Abstract book

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Dear WAIOT members

We are pleased to present to you the abstract book of the 3rd WAIOT Congress, held on September 12-13, 2024 in Miami, Florida. The WAIOT Program Committee's Success in promoting research and education in the fields of musculoskeletal, biofilm, and implant-related infections is evidenced in this high quality collection of scientific data.

We thank our international experts who have shared their latest research and findings, and are privileged to provide this platform to exchange information.

Since its foundation on May 30, 2017, WAIOT has experienced consistent growth. As the first and largest worldwide scientific association focused on musculoskeletal infections, implant- and biofilm-related infections in orthopaedics and trauma, WAIOT plays a pivotal role in advancing research and knowledge in this field WAIOT currently boasts a diverse membership of registered professionals from various countries and regions. Geographically, members are represented from Africa, Asia, South America, Europe, North America, and Oceania. The primary specialization among members is orthopaedics and trauma; however, there is also substantial representation from infectious disease specialists, microbiologists, rheumatologists, radiologists, nuclear medicine specialists, and other related specialties.

Over the years, WAIOT has actively disseminated its strategies and expertise by participating in numerous symposia, meetings, and congresses held worldwide. This engagement facilitates the global dissemination of knowledge to benefit professionals globally and fosters collaborations within the field of musculoskeletal infections.

We are confident this abstract book will be of interest now and in the future and continue to benefit our healthcare professionals and their patients.

Thank You,

Sincerely,

Joseph Benevenia M.D.

President WAIOT

Chair 2024 Annual Meeting

1# Title: Advancements in the Management of Periprosthetic Infections: Optimization of Procedures and Pretreatment Methods.

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ABSTRACT

Introduction:In recent years, the management of peri-prosthetic infections (PJI) become a critical aspect of surgery, with implications extending to patient outcomes and healthcare costs. This study delves into postoperative joint infections and their specific impact on surgical revisions. The primary objective is to address the complexities surrounding PJI, acknowledged as one of the most dangerous complications in the surgical domain.

Exploration of Modes of Infection Onset

The investigation embarks an examination of diverse modes through which infections manifest, encompassing the direct contiguous pathway, hematogenous dissemination, and instances of recurrent infections. The presence of foreign bodies, particularly prostheses, amplifies the susceptibility to infections, predominantly due to the formation of resilient biofilms. Consequently, our approach centers on refining operating room protocols to proactively prevent cross-contamination and heightening awareness regarding the meticulous processing of explants suspected to be infected.

Results and Innovative Strategies

The study introduces innovative strategies such as sonication and pre-treatment with dithiothreitol (DTT) to enhance the isolation rates of pathogens. These methodologies, both physical and

chemical in nature, are strategically designed to disrupt bacterial biofilms, thereby refining culture techniques, and mitigating potential diagnostic errors such as false positives and false negatives. This nuanced approach underscores the paramount importance of accurately identifying pathogens responsible for infections. By employing techniques that

augment the specificity and sensitivity of existing microbiological tests, we aim to enable targeted therapeutic interventions for individual patients. This not only ensures effective treatment but also actively addresses the growing concern of antibiotic resistance.

Conclusion and Clinical Implications

In conclusion, our study represents a significant advancement in the management of prosthetic infections. It is distinguished by the improvement of operative procedures and the adoption of appropriate pre-treatment methods applied to explanted samples, aiming to optimize the subsequent microbiological analyses of suspected infected explants. This approach provides an opportunity to accurately identify the pathogens responsible for infections, thereby facilitating the implementation of a targeted and in-depth therapeutic regimen. This regimen not only promises more effective treatment but also acts as a defense against the escalation of antibiotic resistance. We anticipate that these advancementto a change in the treatment practices of prosthetic infections, ultimately improving outcomes for patientss will lead .

2.# Multi-drug resistant bacteria and the role of bacterial biofilms in war-related musculoskeletal infections: a review

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Country: Albania, Romania

ABSTRACT

Background: Among the myriad challenges confronting modern military medicine, the emergence of multi-drug resistant (MDR) bacteria presents a formidable adversary. Aim of the present review is to investigate the epidemiology of MDR bacteria and the role of bacterial biofilms in War-related Musculo-skeletal infections (W-MSIs).

Methods: Full-text papers and those with an abstract in English published from 2004 to December 2023, identified through international databases, were reviewed. Those reporting the incidence of MDR bacteria in battlefield wounds were included as well as those papers investigating the role of bacterial biofilms in war-related MSIs. Data were pooled for further analysis in order to answer the following questions: (i) what is the incidence of MDR bacteria in W-MSIs and what is the role of bacterial biofilms? (ii) what are the main drivers that sustain the occurrence of MDR bacteria in W-MSIs and which preventive measures can be applied?

Results: Nine original articles reporting the incidence of MDR bacteria in W-MSIs and one study dealing with the impact of bacterial biofilms in war-related injuries were included. Data were collected by the following battlefield theatres: Iraq, Syria, Lebanon, Palestine, Yemen, Afghanistan. The reported incidence of MDR bacteria in W-MSIs was as high as 81% in patients with osteomyelitis, with up to 33% extended-spectrum beta-lactamases found in Gram-negative isolates, and almost 25% *Enterobacteriaceae* being resistant to carbapenem. In particular, MDR found in skin and soft tissues and bones included *Staph. aureus* (range 21.3% to 60.5%), *Enterobacteriaceae* (12.5% to 86.2%), *P. aeruginosa* (7.6% to 53.4%), *Enterococci* species (3.2% to 74.0%), *A. baumannii* (45% to 86.2%). *Escherichia coli* (78.3%), *Klebsiella* spp. (45%); Coagulase negative *Staphylococcus* and Anaerobes showed much lower or null MDR isolates. Biofilm formation was significantly associated with infection persistence in a univariate analysis. Multidrug resistance,

intensive care unit admission, mechanical ventilation, mechanism of injury, injury severity scores, packed red blood cell transfusion requirements within the first 24 hours, operating room visits prior to and on the date of infection diagnosis, anatomical location of infected wound, and occurrence of polymicrobial infections were significant risk factors for persistent infection, whereas more easily modifiable factors such as early operative intervention or antibiotic administration were not.

Conclusions: According to the data available, both Gram positive and negative MDR bacteria are frequently associated with W-MSIs in various battlefield theatres. While several risk factors have been identified, the majority of them appear unmodifiable. The most commonly reported explanation is the selective pressures exerted by the indiscriminate use of antibiotics. Suggested preventive measure then include early transport and treatment in specialized centers and antibiotic use restrictions, but a deeper understanding and more effective measures to mitigate the occurrence of MDR W-MSIs appear urgently needed.

3.# One-Stage Cementless Revision for Peri-Prosthetic Hip Infection: a Systematic Review

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Country: Albania, Romania

ABSTRACT

Background: The best surgical modality for one-stage revision of chronic periprosthetic hip infections remains controversial, with a lack of randomized comparative studies. In fact, while the use of antibiotic-loaded bone cement has been traditionally advocated to perform one-stage revision surgery in the presence of infection, cementless techniques have been more recently proposed. Aim of this systematic review is to investigate the infection recurrence rate after one-stage cementless revision for chronic periprosthetic hip infections, with a further analysis of the different techniques used for local antibiotic protection.

Methods: We searched for eligible studies published from 2000 to May 2024. Full text or abstracts in English were reviewed. We included studies reporting the infection recurrence rate as the outcome of interest following cementless single exchange arthroplasty for peri-prosthetic hip infection with a minimum follow-up of 24 months. Two reviewers independently abstracted data and appraised quality assessment.

Results: After study selection, 17 observational studies were included for a total of 689 patients. The overall recurrence infection rate in cementless single-stage hip exchange was 8.6% (range 56.8% - 100%) at an average follow-up of 62.5 +- 20.5 months. Due to the relative low number of patients, no statistical difference could be found when comparing four different local antibiotic delivery techniques which, on the average, provided the following results: intra-articular or local antibiotic powder: 9.9% recurrence rate; antibiotic-impregnated allografts: 8.5%; antibiotic-loaded collagen-fleece: 6.8%; antibiotic-loaded hydrogel coating: 0%.

