical site had undergone previous surgery in 93%.CoNS infection was diagnosed by phenotyping in 73% of patients (mean,2.2±1.3 different strains identified per episode)and 77% by rep-PCR analysis(mean,1.8±0.6 different strains per episode).The kappa index of concordance was 0.59±0.14 ($p<0.01$).In patients in whom CoNS was considered not a cause of infection by phenotyping, 37% were considered infective agents by genotyping,accounting for 10%of the total.

Conclusions: The two diagnostic methods showed moderate agreement in the diagnosis of postoperative bone and joint infection.Rep-PCR had a somewhat higher capacity for identifying CoNS strains. Rep-PCR could be of value as a complementary technique to phenotyping when the latter technique identifies CoNS strains as being non-pathogenic.

[FP74] USE OF BIOMARKERS AND CELL COUNT ON SYNOVIAL FLUID IN THE DIAGNOSIS OF PROSTHETIC JOINT INFECTION

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Aim: We report on the performance of a simple algorithm using a combination of synovial fluid White blood cell count(WBC), C-reactive protein(CRP) and α-Defensin(AD) tests to aid in the diagnosis of prosthetic joint infections.

Methods: Sixty-six synovial fluid samples were collected prospectively in patients with suspected PJI (hip and knee). All samples were tested by: WBC counts (read manually) and CRP test (Alere-Afinion™ validated in-house); and on 37 of these with AD test.

Synovial fluid samples were collected in 5 ml ethylenediaminetetraacetic acid (EDTA) tubes. Samples that were very viscous were pre-processed by the addition of 100µl of hyaluronidase solution. Grossly blood stained and clotted samples were excluded.

A clinical diagnosis of infection was based IDSA definitions[1].Cut offs of >3000 X 10^6 cells/L for total synovial WBC count and >12mg/L for CRP were used to define infection[2,3].

Results: Of 66 samples tested, 20 samples were categorised as clinically infected. Combination of WBC count and CRP yielded a sensitivity of 95% (95% CI: 75.13% to 99.87%) and specificity of 100% (95% CI: 92.29% to 100.00%). Only one patient, who had a chronic infection with *S.epidermidis* and *S.warneri,* had a CRP and WBC count that was falsely negative (<5mg/L and 93 X 10^6 cells/L respectively). AD test was used on 37 samples (of which 20 were infected). Sensitivity of this test alone was 85.71% (95% CI: 63.66% to 96.95%) and specificity 87.5% (95% CI: 61.65% to 98.45%). There were 2 falsely positive AD test results (one of whom had a metal on metal prosthesis) and 3 false negative results (2 *E.coli* infections and one patient with chronic infection with *S.epidermidis* and *S.warneri*).

Conclusion: Use of a combination of synovial fluid WBC count and CRP (both of which can be performed using simple and inexpensive laboratory tests), has a sensitivity of 95% and 100% specificity in the diagnosis of PJI. AD test may be useful on some occasions when near patient testing result may affect patient management.

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[FP75] DIAGNOSTIC ACCURACY OF SERUM INFLAMMATORY MARKERS IN FRACTURE-RELATED INFECTION: A SYSTEMATIC REVIEW AND META-ANALYSIS.

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Aim: Fracture related infection (FRI) remains a challenging diagnosis in orthopedic and trauma surgery. In addition to clinical signs and imaging, serum inflammatory markers are often used to estimate the probability of FRI. To what extent serum inflammatory markers can be used to rule out and diagnose FRI remains unclear. The aim of this systematic review was to assess the diagnostic value of the serum inflammatory markers C-reactive protein (CRP), leukocyte count (LC) and erythrocyte sedimentation rate (ESR) in suspected fracture related infection.

Method: PubMed, Embase and Cochrane databases were searched for all articles focusing on the diagnostic value of CRP, LC and ESR in FRI. Studies on other inflammatory markers or other types of orthopedic infection, such as periprosthetic and diabetic foot infections, were excluded. For each serum inflammatory marker, all reported sensitivity and specificity combinations were extracted and graphically visualized. Average estimates were obtained using bivariate mixed effects models. This study utilized the QUADAS-2 criteria and was reported following the PRISMA statement.