Conclusion: The methodological limitations and the heterogeneity between studies notwithstanding, this review shows that cementless one-stage revision is a viable option for treating chronic hip peri-prosthetic infection. Our findings challenge the more traditional antibiotic-loaded

cemented one-stage revision technique and pave the way for a more extensive use of cementless solutions. Further studies and larger series are needed to evaluate the role of different technologies for local antibacterial protection applied to uncemented one-stage revision surgery.

4.#A promising antimicrobial peptide against biofilm and other virulence features of Acinetobacter baumannii clinical strains

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ABSTRACT

Background: *Acinetobacter baumannii* is a multidrug-resistant (MDR) nosocomial pathogen, recognized as a major cause of hospital acquired infections. *A. baumannii* eradication is very complicated for its ability to form biofilm, survive desiccation and make motility on medical implantable devices. These are only some of the features that contribute to MDR of this pathogen. Antimicrobial peptides have been identified as new potential drugs to replace or integrate classical antibiotics, as they show a broad spectrum of activity against human bacterial pathogens. In our previous work, we tested a mutant peptide (KHS-Cnd) designed on the scaffold of the natural peptide, named chionodracine (Cnd), deriving from an Antarctic icefish on ESKAPE pathogens and on virulence factors of Pseudomonas aeruginosa. In this study, we analyzed the antimicrobial, antibiofilm and other anti-virulence activity of KHS-Cnd against clinical *A. baumannii* strains, also in synergy with conventional antibiotics. Methods: Clinical *A. baumannii* strains were characterized for the presence of genes coding for virulence factors and for their antimicrobial resistance. Minimal concentration (MIC) of KHS-Cnd able to inhibit bacterial growth was determined. Sub-MIC concentrations of KHS-Cnd were used to evaluate the inhibition of biofilm formation, motility and invasion of *A. baumannii* to eukaryotic cells. Synergistic effect of KHS- Cnd with conventional antibiotics was also tested by checkboard assay. Cytotoxicity assay was performed with MTT test.

Results: Bacterial strains were characterized for their ability to form biofilm and for their motility. Obtained results demonstrated that KHS-Cnd peptide exerted an effect on bacterial growth (MIC), and it was able to reduce biofilm formation, at a concentration of ¼ MIC. KHS-Cnd was also able to disaggregate mature biofilm. The peptide also demonstrated effective inhibition of both surface motility and twitching on all analyzed strains. A synergistic effect was found between KHS-Cnd and colistin in colistin-resistant clinical strains. KHS-Cnd cytotoxicity analysis showed a negligible effect at used concentrations.

Conclusions KHS-Cnd could be a valid molecule for the treatment of prosthetic infections caused by MDR *A. baumannii*, also in association with conventional antibiotics.

5.# A New Antibiofilm Protein Produced by the Antarctic Marine Bacterium Pseudomonas sp. TAE6080, named Cold-Azurin

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ABSTRACT

Background: Biofilm is the bacterial phenotype responsible for periprosthetic infections, a serious problem for surgeons causing serious economic and public health problems. *Staphylococcus epidermidis,* able to form biofilm and colonize biomaterials, represents the most frequent causative agent of biofilm prosthetic infections. Therefore, the research of new molecules able to interfere with *S. epidermidis* biofilm formation catch a remarkable interest.

Methods: This work is focused on Pseudomonas sp. TAE6080, an Antarctic marine bacterium producing an effective antibiofilm compound. The molecule responsible for this activity was purified by an activity-guided approach and identified by liquid chromatography-mass spectrometry. It's antibiofilm activity was assessed on *S. epidermidis* O-47 isolated from clinical septic arthritis and *S. epidermidis* RP62A, a biofilm reference strain isolated from an infected catheter (ATCC collection no. 35984).

Results: Results indicated the active protein is a periplasmic protein similar to *Pseudomonas aeruginosa* PAO1 azurin, named cold-azurin. Cold-azurin, recombinantly produced in *E. coli* and purified, was able to impair *S. epidermidis* attachment to the polystyrene surface and effectively prevented biofilm formation. Moreover, Confocal Laser Scanning Microscopy analyses on *S. epidermidis* treated biofilm revealed that the purified *r*cold-azurin not only reduced biofilm biomass but deeply modified the *S. epidermidis* biofilm structure without affecting cell viability.

It has been suggested that azurin's promiscuity in targeting multiple proteins is related to its three- dimensional structure. Azurin is a member of the family cupredoxins and members of this family demonstrate structural features similar to the immunoglobulin variable domains; hence azurin could be used by the bacterium as a multitarget weapon to avoid the entry of pathogenic competitors into the host cell and to eliminate foreign invaders from the host organism. In this way, the bacterium preserves its own survival. This behavior is exactly the job of the immune system.

Conclusions: In this view, the reported antibiofilm activity of cold-azurin can be interpreted as an additional strategy to reduce the presence of potential bacterial competitors and the activity could be related to the ability of cold-azurin to interact with specific proteins required for biofilm formation. Further corroboration of these results on a wide array of clinical *S. epidermidis* strains can confirm the possible use of cold-azurin for primary/secondary prevention and treatment of biofilm prosthetic infections.

6.# Precision in Periprosthetic Joint Infection Genetic Diagnosis: Bead-Beating DNA Extraction Method Improves Real-Time PCR Accuracy of Synovial Fluid

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Country: Japan

ABSTRACT

Background: Polymerase chain reaction (PCR)-based genetic diagnosis is a rapid and sensitive approach to identifying periprosthetic joint infections. However, the presence of false negatives remains a significant problem. The use of bead-beating for DNA extraction has proven to be an effective technique for capturing bacterial genes, especially Gram-positive bacteria. This study aimed to evaluate whether introducing bead-beating DNA extraction for synovial joint fluid would improve the accuracy of PCR targeting bacterial 16S ribosomal ribonucleic acid (rRNA) genes in patients with periprosthetic joint infections.

Materials and Methods: A total of 45 synovial fluid samples were obtained from the patients diagnosed with Gram-positive bacterial periprosthetic joint infection of the hip between March 2013 and October 2022. DNA extraction was performed on each sample by conventional or bead-beating methods. We quantified the cycle threshold values of 16S rRNA in bacterial synovial fluid (45 samples) and aseptic samples (20 samples) by universal PCR assay. The difference between the cycle thresholds values (Ct) of the sample and that of the negative control was defined as ΔCt, and a value of 2.0 or higher was a positive result. The sensitivity and specificity of 16SrRNA-PCR for each method were evaluated. Ct and ΔCt were also compared between bead-beating and conventional DNA extraction methods by the Paired-samples t-test.

Results: Sensitivity and specificity were 95.6% and 100.0% for the bead-beating method, and 86.7% and 95.0% for the conventional method. Ct were significantly reduced in the bead-beating group compared to the negative control [25.6 (±3.9, 11.0- 31.6) vs 26.3 (±3.0, 17.2- 31.1), P value 0.0193]. ΔCt was also significantly higher in the bead-beating group [8.1 (±3.8, 2.4- 22.1) vs 6.2 (±3.0, 1.5- 15.5), P value < 0.0001].

Conclusion: This study suggested that incorporating bead beating into DNA extraction of synovial fluid in periprosthetic joint infections would improve the accuracy of genetic diagnosis of the bacterial PCR assay.

7# Efficacy and Safety of Continuous Local Constituent Injection Therapy for Artificial Joint Infection

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ABSTRACT

Background: Periprosthetic joint infections (PJI) are often difficult to treat. Continuous local antibiotics perfusion (CLAP) using gentamicin sulfate (GM) to destroy biofilms as a treatment for PJI has recently attracted attention, but there are few reports on its efficacy and complications. The purpose of this study was to investigate the outcomes and complications of CLAP using GM for PJI.

Methods: The subjects were 24 patients (22 hip joints and 2 knee joints), excluding 5 patients who used local antimicrobial agents other than GM and 4 patients who had no postoperative follow-up from 33 patients diagnosed with PJI and treated with CLAP therapy at our hospital. The survey items included the number of CLAP procedures, daily GM dose, maximum blood GM concentration, and the presence of postoperative complications (renal dysfunction and hearing impairment). Renal dysfunction was defined as an increase in serum creatinine level of 0.3 mg/dl or higher.

Results: All patients were sedated of infection except one who died of complications of pneumonia after treatment. The mean number of CLAP procedures was 1.67 (1-4). The mean daily dose of gentamicin was 113.7 (57.6-172.8) mg. The mean duration of CLAP indwelling was 14 (6-27) days. The blood GM concentration exceeded 1.0 μg/ml in 5 patients. None of the five showed complications, but two patients whose blood GM levels were not measured showed acute renal

failure, and it took 29 days and 64 days, respectively, for renal function to improve. There were no cases of hearing impairment.

Discussion: PJI treatment with CLAP therapy has a high sedimentation rate and is a treatment modality that can improve the outcome of PJI treatment. However, transient decline in renal function was observed in 2 of 24 patients (approximately 8%). Although renal function improved after CLAP was completed in both cases, the results suggest that attention should be paid to renal dysfunction during the period of CLAP administration.

8.#Evaluation of the Efficacy and Safety of Intrapelvic Gentamicin Administration via CLAP in Hip PJI Cases

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ABSTRACT

Background: Periprosthetic joint infection (PJI) presents significant treatment challenges, frequently attributed to biofilm formation. Once established, biofilms are difficult to eradicate with systemic antibiotics alone, necessitating high-dose local gentamicin administration. This study assesses the efficacy and safety of intrapelvic gentamicin and amikacin administration as a local antimicrobial therapy using the Novel Continues Local Antibiotic Perfusion (CLAP) technique [1][2] into the pelvis in patients with hip PJI.

Materials and Methods: This study involved 15 patients diagnosed with hip PJI at our institution, who underwent intrapelvic antibiotic perfusion treatment and were observed for over six months. Bone

holes were created from the anterior superior iliac spine to the cup for intrapelvic antibiotic injection using an intra-medullary agent perfusion (i-map) needle (Cubex medical, Tokyo). After inserting the i- map needle, bone marrow fluid was collected for bacterial culture to assess the

presence of bacterial infection in pelvis. The resolution rate of PJI and the occurrence of adverse events were assessed following the perfusion of gentamicin or amikacin into the pelvis.

Results: The average age of the patients was 68.4 years, with 11 females. DAIR was performed in 4 patients, one-stage revision surgery in 4, and two-stage revision surgery in 7. Twp patients required chronic suppression and none of the other patients showed recurrence of PJI postoperatively. Positive bacterial cultures from collected pelvic bone marrow fluid were found in 4 cases. A transient renal impairment was observed in one patient but improved immediately, with no other significant adverse events reported.

Conclusion: This study suggests that the administration of antimicrobials into the pelvis can improve postoperative outcomes in patients with hip PJI, given the presence of infection spreading within the

pelvic area. (276 words)

1. Choe, H., et al., *Novel Local Antifungal Treatment for Fungal Periprosthetic Joint Infection With Continuous Local Antibiotic Perfusion: A Surgical Technique.* Arthroplast Today, 2023. 24: p. 101245.
2. Maruo, A., et al., *Continuous local antibiotic perfusion: A treatment strategy that allows implant retention in fracture-related infections.* J Orthop Surg (Hong Kong), 2022. 30(2): p. 10225536221111902.

9.# Evaluation of Serum Albumin and Globulin in Combination with C-Reactive Protein Improves Serum Diagnostic Accuracy for Spinal Infection

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ABSTRACT

Objective: The aim is to investigate whether serum markers contribute to improving the diagnostic accuracy of spinal infections, enabling early diagnosis and treatment.

Methods: The study included 125 patients diagnosed with spinal infections who visited Yokohama City University Hospital between January 1, 2004, and March 31, 2021. A control group comprised 531 patients treated surgically for lumbar spinal stenosis during the same period. Serum markers including albumin (Alb), total protein (TP), globulin (Glb), CRP, platelet count, white blood cell count, neutrophil count, lymphocyte count, monocyte count, and combination markers such as albumin-globulin ratio (AGR), CRP-albumin ratio (CAR), CRP-AGR ratio (CAGR), neutrophil-lymphocyte ratio (NLR), and platelet-lymphocyte ratio (PLR) were investigated. The accuracy of infection diagnosis was examined to evaluate whether these serum markers are useful for differentiating between spinal infections and lumbar spinal stenosis. Additionally, the usefulness of these serum markers in diagnosing low-inflammatory spinal infections with CRP levels below 1mg/dl was evaluated.

Results: Significant differences were observed between the spinal infection group and the lumbar spinal stenosis group in Alb, Glb, CRP, platelet count, white blood cell count, neutrophil count, lymphocyte count, AGR, CAR, CAGR, NLR, and PLR, but not in TP and monocyte count. The AUC was highest for CAGR, followed by CAR, CRP, AGR, and Glb, with values of 0.87, 0.87, 0.85, 0.82, and 0.80, respectively, suggesting their potential usefulness in diagnosing spinal infections. AGR, CAR, and CAGR had AUC values of 0.82, 0.87, and 0.87, respectively, indicating an improvement in diagnostic accuracy with combination markers compared to individual serum markers, with sensitivity (0.68, 0.73, 0.78) and specificity (0.87, 0.89, 0.88) both higher than those of single markers. Significant differences were observed between the pyogenic spondylitis group and the lumbar spinal stenosis group in Alb, Glb, CRP, platelet count, white blood cell count,

neutrophil count, lymphocyte count, AGR, CAR, CAGR, NLR, and PLR, with CAGR having the highest AUC. In the low- inflammatory (CRP below 1mg/dl) spinal infection group compared to the lumbar spinal stenosis group, significant differences were observed in Alb, Glb, CRP, platelet count, lymphocyte count, AGR, CAR, CAGR, NLR, and PLR, with CAGR having the highest AUC. In the low-inflammatory pyogenic spondylitis group (CRP below 1mg/dl), significant differences were observed in TP, Glb, CRP, platelet count, AGR, CAR, CAGR, NLR, and PLR, with CAGR having the highest AUC.

Conclusion: Blood tests for spinal infections, including measurements of Alb, Glb, and combination markers such as AGR, CAR, and CAGR, suggest that more sensitive screening is possible.

10.#Analysis of Infection Control Rates Using Continuous Local Antibiotics Perfusion in PJI after Bone Tumor Surgery

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ABSTRACT

Background: Periprosthetic joint infection (PJI) is a serious complication of arthroplasty in patients with bone tumors due to the disadvantages of infection, such as extensive soft-tissue loss and decreased immunocompetence caused by chemotherapy. In recent years, continuous local antibiotic perfusion(CLAP), in which highly concentrated antibiotic agents are returned to the site of infection, has been attracting attention as a treatment for bone and soft tissue infections, and it is expected to be effective in postoperative oncologic joint replacement surgery. However, the effect of CLAP on the outcome of postoperative PJI after bone tumor surgery is unknown.

Objective: To clarify the outcomes of CLAP in the treatment of periprosthetic infection after bone tumor surgery.

Methods: Patients with a diagnosis of PJI based on the Musculoskeletal Infection Society (MSIS) criteria who required invasive treatment after implant-based reconstruction for bone tumors over a 14-year period from 2009 to 2023 at our institution were included in the study. The study items included age, gender, primary disease, surgical site, causative organism, time of infection, waiting period from the first sign of infection to the last invasive procedure performed for infection control, surgical technique, ASA score, preoperative WBC, CRP, and whether infection control was achieved. Patients were divided into CLAP and non-CLAP groups according to whether CLAP was used or not.

Results: The mean age was 47±19 years. 4 patients were in the CLAP group and 12 were in the non-CLAP group. One patient in the CLAP group and five patients in the non-CLAP group underwent bi-stage revision surgery. Mean preoperative WBC was 8250±1360/μL in the CLAP group and 8510±3710/μL in the non-CLAP group. Mean preoperative CRP was 2.4±1.4 mg/dL in the CLAP group and 9.9±7.7 mg/dL in the non-CLAP group. Patients$^{2}i^{0}n^{2}t^{4}$he CLAP group waited

150±287 days for final surgery, while those in the non-CLAP group waited 60±104 days. The infection control rate was 100% (4/4 patients) in the CLAP group and 75% (9/12 patients) in the non-CLAP group.

Conclusion: In this study, the CLAP group achieved quiescence of infection with preservation of implants in all but one case of chronic PJI in a compromised host.

11.#The mid-term result of conversion to plate after bone transport for infected tibial nonunion

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ABSTRACT

Introduction: Infected nonunion with large bone and skin defects is severe problem. Osteogenesis with external fixator is useful even for infected nonunion with skin defects, however it needs patients to spend with external fixation for a long time. To shorten Healing index (HI), We perform conversion to plate or nail after bone transport (CPBT), but its safety is unknown. Therefore, this study aimed to investigate mid-term result for CPBT.