Results: The search resulted in 8280 articles, of which seven were eligible for inclusion. One study was excluded after quality assessment. CRP was reported in all included studies, with sensitivity ranging from 60.0 to 100.0% and specificity from 34.3 to 85.7%. Five of these studies were pooled. The average pooled sensitivity and specificity of CRP were, respectively, 77.0% (95% CI 66.5-85.0%) and 67.9% (95% CI 38.7-87.6%). LC was reported in five studies. Sensitivity ranged from 22.9 to 72.6% and specificity from 73.5 to 85.7%. The results of four of these studies were pooled, resulting in a 51.7% (95% CI 27.2-75.5%) sensitivity and 67.1% (95% CI 19.3-50.2%) specificity. ESR was reported in five studies. Sensitivity and specificity ranged from 37.1 to 100.0% and 59.0 to 85.0% respectively. Three of these studies were pooled, showing a 45.1% (95% CI 37.8-52.6%) sensitivity and 79.3% (95% CI 71.7-85.2%) specificity of ESR. Four studies analyzed the combined value of inflammatory markers, reporting an increased diagnostic accuracy. These results could not be pooled due to heterogeneity.

Conclusions: The serum inflammatory markers CRP, LC and ESR are insufficiently accurate to diagnose FRI. These markers cannot rule out the presence of FRI, but they may be used as a suggestive sign in the diagnosis of FRI.

[FP76] LIMITED PREDICTIVE VALUE OF SERUM INFLAMMATORY MARKERS FOR DIAGNOSING FRACTURE RELATED INFECTIONS: RESULTS OF A LARGE RETROSPECTIVE MULTICENTER COHORT STUDY.

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Aim: Diagnosing fracture related infections (FRI) based on clinical symptoms alone can be challenging and additional diagnostic tools such as serum inflammatory markers are often utilized. The aims of this study were 1) to determine the individual diagnostic performance of three commonly used serum inflammatory markers: C-Reactive Protein (CRP), Leukocyte Count (LC) and Erythrocyte Sedimentation Rate (ESR), and 2) to determine the diagnostic performance of a combination of these markers and their value additionally to clinical predictors for FRI.

Method: This cohort study included patients who presented with a suspected FRI at two level I academic trauma centers between February 1st 2009 and December 31st 2017. The parameters CRP, LC and ESR, were obtained from hospital records when FRI was suspected. The gold standard for diagnosing or ruling out FRI was defined as: positive microbiology results of surgically obtained tissue samples, or absence of FRI at a clinical follow-up of at least six months. Separate markers were analysed using hospital thresholds, to determine current diagnostic performance, and continuously, to determine maximum possible diagnostic performance. Multivariable logistic regression analyses were performed to obtain the discriminative performance (Area Under the Receiver Operating Characteristic, AUROC) of (1) the combined inflammatory markers, and (2) the value of these markers additional to clinical parameters.

Results: A total of 168 patients met the inclusion criteria and were included for analysis. CRP had a 38% sensitivity, 34% specificity, 42% positive predictive value (PPV) and 78% negative predictive value (NPV). For LC this was 39%, 74%, 46% and 67% and for ESR 62%, 64%, 45% and 76% respectively. The diagnostic accuracy was 52%, 61% and 80% respectively. The AUROC was 0.64 for CRP, 0.60 for LC and 0.58 for ESR. The AUROC of the combined inflammatory markers was 0.63. Serum inflammatory markers combined with clinical parameters resulted in AUROC of 0.66 as opposed to 0.62 for clinical parameters alone.

Conclusions: The added diagnostic value of CRP, LC and ESR for diagnosing FRI is limited. Clinicians should be aware of this finding in the diagnostic work-up of suspected FRI.

[FP77] INNOVATIVE TREATMENT OF ACUTE AND CHRONIC OSTEOMYELITIS OF THE LOWER EXTREMITY: CASE-SERIES OF 33 PATIENTS.

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Aim: The current treatment concepts of acute and chronic osteomyelitis are associated with unsolved challenges and problems, underlining the need for ongoing medical research. The invention and prevalence of an absorbable, gentamicin-loaded ceramic bone graft, that is well injectable for orthopedic trauma and bone infections, enlarges the treatment scope regarding the rise of posttraumatic deep bony infections. This substance can be used either for infection, dead-space, or reconstruction management. The bone cement, eluting antibiotics continuously to the surrounding tissue, outperforms the intravenous antibiotic therapy and enhances the local concentration levels efficiently. This study aims to evaluate the power and practicability of bone cement in several locations of bony infections.

Method: The occurrence of posttraumatic infections with acute or chronic osteomyelitis increases in trauma surgery along with progression of high impact injuries and consecutively high incidence of e.g. open fractures. We present a case-series of 33 patients (18w/15m; 56,8±19,4 years) with posttraumatic osteomyelitis at different anatomic sites, who were treated in our level I trauma center. All of these patients received antibiotic eluting bone cement (Cerement® G) for infection and reconstruction management.