Method: In a retrospective study, 3 patients treated for infected non-union with segmental bone loss with CPBT were included. All patients were treated by Ilizarov methods for gradual correction. The treating surgeon selected CPBT based on clinical considerations. Bone graft was performed at the docking site. Mean age at surgery was 36.2 years old (19-56). All patient was male with infected nonunion after open fracture. Tibial shaft 4 cases, femoral shaft 1 cases. Pathogenic bacteria were methicillin resistant staphylococcus aureus in 3 cases, methicillin susceptible staphylococcus aureus in 1 case, and pseudomonas aeruginosa in 1 case. Outcome measures were mean follow-up period, the mean length of distraction, the Healing Index (HI), which is the period from external fixation application to removal per distraction length, bone results, function, and recurrence. Criteria of recurrence were fistula that does not close, swelling, redness, and elevation of inflammatory response.

Result: Mean follow-up period was 91.2 months (42-175). The mean length of distraction was 8.2 cm (6-12.5). HI was 29.4 days/cm (20.7-44.1). All patients acquired bone healing and walk alone (100%). There is no recurrence and refracture (0 %).

Conclusion: Conversion to plate after bone transport was safety and useful method if radical resection was performed. It shortened period of external fixator application without recurrence during mid-term follow-up.

12.# The Concept Of Treatment For Surgical Infection In The Calcaneus Area.

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Background: Chronic calcaneal osteomyelitis (CA) and open infected calcaneal fractures, especially when complicated by infected soft tissue defects, pose a challenge for surgeons. There are still no accepted recommendations for surgical treatment of this pathology.

Patients and Methods: We conducted a retrospective study of treatment outcomes for 44 patients (4 women and 40 men) from 2009 to 2022. The group included 4 patients with open infected fractures of the calcaneus with skin defects, 17 with chronic post-traumatic and postoperative osteomyelitis of the calcaneus (3 with skin defects), 10 with chronic hematogenous osteomyelitis, and 13 with only an infected skin defect in the heel area. We evaluated treatment success based on disease recurrence within a 2-year observation period, instances of below-knee amputations, and the restoration of limb weight-bearing ability. Patients with diabetes mellitus, neurotrophic diseases were excluded from this analysis.

Results: Disease recurrence occurred in 4 patients, leading to 6 subsequent surgeries, with 2 (4.5%) resulting in amputations. In other cases, we successfully restored limb weight-bearing through reconstructive surgical interventions with or without skin grafts, effectively eliminating the infectious process. Based on our experience and the opinions of other experts, we attempted to formulate a concept for choosing optimal well-known surgical solutions depending on the condition of the pathological focus. A retrospective analysis of the treatment results of our patients with some refined operations is presented from the perspective of this concept.

Conclusion: Surgical infectious pathology of the hindfoot is a complex and as yet not fully resolved issue. The concept proposed by us for selecting surgical solutions based on the condition of the

pathological focus may be another step towards its resolution. This concept can assist young orthopedic surgeons at the beginning of their practical activities.

Keywords: Osteomyelitis of the calcaneus; Open infected calcaneal fractures; Skin defects in the hindfoot area; Skin plasty; Reconstructive surgery in the hindfoot area.
Level of Evidence: IV

13.#Reconstructive Techniques for Hindfoot Injuries Involving Loss of Calcaneus and Talus Bones

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Country: [1] [2]Azerbaijan, [3]Germany

Introduction: In this study, we share our experience in treating individuals wounded by mine-explosive injuries (MEI) during the 2020 Patriotic War in Azerbaijan, aimed at reclaiming territories occupied by Armenia.

Materials and methods: We conducted examinations and treatments for 6 individuals with MEIs in the rear of the foot. The average age of the patients was 23.6 years (min. 20, max. 27). Patients were admitted for reconstructive treatment between 15 to 40 days after injury. All patients exhibited injuries classified as Gustilo R.B. and Anderson J.T. 3-B-C, and according to Sanders classification -4. Five patients had either absent or multifragmented and infected fractures of the calcaneus, while four patients had multifragmented fracture-dislocations of the talus. One patient presented an infected defect in the distal part of both lower leg bones with a multisegmented fracture-dislocation of the talus and required amputation of the other leg below the knee. Despite the need for amputation, all patients opted for reconstructive surgery. Each patient underwent 4 to 5 reconstructive surgeries, and two received skin grafting using a sural flap in the heel area. New operations were developed to create and stabilize the hindfoot, utilizing the Ilizarov apparatus and the bilocal Ilizarov method. Additionally, two patients underwent an additional 4 cm lengthening of the lower leg after 8 months.

Results: The infectious process was successfully eradicated, and the hindfoot was restored in all patients. Shortening was corrected in four patients. Currently, all patients ambulate with full load using orthopedic shoes, with one utilizing a cane. One patient underwent a below-knee amputation two years later due to persistent hypersensitivity of the skin in the foot area.

Discussion: We developed a classification for MEIs of the hindfoot and devised operations for its reconstruction. We believe that the removal of all fragments of the calcaneus and talus is crucial in preventing the infectious process and allows for the creation of support from the distal tibia. The relief of the infectious process and wound closure using known skin grafting methods are pivotal aspects of the reconstruction. The use of the Ilizarov technique and apparatus in hindfoot reconstruction proved effective in averting amputations.

Conclusion: Reconstructive operations using Ilizarov techniques enabled us to circumvent amputation in 5 out of 6 patients during the medium-term follow-up, restoring weight-bearing ability. We advocate for further study and refinement of the proposed treatment direction for individuals affected by similar injuries.

14.#Evaluating the Diagnostic Capacity of Rotational Thromboelastometry in Periprosthetic Joint Infections

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Country: Greece, Italy, Cyprus

ABSTRACT

Background: Periprosthetic joint infections (PJIs) are associated with altered hemostatic dynamics; therefore, coagulation laboratory methods such as rotational thromboelastometry (ROTEM) may be

valuable in their diagnosis. The aim of this study was to evaluate the diagnostic role of ROTEM in PJI.

Methods: A diagnostic study was conducted including 65 patients who underwent revision total hip arthroplasty or total knee arthroplasty due to PJI (30 patients) or aseptic loosening (35 patients). Preoperative laboratory evaluation included conventional coagulation studies, inflammatory markers, and ROTEM analysis. These parameters were compared between patients with PJI and patients with aseptic loosening.

Results: Several ROTEM parameters differed in the patients with PJI, indicating a higher coagulation potential associated with PJI. Specifically, the development of PJI was associated with higher EXTEM maximum clot firmness (MCF) (odds ratio [OR], 1.12 [95% confidence interval (CI), 1.04 to 1.20]; p = 0.001). Among the ROTEM parameters, EXTEM MCF was found to have the highest diagnostic accuracy for PJI (area under the receiver operating characteristic curve, 0.850; sensitivity, 76.6%; specificity, 91.4%), which was comparable with C-reactive protein (CRP) (p = 0.22) and erythrocyte sedimentation rate (ESR) (p = 0.65), but higher than D-dimer (p = 0.037). Moreover, the combined diagnostic accuracy of elevated EXTEM MCF and CRP was improved compared with CRP alone (p = 0.019).

Conclusions: Our results indicate that ROTEM analysis might be helpful for the detection of the hemostatic derangements that are associated with the development of PJI. However, because of the small size of this pilot study, further research is needed to investigate the value of incorporating viscoelastic studies in diagnostic scores for PJI.

15.# SPECT/CT use as an indicator of low-grade infection in the spine: case series study.

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Country: Argentina

ABSTRACT

Low back pain is one of the most common pathologies worldwide. When conservative treatment fails to yield good results, surgery is the recommended approach. Despite spinal fusion, some patients continue to experience persistent low back pain. This is where a series of studies come into play to detect the source of treatment failure. As a first measure, it is important to perform tomography and nuclear magnetic resonance imaging to evaluate signs of loosening. In addition, laboratory tests must be requested in search of inflammatory or infectious parameters. Therefore, the accurate identification of patients who may benefit

from reintervention is crucial. Loosening of hardware following lumbar fusion can reach up to 65%, affecting bone fusion and segmental stability, which can lead to pain and serve as a potential reason for intervention. When the patie^{2}n^{0}t^{2}p^{4}ersists with pain, and no pathological alterations are observed in the images, the use of bone scintigraphy with SPECT (single-photon emission computed tomography) in combination with computed tomography (CT), is an imaging study that has gained relevance in recent times. It has greatly improved the anatomical localization of abnormalities found in SPECT, significantly enhancing its specificity. While pseudoarthrosis is a significant cause of spinal fusion failure, in recent years, it has been observed that certain low-virulence pathogens are also implicated in persistent low back pain. The number of previous surgeries appears to be a risk factor for the increase in chronic low-grade infections (29.1%), predominantly caused by Propionibacterium spp and Staphylococcus in cases of spinal revision. The chronic inflammatory reaction induced by biofilm formation on the infected implant leads to bone resorption and material loosening. The formation of a biofilm on the implant that is not penetrable by the immune system or maximum doses of antibiotics during systemic therapy appears to generate a local inflammatory reaction that may be the cause of osteolysis. Some studies evaluated the sonication method in revision spine surgery and found a high positivity rate in patients operated on for lumbar pseudoarthrosis. This is the focus of our study, in which we identified four patients with persistent

low back pain after surgery, both of whom tested positive for chronic low-grade infection using SPECT/CT and sonication.

16# Dead Or Alive? Use Of Indocyanine Green Fluorescence For Assessment Of Vitality In Non- Union.

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Country: Saudi Arabia

Aim: Our purpose was to introduce the use of ICG fluorescence angiography to evaluate the blood flow of bone in patients with atrophic non-union.

Background: Bone perfusion is surgically assessed based on the surgeon's experience and paprika sign. Large bone defects are missed due to the surgeon's inability to determine the amount of affected bone that needs to be removed. Intraoperative estimation of bone microcirculation in traumatology using indocyanine green (ICG) fluorescence may serve as a valuable and safe procedure that may aid in decision making

Technique:We preliminary used this technique in our institute from April 2019 to June 2021 on twelve patients treated for tibia non-unions. We used Stryker System for ICG fluorescence imaging. After debridement, the tourniquet was deflated, 0.5 mg/kg of ICG powder dissolved in sterile saline at 2.5 mg/ml concentration was administered. The time from injection and the beginning of appreciation of the green area was measured.Non-viable bone was resected accordingly.

Conclusion: ICG fluorescence angiography allowed a rapid visualization of blood flow in the bones after 25–45 s. In all patients, tissue resection was less than what planned preoperatively and what observed intraoperatively. No intraoperative or post-operative adverse events were observed.After ICG injection, the oxygen level was reduced due to a bias in pulse oximeter reading.This phenomenon was not clinically relevant.

Clinical Significance: ICG fluorescence imaging is promising in the treatment of non-union defects because it is safe, easy, rapid and contribute in intraoperative decision for establishing resection levels. Using ICG fluorescence could demonstrate bone perfusion to help surgeons to reduce bone resection and avoid massive bone defects.

17.# Can A Simple Fracture Make A Disaster?

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Bone infection is one of the most serious complications that presents in orthopaedic surgery. The case presentation is a three years old boy who presented by a simple fracture femur after a motor vehicle accident. He was treated by open reduction and k wires intramedullary fixation with cerclage fixation around the fracture.

After that, infection was present, shortening and non union. The surgeon removed the k wires and castes the patient for three months without any benefit. The patient presented to us with 2 two centimeters shortening and nonunion and it was a big problem because all the length of his femur was about 20 centimeters. Large segment of sclerotic area was excised , subtrochanteric osteotomy and fixation by ilizarov was done. After that lengthening was started but the problem was in the site of fracture because there was a delayed union. Intramedullary reaming was done which stimulated the bone healing and complete union was done.

18.#Management of Open Wound Infection on Ankle and Foot with Ilizarov Technique.

A. M. Shayan Bari

Affiliation: Bari-Ilizarov Orthopaedic Centre

Country: Bangladesh

ABSTRACT

Introduction: Open wound infections affecting the ankle and foot present significant challenges in orthopedic practice due to their complex anatomy and susceptibility to complications such as osteomyelitis and soft tissue necrosis. Ilizarov technique offers unique advantages, including stable fixation, preservation of soft tissues, and the ability to address infection while promoting tissue regeneration. This paper presents a case study outlining the management of an open wound infection on the ankle and foot using the Ilizarov technique.

Materials & Methods:From 2019 to 2023,26 patients were performed surgeries (16 males, 10 females) with Ilizarov apparatus in foot ankle with Open Wound infection. The mean age of patients was 36 of which all patients were infected. Through meticulous wound care, debridement, and application of the Ilizarov external fixator, significant improvements in infection control and tissue healing were achieved.

Results: All healed with the application of Ilizarov fixator.

Conclusion: The management of open wound infections on the ankle and foot using the Ilizarov technique demonstrates promising outcomes in terms of infection control, tissue healing, and functional restoration.

19.# Infected Big Gab Nonunion of Tibia

A. M. Shayan Bari

Affiliation: Bari-Ilizarov Orthopaedic Centre

Country: Bangladesh

ABSTRACT

Introduction: Infected big gap non-union of tibia is difficult to treatment because of infection, bone loss, shortening, poor sift tissue over and deformity. Materials & Methods:145 Infected big gap non-union of tibia were treated from 2015 to 2023; 15 presented without active discharge and was treated with Ilizarov ring fixator, 53 presented with draining infection and were treated with debridement and Ilizarov bone transport, 47 had a bone transport to fill gap of 2.5 to 27 cm. Bifocal treatment were in 30 cases. None had bone grafting to achieve union.

Results: All healed with the application of Ilizarov fixator, 3 needed reapplications of Ilizarov to achieve 100% union.

Conclusion: A well plan step by step Ilizarov technique to cover infected gap nonunion of tibia is an excellent method in challenging cases. Excellent results cannot be achieved with conventional methods but can be easily achieved with Ilizarov technique within 1-2 years.

20.# Chronic Osteomyelitis in Children treated by Ilizarov.

Prof. Md. Mofakhkharul Bari

Affiliation: Bari-Ilizarov Orthopaedic Centre

Country: Bangladesh

ABSTRACT

Introduction: Chronic osteomyelitis in children is very difficult to eradicate completely. The patient with chronic osteomyelitis has a new hope of cure by recent advances in the management of chronic osteomyelitis. Systemic manifestations may subside, but one or more foci in the bone may contain purulent material, infected granulation tissue or a sequestrum. Treatment of this condition is to irradiate the infection and to restore the functional activity of the patient.

Materials & Methods: Duration: 1990 to 2023. Number of Children: 265 (105 were severe)

Age range: 3-15 years. Follow-up period: 2-19 years. Preoperative planning and assessment are very important in treating the chronic osteomyelitis in children. 1. We must palpate arteria dorsalis pedis and posterior tibial artery. 2. Local temperature and color of the foot must be seen. 3. We must assess with preoperative pulse- Occimeter. If the Ilizarov fixator is stable then the Corticotomy is performed at the proximal metaphyseal or distal metaphyseal region. To eliminate infection vascularization of the osteomyelitic centre is increased by the biological stimulation of corticotomy. The gap is closed by gradual controlled coordinated stretching by transporting the segment. 1mm per day till the distal end locks the proximal end of the distal fragment. Then the two fragments are compressed together. If the gap is too large, we should introduce a guide wire in between the fragments to keep the bone in anatomical position and to prevent any kind of angulation and rotation which can cause malunion and deformity of the limb. The Ilizarov fixator is kept till the new corticotomy site the fragments are distracted till the limb length is restored.

Results: Chronic osteomyelitis in children with pandiaphyseal osteomyelitis with pathological fracture, including discharging sinus can be treated by stable fixation of Ilizarov apparatus. Sometime radical resection can also be done to create a gap which can be filled up by bone transportation with excellent results.

21.# Infected Gap Non-Union Of The Radius And Ulna Treated By Ilizarov.