Results: With admission to our trauma-center all patients with obvious or suspected osteomyelitis undergo an interdisciplinary pre-work up, including thorough clinical examination and different measures of diagnostic imaging, ultimately leading to the definition of an individual treatment plan. We diagnosed 33 bone infections anatomically allocated to the proximal and distal femur (12x), the pelvis (2x), distal tibia (3x), tibial diaphysis (10x),the ankle joint (4x) and calcaneus (2x). According to Cierny-Mader we diagnosed grade I (6), II (7), III (13) and IV (7). These 33 patients were treated (1) with surgical debridement, (2) with Cerament G, (3) bone stabilisation (including nail osteosynthesis, arthrodesis nails, plates, or external ring fixation), (4) optionally VAC-conditioning, and (5) optionally soft tissue closure with local or free flaps.The overall number of surgery was 2.9±2.26. We observed very good clinical, functional and radiological results by using bone cement augmented with gentamicin. The overall recurrence rate of infection is low (12%, 4/33). “White fluid” secretion was observed in six cases.

Conclusions: Current concepts for treatment of osteomyelitis include radical surgical debridement and additional antibiotic therapy. It could be demonstrated that the usage of an antibiotic biocement with osteoconductive characteristics enlarges the success rate in septic bone surgery. The treatment concepts, however, remain complex, time consuming, require a high patient compliance, and are highly individually.

[FP78] A SYSTEMATIC REVIEW OF THE SINGLE-STAGE TREATMENT OF CHRONIC OSTEOMYELITIS

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Aim: Despite advances in surgical and antibiotic therapies the treatment of chronic osteomyelitis remains complex and is often associated with a significant financial burden to the National Health Service. The aim of this review was to identify the different types of single-stage procedures being performed for this condition as well as to evaluate their effectiveness.

Method: Ovid Medline and Embase databases were searched for articles on the treatment of chronic osteomyelitis over the last 20 years. 3511 journal abstracts were screened by 3 independent reviewers. Following the exclusion of paediatric subjects, animal models, non-bacterial osteomyelitis and patients undergoing multiple surgical procedures we identified 13 studies reported in English with a minimum follow up of 12 months. Following a quality assessment of each study, data extraction was performed and the results analysed.

Results: 505 patients with chronic osteomyelitis underwent attempted single-stage procedures. Following debridement a range of techniques are described to eliminate the remaining dead space. These include musculocutaneous flaps, insertion of S53P4 glass beads or packing with antibiotic loaded ceramic or calcium-sulphate pellets. The average follow-up ranged from 12 to 110 months. The most common organism isolated was Staphylococcus Aureus. Success was defined as resolution of pain with no recurrence of sinuses and no need for a second procedure to treat infection. Success rates ranged from 60%-100%.

Conclusions: There are currently a wide range of single-stage procedures being performed for chronic osteomyelitis with varying success rates. Treating patients with these methods in specialist centres can result in resolution of infection and may lead to improved quality of life for the patient and a financial saving for the National Health Service. So far no one technique has been shown to be superior and further long term follow up data is required.

[FP79] INDICATIONS AND RESULTS OF BONE-RECONSTRUCTION WITH THE MASQUELET-TECHNIQUE IN TREATMENT OF OSTEOMYELITIS

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Aim: For which patients is bone defect reconstruction with the Masquelet-technique after the treatment of osteomyelitis suitable and which results did we have.

Methods: From 11/2011 to 4/2018 we treated 112 Patients (36f, 76m) with bone defects up 150mm after septic complications with the Masquelet-technique. We had infected-non-unions of upper and lower extremity, chronic osteomyelitis, infected knee-arthrodesis and knee- and ankle-joint-empyema. On average the patients were 52 (10-82) years old. The mean bone defect size was 48 mm (15-150). Most of our patients came from other hospitals, where they had up to 20 (mean 5.1) operations caused by the infection. Time before transfer in our hospital was on average 7,1 months (0,5-48). 77 patients received free (25) or local (52) flaps because of soft tissue-defects. 58 patients suffered a polytrauma. In 23 cases femur, in 4 cases a knee arthrodesis, in 68 cases tibia, in 1 case foot, 6 times ankle-joint arthrodesis, in 6 cases humerus, in 4 cases forearm were infected resulting in bone defects,

In most cases the indication for the Masquelet-technique was low-/incompliance due to higher grade of brain injury and polytrauma followed by difficult soft tissue conditions and problems with segment-transport.

In 2/3 positive microbial detection succeeded at the first operation. Mainly we found difficult to treat bacteria. After treating the infection with radical sequestrectomy, removal of foreign bodies and filling the defect with antibiotic loaded cementspacer and external fixation we removed the spacer in common 6-8 weeks later and filled the defect with autologeous bone graft. Most of the patients needed an internal fixation after removing of the fixex.

All patients were examined clinically and radiologically every 4-6 weeks in our outpatient department until full weight bearing, later every 3 Months.

Results: in 93 of 112 cases the infection was clinically treated successful. 48 patients are allowed full weight bearing (45 with secondary internal plates). There were 18 recurrences of infection, 3 patients underwent lower limb amputation.

Conclusions: For patients with low-/incompliance for various reasons and for those with difficult soft tissue conditions following flaps the masquelet technique is a valuable alternative to normal bone graft or segmenttransport. The stiffness of the new masquelet-bone as a rod seems a problem and internal fixation is necessary.

[FP80] ASSOCIATIONS OF INTERLEUKIN-1 BETA GENE POLYMORPHISMS (RS16944, RS1143627, RS1143634 AND RS2853550) AND THE RISK OF DEVELOPING EXTREMITY CHRONIC OSTEOMYELITIS IN CHINESE POPULATION

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Aim: Previous studies had indicated that interleukin-1 beta (IL-1β) gene single nucleotide polymorphisms (SNPs) associate with different inflammatory diseases. However, potential links between these polymorphisms and susceptibility to extremity chronic osteomyelitis (COM) in Chinese population remain unclear. This study aimed to investigate relationships between IL-1β gene polymorphisms (rs16944, rs1143627, rs1143634 and rs2853550) and the risk of developing extremity COM in Chinese population.

Method: Altogether 233 extremity COM patients and 200 healthy controls were genotyped for the four tag SNPs of the IL-1β gene using the SNapShot genotyping method. Comparisons were performed regarding genotype distribution, mutant allele frequency and four genetic models (dominant, recessive, homozygous and heterozygous models) of the 4 SNPs between the two groups.

Results: Significant associations were identified between rs16944 polymorphism and the risk of developing COM by dominant model (P = 0.026, OR = 1.698, 95% CI 1.065-2.707) and heterozygous model (P = 0.030, OR = 1.733, 95% CI 1.055 - 2.847). Although no statistical differences were found of rs1143627 polymorphism between the two groups, there existed a trend that rs1143627 may be linked to an elevated risk of developing COM by outcomes of dominant (P = 0.061), homozygous (P = 0.080) and heterozygous (P = 0.095) models. However, no statistical correlations were found between rs1143634 and rs2853550 polymorphisms and susceptibility to COM in Chinese population.

Conclusions: To our knowledge, we reported for the first time that IL-1β gene rs16944 polymorphism may contribute to the increased susceptibility to extremity COM in Chinese population, with genotype of AG as a risk factor.

[FP81] OUTCOMES AND COMPLICATIONS OF DIABETIC FOOT SOFT TISSUE INFECTIONS AND OSTEOMYELITIS

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Aim: The aim of this study was to compare outcomes between patients with diabetic foot soft-tissue infection and osteomyelitis.

Methods: Medical records of patients with diabetic foot infection involving either soft-tissue (STI) or bone (OM) were retrospectively reviewed. Diagnosis was determined by bone culture, bone histopathology or imaging with magnetic resonance imaging (MRI) or single-photon emission computed tomography (SPECT/CT). Patient outcomes were recorded up to 1 year after admission.

Results: Out of 294 patients included in the study, 137 were diagnosed with STI and 157 had OM. No differences in age (p=.40), sex (p=.79), race (p=.83), body-mass index (p=.79) or type of diabetes (p=.77) were appreciated between groups. Frequency of comorbidities (neuropathy, chronic kidney disease, peripheral arterial disease) also did not differ except for increased prevalence of cardiac disease in patients with STI (86.9%) compared to those with OM (31.8%) (p<.00001) and decreased prevalence of retinopathy (24.8% vs. 35.7%) (p=.04). Patients with OM had greater C-reactive protein (p<.00001), erythrocyte sedimentation rate (p<.00001) and white blood cell count (p<.00001). Among 1-year outcomes, patients with OM more often underwent surgery (p<.00001), had lower limb amputations (p<.00001), became reinfected (p=.0007), were readmitted for the initial problem (p=.008), had longer time to healing (p=.03) and had longer hospital length of stay (p=.00002). However, no differences in 1-year mortality (p=1.000), overall 1-year readmission (p=.06) or healing within 1-year (p=.64) were appreciated.