Prof. Md. Mofakhkharul Bari

Affiliation: Bari-Ilizarov Orthopaedic Centre

Country: Bangladesh

ABSTRACT

Introduction: Infected non-union of radius and ulna are difficult to treatment because of infection, bone loss, shortening, poor sift tissue over and deformity

Materials & Methods:From 1990 to 2023, We treated 90 men and 36 women aged 6 to 57 years by Ilizarov technique. All patients were checked monthly until there was radiological evidence of infected bone healing. To evaluate the time of union of the infected non-union of radius and ulna, a combined clinical and radiographic assessment was used. The lengthening index, x-ray consolidation index, functional status, bone healing and complications encountered during the treatment were assessed.

Results: All the difficult infected non-unions healed in a mean of 7 months ranging from 5 to 12 months. At the latest follow up of radius and ulna function were satisfactory.

Conclusion: The Ilizarov compression distraction device is a fantastic tool in promoting the healing of infected non-union of radius and ulna.

Significance: Early diagnosis of FRI by rapid kits based on the our results, will go a long way in , managing cases and achieving better results through early intervention. This in turn, will reduce the durations of hospital stay, and development of osteomyelitis or non unions.

22.# Management of Buerger's Disease (TAO) With Ilizarov

Prof. Md. Mofakhkharul Bari

Affiliation: Bari-Ilizarov Orthopaedic Centre

Country: Bangladesh

ABSTRACT

Introduction: Buerger's Disease (Thrombo Angiitis Obliterans- TAO) is an episodic, segmental inflammatory thrombotic disease that most commonly affects the arteries and superficial veins resulting signs and symptoms of ischaemia of both upper and lower limbs usually in men between 25 to 45 years of age. The etiology of TAO is unknown, seen very commonly in smokers [1,2]. The standard treatment modalities include, discontinue using tobacco, food care, calcium channel blockers, prostaglandin analogues, revascularization, lumbar sympathectomy, amputation- if all the above fails. Aims: This study aims to evaluate the efficacy of the Ilizarov external fixation technique in the management of Buerger's Disease, particularly in achieving limb salvage and alleviating ischemic symptoms.

Materials & Methods: From 2000 to 2023, 25 patients, were male, a chronic smoker.

C/C: Discoloration of foot associated with blebs, coldness and swelling of the foot. All patients had severe nocturnal rest pain. O/E: Popliteal and distal pulses were not palpable in the foot. Mild discoloration was present and popliteal and distal pulses were feeble.

In view of the above symptoms Ilizarov external fixator was applied in the right or left leg with vertical corticotomy of the proximal and middle 1/3 of the tibia, distraction continued for 3 weeks. Ilizarov external fixator was removal after 8-10 weeks depending upon the cases. After removal of Ilizarov apparatus plaster cast was applied for 3 weeks.

Results: The treatment of TAO and limb salvage was successful by this method. Ilizarov external fixator in the proximal half of the tibia followed by distraction of this procedure creates neovascularization in blood circulation of the lower limbs, which relieves the patient's pain and ischaemic symptoms

Conclusion: The findings of this study highlight the efficacy of the Ilizarov external fixation technique as a valuable therapeutic modality in the management of Buerger's Disease. By

promoting neovascularization and alleviating ischemic symptoms, the Ilizarov method offers promise in the preservation of limb function and overall patient well-being.

23.# Charcot Arthropathy of Ankle and Foot

Prof. Md. Mofakhkharul Bari

Affiliation: Bari-Ilizarov Orthopaedic Centre

Country: Bangladesh

ABSTRACT

Introduction: Treatment of Charcot's joints with diabetic foot is a great challenging situation of soft tissues due to associated neuropathy and vascular compromise. The use of the Ilizarov fixator in Charcot's arthropathy is a disabling pathology of the foot and ankle which requires an effective treatment to improve clinical and functional outcomes and prevent foot amputation.

Materials & Methods: From 1990 to 2023,56 patients were performed surgeries (36 males, 20 females) with Ilizarov apparatus in diabetic foot patients with Charcot's joints (Eichenholtz stage II and III). The mean age of patients was 56 of which all patients were diabetic. Deformity, resorption of bones and instability of the ankle joint those results in a non-plantigrade foot was considered as the operative indication.

Results: Satisfactory in all 56 patients.

Conclusion: The Ilizarov method has been shown to be an effective method of treating Charcot Arthropathy of Ankle and Foot.

24.#Management of Diabetic Foot Ulcer (DFU) using Tibial Transverse Technique (TTT)

Prof. Md. Mofakhkharul Bari

Affiliation: Bari-Ilizarov Orthopaedic Centre

Country: Bangladesh

ABSTRACT

Introduction: Diabetic foot ulcer (DFU) is always associated with peripheral and automatic neuropathy.

Methods: From 1990 to 2023,96 patients were performed surgeries (60 males, 36 females) with Ilizarov apparatus in diabetic foot Ulcer patients (Wagner type I, II, III, or IV, V). The mean age of patients was 55 (range 36-65 yrs.) of which all patients were diabetic. Deformity, resorption of bones and instability of the ankle joint those results in a non-plantigrade foot was considered as the operative indication. TTT (Tibial Transverse technique) was done. The mean follow-up time has been 36 months.

Results: Satisfactory in all 96 patients.

Conclusion: Diabetic foot ulcer is associated with a high rate of morbidity, disability, mortality and psycho-social cost.

25.#Wound Alpha Defensin And Early Diagnosis Of Open Long Bone Fracture Related Infection

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Affiliation: Department of Orthopaedics, PGIMER, Chandigarh

Country: India

ABSTRACT

Introduction: Diagnosing fracture related infection (FRI) requires either purulent discharge from wound or positive culture reports. Cultures are time-intensive and may be falsely negative. This necessitates the need for accurate and rapid biomarker-based diagnosis. Taking forward a pilot study looking at multiple biomarkers for the diagnosis of FRI, this study was conducted to determine the accuracy of Alpha Defensin(AD) for the diagnosis of FRI in open long bone fractures.

Methods: This was a prospective cohort study on adult patients with long bone open fractures. Wound fluid levels of AD were evaluated on post-operative day 2 via sandwich ELISA, and patients were followed up for three weeks. Patients were categorized as cases (FRI) or controls (no FRI), on the basis of the consensus

definition of FRI. Univariate and multivariable logistic regression analysis, along with receiver operating characteristic (ROC) analysis were performed.

Results: 153 patients with average age of 36.3 (SD ± 14.6) years were included. AD levels showed a significant (P=0.001), 2.1-fold elevation in cases (n = 63, Mean = 28.8 µg/ml) as compared to controls (n = 83, mean = 13.5 µg/ml). The area under the curve for this estimate was 0.71. As per Youden's index, an AD value cut-off value of a value of 7.85 µg/ml had a sensitivity of 71.4% and specificity of 68.7%. Multivariate logistic regression with multiple confounding factors revealed AD and Gustilo Anderson grade of open fracture as significant independent predictors of FRI.

Discussion: Wound AD levels are significantly elevated in patients with open fractures who develop FRI. This can be used as a tool for early diagnosis of FRI, at a time when frank pus/ wound dehiscence hasn't developed. This can be done via development of ELISA based rapid diagnostic

kits based on our results. Further studies can look at the role of wound AD levels for guiding conversion osteosynthesis in open fractures.

26.# Eradication of Biofilm Related Infection Using AC Generated Electromagnetic Force and MIC Doses of Antibiotics in a Flow Reactor

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Affiliation: Medical City Hospital Plano, Texas and Oklahoma State University, Tulsa, Oklahoma

Country: United States

ABSTRACT

Introduction: Approximately 1-3% of patients with total joint replacements develop bacterial or fungal infections which respond poorly to antibiotic treatment. These infections are often serious enough to warrant removal, debridement, and replacement of the implant. There is a need to provide a non-invasive solution for treating infections occurring on medical implants.

Methods: Coupons (19 mm x 25.4 mm x 2 mm) composed of 430 stainless steel, were inoculated with MRSA M2 Methicillin and incubated for one week at 37 C in Tryptic Soy Broth (TSB) to culture biofilms. M2 MRSA was minimally susceptible to 1 μg/ml of vancomycin. After biofilm growth, the coupons were washed to remove non-adherent bacteria and transferred to 50 mL tubes containing 40 mL TSB with and without vancomycin. Bacteria were exposed to an AC-EMF at 10.7 mTelsa at low radio frequency of 30-100kHz frequency for varying times to heat the coupons to 45, 55, 60, and 65 degrees C. After exposure to EMF and overnight incubation, the coupons were washed four times with PBS. Biofilm bacteria were removed from the coupons using a plastic scraper. Bacteria in the culture supernatant and in the biofilm were enumerated by plating on agar plates and colony-forming units (CFU) were determined.