Conclusion: In our study, OM was associated with more aggressive treatment, reinfection and longer time to healing than STI. However, despite being associated with more aggressive care and readmissions, patients with diabetic foot OM has similar 1-year mortality and healing rates to those with diabetic foot STI.

TABLE. Comparisons of patient factors between STI and OM foot infections in diabetic patients

TABLE. Comparisons of patient factors between STI and OM foot infections in diabetic patients

	Overall N = 294		STI N = 137		OM N = 157		
Parameter[b]	**Value**	**(SD)**	**Value**	**(SD)**	**Value**	**(SD)**	**P-value[a]**
Patient Factors							
Age, mean, years	52.7	(10.8)	52.3	(10.9)	53.1	(10.8)	.396
Male gender, N (%)	221	(75.2)	102	(74.5)	119	(75.8)	.790
Race, N (%)							.832
White	216	(73.5)	100	(73.0)	116	(73.9)	
Black	70	(23.8)	34	(24.8)	36	(22.9)	
Ethnicity, N (%)							.518
Hispanic	140	(47.6)	68	(49.6)	72	(45.9)	
BMI, mean, kg/m^2	32.3	(9.6)	32.3	(10.1)	32.3	(9.3)	.794
Diabetes Mellitus							
Type 2, N (%)	280	(95.2)	131	(95.6)	149	(94.9)	.774
Comorbidities, N (%)							
Cardiac disease	169	(57.5)	119	(86.9)	50	(31.8)	**<.00001**
Retinopathy	90	(30.6)	34	(24.8)	56	(35.7)	**.040**
Neuropathy	267	(90.8)	123	(89.8)	144	(91.7)	.566
Previous ulcer	188	(63.9)	82	(59.9)	106	(67.5)	.172
Amputation[c]	104	(35.4)	45	(32.8)	59	(37.6)	.397
CKD stage							.216
I	31	(10.5)	9	(6.6)	22	(14.0)	
II	18	(6.1)	11	(8.0)	7	(4.5)	
III	44	(15.0)	18	(13.1)	26	(16.6)	
IV	13	(4.4)	6	(4.4)	7	(4.5)	
V	27	(9.2)	15	(10.9)	12	(7.6)	
Dialysis	30	(10.2)	16	(11.7)	14	(8.9)	.435
PAD	206	(70.1)	99	(72.3)	107	(68.2)	.443
Laboratory values							
HbA_{1C}, %	9.4	(5.6)	9.6	(7.7)	9.3	(2.5)	.300
Hemoglobin, mg/dL	11.5	(2.7)	11.6	(2.1)	11.5	(3.1)	.284
Serum albumin, mg/dL	3.5	(2.0)	3.7	(2.8)	3.3	(0.6)	.139
WBC, cells/mm^3	10.6	(4.3)	9.5	(3.9)	11.6	(4.4)	**<.00001**
ABI							.295
<0.40	1	(0.3)	1	(0.7)	0	(0)	
0.41-0.90	17	(5.8)	7	(5.1)	10	(6.4)	
0.9-1.3	87	(29.6)	35	(25.5)	52	(33.1)	
>1.3	189	(64.3)	94	(68.6)	95	(60.5)	
C-reactive protein, mg/dL	7.4	(8.5)	5.0	(6.7)	9.4	(9.3)	**<.00001**
ESR, mm/h	72.5	(36.3)	58.7	(36.3)	84.6	(33.5)	**<.00001**

STI = Soft-Tissue Infection; OM = Osteomyelitis; BMI = Body-Mass Index; CKD = Chronic Kidney Disease; PAD = Peripheral Artery Disease; HbA_{1C} = Glycosylated Hemoglobin; WBC = White Blood Cell Count; ABI = Ankle-Brachial Index; CRP = ESR = Erythrocyte Sedimentation Rate

[a]Determined using appropriate statistical analyses–Mann-Whitney U-test for continuous variables. Chi-squared test of homogeneity and Fisher exact test for categorical variables. Significant values are in bold

[b]Mean and standard deviation (SD) presented for continuous variables.