Results: The increased temperatures had little effect on the CFU/mL when cultured without the addition of vancomycin. However, in the presence of 1 μg/ml of vancomycin, temperatures increase of 45C and 55C resulted in significant reductions of CFU. The CFU had a log 3 reduction at 45C and went below the limit of detection at 55C. Increases in temperatures from 37 C to 55C and to

65C results in reductions of CFU's dropped to below the limit of detection in the supernatant at 65C.Discussion: EMF at very low to low frequency and mTesla can eradicate biofilm when externally applied through AC wires with MIC amounts of antibiotics. This may result in in the non-invasive treatment of biofilm related infection on implants or give higher rates of success with procedures like DAIR.

27.# The Use of MgPO4 as a Local Molecular Carrier for Antibiotics in the Treatment of Biofilm and Prevention of Biofilm Periprosthetic Joint Infections

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Country: United States

ABSTRACT

Objective: LOCAL CONCENTRATIONS OF THE ANTIBIOTICS. ORIGINALLY THESE WERE NON RESORBABLE CEMENT PELLETS WHICH REQUIRED REMOVAL OF THE PELLETS THROUGH A SECOND OPERATION. ATTENTION HAS BEEN DIRECTED FOR BIORESORBABLE CASO4 AND CALCIUM HYDROXYAPATITE PELLETS FOR THE MANAGEMENT OF SOFT TISSUE VOIDS LEFT AFTER RESECTION FOR PJI'S. THE CALCIUM BASED PRODUCTS ARE FRAUGHT WITH PROBLEMS SUCH AS WOUND DEHISCENCE, PROLONGED DRAINAGE HETEROTOPIC OSSIFICATION WHEN USED AS A SOFT TISSUE VOID CARRIER. WHEN USED WITH ANATOMIC FIXATION OF STEMS IN INFECTED CASES, WHICH WOULD BE PREFERABLE TO CEMENT, A HIGH RATE OF ASEPTIC LOOSENING OCCURS. OF INTEREST IS THE USE OF MGPO4 USAGE AS A BIORESORBABLE CARRIER WHICH IS A GEOGRAPHIC SIGNAL ENHANCER OF PRIMITIVE PLURIPOTENTIAL FIBRO-MESENCHYMAL CELLS AND MIGHT NOT HAVE THE COMPLICATIONS OF THE CALCIUM BASED PRODUCTS.

METHODS: SIXTY-TWO PATIENTS WERE ANALYZED AFTER PLACEMENT OF ANTIBIOTIC LOADED MGPO4 PELLETS WITH 240MG OF LIQUID TOBRAMYCIN AND 500MG OF VANCOMYCIN POWDER PER 10CC OF THE MGPO4 POWDER. THE BEADS HARDENED IN 10-15 MINUTES IN A PLIABLE PAD WITH HOLES SIZES VARYING FROM 7.5MM-3.0MM. ALL PATIENTS WERE PJI'S OR HIGH RISK FOR PJI'S'S OF HIPS OR KNEES. THE BEADS WERE PLACED AROUND THE PROSTHETIC JOINT AND A WATERTIGHT MYO-FASCIAL CLOSURE WAS PERFORMED. THE PATIENTS WERE FOLLOWED CLINICALLY AND WITH X-RAYS AT 2-, 6-

AND 12-WEEKS POST-OP AND ANALYZED FOR COMPLICATIONS AND FOR DISAPPEARANCE FOR THE BEADS.

RESULTS: THERE WERE 10 PATIENT FAILURES RELATED TO RECURRENCE OF INFECTION. THERE WERE NO OTHER DRAINAGES. THE 7.5 MM BEADS WERE THE SLOWEST TO BE RESORBED. THEY WERE STILL PRESENT AT 3-5 MONTHS POST-SURGICAL IMPLANTATION, BUT ASYMPTOMATIC FROM THE PATIENT'S STANDPOINT. THE 3.0MM BEADS RESORBED AT 3-4 WEEKS POST-OP.. VERY MINOR HETEROTOPIC OSSIFICATION WAS SEEN IN THE SOFT TISSUE POST-SURGICAL. THERE WERE 3 CASES THAT SOME PERIOSTEAL NEW BONE ADJACENT TO THE BEAD PLACEMENT, BUT A MILD AMOUNT AND ASYMPTOMATIC CLINICALLY. THIS COHORT DIDN'T DEMONSTRATE THE LARGE EFFUSIONS SEEN WITH THE CALCIUM BASED CARRIERS, NOR WERE THE AMOUNT OF HETEROTOPIC OSSIFICATION.

Conclusion: pure powered mgpo4 loaded pellets with 240 mg of liquid tobramycin and 500 mg vancomycin powder reliably hardened in 10-15 minutes. The 3 mm pellets were resorbed at 3-4 weeks and are recommended. Unwanted wound complications didn't occur as frequent or heterotopic ossification compared to the calcium-based carriers.

28.#Integrated Protocol For Management Of Infected Nonunion Of The Tibia

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Country: United States

ABSTRACT

Introduction: among all prognostic factors in tibia fracture care, that implying the worst prognosis is deep infection. The management of infected non-union of the tibia entails wide resection of infected tissues to decrease the recurrence rate of infection. Such radical debridement results in bone and soft tissue defects with the creation of a dead space. Elimination of the dead space is a necessity using antibiotic-impregnated cement as a staged technique for further reconstruction of bone and soft tissue. Aim of the study: the objective of this series is to assess the efficacy of our integrated protocol for the management of infected non-union of the tibia.

Materials and methods: this prospective study included 32 patients with infected non-union of the tibia with medullary contamination. They were managed according to an integrated protocol which includes three phases (debridement, management of dead space, and tissue reconstruction) by staged debridement and insertion of antibiotic-impregnated cement spacer with later distraction histogenesis using Ilizarov frame for bone and soft tissue reconstruction. The mean age of the patients was 24 years (19 to 52). The mean size of the defect after debridement was 6 cm (range 4-14.5 cm). The average follow-up period was 28 months (range 16-36 months).

Results: successful reconstruction with no recurrence of infection was achieved in 30 cases (94%) without the need for bone or soft tissue grafts. Below knee amputation was performed in two cases (6%); one due to intractable infection and the other due to intolerance to the procedure. External fixator index ranged from 35 to 60 days/cm (average 45 days/cm). The functional results were satisfactory in 27/30 cases (90%) and unsatisfactory in 3/30 cases (10%) due to residual leg length discrepancy, joint stiffness, and persistent pain. Discussion: the proposed staged protocol represents a valid option for successful bone and soft tissue reconstruction and elimination of the infection without the need for either bone grafting or soft tissue procedures. The procedure is tedious, entails a long learning curve, and committed a patient to sustain such arduous work.

29.# High Rate of Heterotopic Bone Formation in Metal Allergy Patients

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ABSTRACT

INTRODUCTION: Metal-ion allergies occur in 1.5% of patients undergoing primary total knee arthroplasty (PTKA). Recent works demonstrate that infection in this group of patients can be as high as 10% in patients with metal allergies. The use of calcium sulfate hemihydrate as a local carrier for antibiotics has been described with local elution of the antibiotics achieving 10^2 to 10^3 x MIC. The question is whether heterotopic bone formation is higher in the group of metal allergy patients.

METHODS: All patients in this cohort were staged with plain radiographs, WBC scans, tri-phase bone scans, and CT scans of the knee. All had the clinical history of multidirectional instability (MDI) associated with arthrofibrosis and metal-ion allergies, as depicted by the Lymphocyte Transformation Test (LTT). Radiographs were reviewed at an average of 25 days post-revision. Heterotopic bone that formed around the knee was staged by location numerically.

RESULTS: Out of the 200 patients revised with PTKAs for metal-ion allergies associated with MDI with arthrofibrosis, 48 (27%) patients had heterotopic bone forming around the knee after revision. Out of these 48 patients, 22 were male and 26 were females. The average age of the 48-patient cohort was 66 with a range of 30-92. Eight of the 48 (17%) patients' pain was bad enough to warrant resection of the heterotopic bone.