[c]Amputation present at admission

[FP82] TREATMENT CONCEPT AND LONG-TERM OUTCOME AFTER ACUTE POSTTRAUMATIC OSTEOMYELITIS FOLLOWING UNSTABLE TYPE C PELVIC INJURIES

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Aim: Posttraumatic pelvic-osteomyelitis is one of the most serious complications after pelvic-fractures. The necessary extensive surgical debridement as part of interdisciplinary treatment is complicated by the possible persistence of pelvic instability. The aim of this study was to determine the outcome and outline the course of treatment after early posttraumatic pelvic bone infections due to type-C pelvic ring injuries.

Method: In a retrospective cohort study (2005-2015) all patients with pelvic-osteomyelitis within six weeks of surgical stabilization of a type-C pelvic-fracture were assessed. Microbiological results, risk factors, course of treatment and functional long-term outcome using the Orlando-Pelvic-Score were analyzed.

Results: A total of 18 patients (age 43.7 years; Body-Mass-Index 27.9 kg/m2; ASA-physical-status 1.8; Injury-Severity-Score 38) developed a pelvic-osteomyelitis within an average of 27 days after internal surgical stabilization of a type-C pelvic injury (AO-type C1: 10, C2: 4, C3: 4). Os pubis was affected in 7 and Os ilium in 11 cases. In addition to the pelvic-fracture, major vascular injuries occurred in 8, nerve injuries in 9, and intestinal and/or bladder ruptures in 11 cases. In 14 cases a mass transfusion was necessary. In addition to clinical signs of inflammation, (10 x redness, 12 x wound secretion, 6 x fistula) elevated levels of c-reactive-protein (7.7 mg/dl) and white-blood-cells (10.5/nl) were found. Bacterial cultures harvested during the initial surgical revision demonstrated mixed cultures in 17/18 cases, with an average of 3 different organisms isolated per case (61% intestinal bacteria). During the scheduled repetitive debridement a reduction of the initial mixed cultures into a single organism was observed. Overall 6.8 surgical interventions, including implant removal, were necessary until osteomyelitis was eradicated. In no cases was re-osteosynthesis performed. In 6/18 cases recurrence of infection occurred after an average of 5 months, followed by an additional repetitive debridement. An average 3-year-follow-up after the initial osteomyelitis-diagnosis demonstrated eradication of infection in 17/18 cases combined with an Orlando-Pelvic-Score of 21.9 points (best possible function: 40 points). Despite significant pelvic malalignment the ability to walk was achieved in all patients, with one exception due to a spinal cord injury.

Conclusions: Despite no new surgical stabilization of the initial unstable pelvic injury, the early removal of implants combined with extensive debridement and antibiotic therapy led to sufficient long-term outcomes in patients with early posttraumatic pelvic-osteomyelitis. In particular, due to the severity of the initial injury and the complex interdisciplinary approach, early diagnosis of the osteomyelitis is essential.

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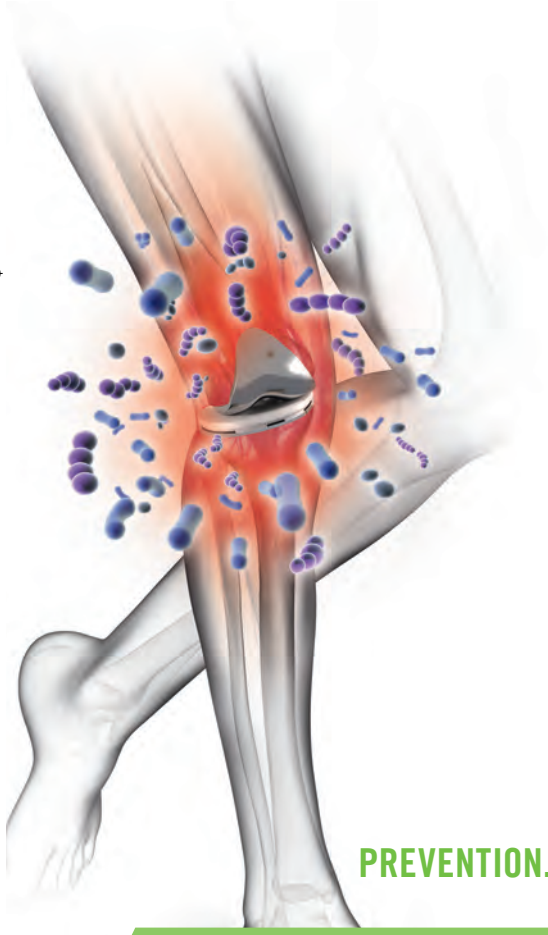

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