DISCUSSION and CONCLUSION: Heterotopic bone can be a cause of underlying pain after total knee revision. Calcium sulfate hemihydrate has been used as an antibiotic carrier in infections and prophylactically in high risk patients. In this group of patients with metal ion allergies, 27% of the patients had problems associated with heterotopic bone, and 17% of these required resection of the heterotopic bone. $CaSO_4$ may be contraindicated as a carrier in this group of patients.

30.# Reconstructive Approaches for Traumatic Composite Bone and Soft Tissue Loss of the Leg: Are we speaking a common language?

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Country: Egypt

ABSTRACT

Introduction: Reconstruction of traumatic bone and soft tissue loss (TBSTL) represents a great challenge to limb reconstruction services due to several factors including the overwhelming number of referred cases due to increasing road traffic accidents, especially in developing countries, late presenting cases with deep wound infection and factors related to the injury like vascular compromise which impede pedicled- or free-flap reconstruction; moreover, the effect of the initially instituted surgical interference would influence subsequent trials at reconstruction. Several approaches for the reconstruction of TBSTL have been described. The choice of the treatment method is influenced by certain factors among which are the surgeon's experience and training, available resources, surrounding environment (war injuries versus civilian ones), severity of injury, chronicity of injury, contamination, or infection. Despite this, there is a lack of clear guidelines regarding the most suitable treatment for every case scenario in terms of description, classification, algorithm for management, prognosis, and outcome measurement.

Aim of the study: the introduction of a new classification system and treatment algorithm for the management of TCBSTL of the leg whether infected or not.

Materials and Methods: in the past 20 years there were 300 cases of TCBSTL of the leg that were treated in the author's department according to our protocol. Based on this experience, a classification system and management algorithm were formulated and their outcome was analyzed. Our classification for TCBSTL of the leg is based on: 1) stability of the host bone (consolidated bone or a well-fixed fracture Vs. unstable Fx.); 2) infection of the host bone (Ch. O.M.); 3) size of bone defect; and 4) Contamination of the medullary cavity.

Discussion: The proposed classification provides a universal system of evaluation, technique selection criteria, and outcome measurement tools. This would improve our patients' management and treatment and set a common communication language among reconstructive surgeons.

31.# One Stage Charcot Midfoot Management

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ABSTRACT

Introduction: Charcot foot and ankle considered one of the common and compromising complication of DM. Mid foot affection involve tarsometatarsal and naviculocuniform joints. This may cause collapse that leads to fixed deformity, rocker bottom and valgus angulation. It is considered 60 % of Charcot foot and ankle.

Patients and Methods: We aim to assess use of one stage correction and maintenance of Charcot mid foot affection of tarsometatarsal and naviculocuniform according to presence of ulcer, osteomyelitis or not, and soft tissue tightens or not. 6 cases managed by internal fixation, 3 cases managed by internal fixation (IF) and external fixation (EF)

Charcot foot and ankle considered one of the common and compromising complication of DM. Mid foot affection involve tarsometatarsal and naviculocuniform joints. This may cause collapse that leads to fixed deformity, rocker bottom and valgus angulation. It is considered 60 % of Charcot foot and ankle. We aim to assess use of one stage correction and maintenance of Charcot mid foot affection of tarsometatarsal and naviculocuniform and 2 cases exestictomy only was done. In most of these cases Tendo Achilles lengthening or gastrocnemius recession had been done. Though difficulties in management procedures, follow up soft tissue complications, the resultswere no flaps or amputation in any one. The conditions of our cases have been characterizes and compared with other literatures. We that in our cases that one stage technique with simple fixation, IF, EF, or combined is valuable and successful in management of Charcot foot and avoid amputations.

Results: We conclude that in our cases that one stage technique with simple fixation, IF, EF, or combined is valuable and successful in management of Charcot foot and avoid amputations

32.# Orthoplastic Ilizarov Assisted Technique In Large Leg Bone And Soft Tissue Defect.

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Country: Egypt

Introduction: Many conventional methods are used for management of nonunion of tibia bone defect. We discuss some use of Ilizarov principles in treatment of infected nonunion of the tibia bone defect. It is derived from our practical experience.

Patients and Methods: Our study includes bone defect due to infected nonunion of tibia in patients received between September 2015 and 2020. We treated 43 cases of post traumatic bone defect due to infected tibia shaft in our hospitals. Technique: Infected site: The wound was debrided and excision of the sinus was performed. The bone was explored, debrided, sequestrectomy was removed, and local antibiotic was added, if financially possible.

- Ilizarov external fixator (IEF): To close different size of defects, IEF was applied, then acute compression in some case,
- compression followed by distraction compensating lengthening,
- bone transport using gradual compression with distraction at the corticotomy site,
- bone transport using gradual compression
- with distraction at 2 corticotomy sites,
- free vascularized fibular graft,
- free nonvascularized fibular graft,
- and Ilizarov assisted fibula transportation.

Osteotomy was performed percutaneously at metaphyseal area proximally or distally using multiple drills and an osteotome for lengthening or bone transport technique. During follow up, patients were evaluated according to the ASAMI criteria of bone healing improvement.

Results: Patients: All treated 43 cases were followed for at least two years. Their average age was 30 years (range: 18: 62). There were 6 females. Patients presented with discharging sinus in 27 cases, intermittent discharging sinus in 8 cases, and past history of infection less than 6 months in 8 patients. There was past history of more than 2 previous surgical attempts for management in all cases. Nonunion was associated with stiff ankle in 21 cases. Different techniques were used e.g., monofocal technique in 14, bifocal bone transport in 21 (one with acute).

Complications: The main complications included pin tract infection in 9 cases, ankle stiffness in 15 cases and refracture after frame removal in one case. The complications did not preclude the surgical outcome.

Conclusion: We concluded that the Ilizarov external fixator is effective in management of bone defect pre or post debridement of infected nonunion of the tibia shaft. It provides advantages of many variable technique post Ilizarov application following acute docking, lengthening, and correction of deformity.

33#Fungal Prosthetic Joint Infection

Prof. Hazem Alkhwawashki

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ABSTRACT:

Fungal prosthetic joint infection (fPJI) is one of the orthopaedic pathologies where there is no clear evidence, guidelines or algorithm to guide the surgeon in its management. What adds to this is the difficulty with which these infections are diagnosed, isolated and treated. Fungi form notorious biofilms which are difficult to eradicate once formed and which provides resistance to antimicrobial agents. This biofilm has been shown to act synergistically with the biofilm of bacteria, further adding to medical treatment resistance. We have reviewed the literature for those reports which describe the results of different methods in surgically treating fPJI. We found that surgical management with two stages remains the gold standard for treatment of fPJI, as is the case for bacterial PJI (bPJI). We have investigated medical treatment, debridement with implant retaining (DAIR) and staged revisions and whether a reasonable recommendation can be made based on the f.best knowledge and practice available. From the data on bPJI, there exists a role for conservative management of acute PJI with debridement, antibiotics and implant retention (DAIR). While fPJI and bPJI both represent infections, the differences in our ability to detect these infections clinically, culture the pathogens, treat them with proper antimicrobial agents, along with the difference in the reported results of the surgical treatment, all these make us believe that those two types of infections should not be treated in the same manner. With all this in mind, we reviewed several reports in the literature on fPJI to determine the efficacy of current treatment modalities, including DAIR, which followed current guidelines for PJI. Data show an overall treatment success rate of 64.4% [range 17.4-100%]. Subgroup analysis revealed a success rate of 11.6% [range 0-28.7%] in patients treated with DAIR. There is no doubt that DAIR should not be encouraged as it consistently has a bad record. Although there is not enough studies or number of patients to show an evidence-based preference over one or two staged revisions, but the two-stage revision of fPJI consistently shows better results and should be considered the gold standard of management in cases of revision fPJI. This should also be coupled with the proper expertise, backup and recommended length of medical treatment, which should not be less than six months. From review of these data, we believe to have developed reasonable recommendations for the management of fPJI. These recommendations center on staged surgical debridement with explanation of all

hardware along with medical management. Medical treatment should be for at least 6 months under the guidance of an infectious disease team and based on intraoperative cultures. In the case of local antimicrobial treatment, from the literature many patients with fPJI were found to have a polymicrobial infection. As such it is our recommendation that antifungals as well as antibacterials should be incorporated into the cement spacer mix of these cases. Fungal PJI remains an exceedingly difficult pathology to treat and should be managed by experienced surgeons in a well-equipped institution.