WETENSCHAPPELIJKE OUTPUT VAKGROEP ORTHOPEDIE 2014
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1. Dissertaties

1. ten Broek RH
Diagnostic tools for early evaluation of total hip performance: Studies on preclinical and clinical monitoring of implant quality.
25-04-2014, Maastricht University.

2. Wetenschappelijke publicaties in internationale tijdschriften (wi-1)


18F-FDG microPET imaging differentiates between septic and aseptic wound healing after orthopedic implant placement

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Background and purpose — 18F-FDG PET is a widely used tool for molecular imaging of oncological, cardiovascular, and neurological disorders. We evaluated 18F-FDG microPET as an implant osteomyelitis imaging tool using a Staphylococcus aureus-induced peroperative implant infection in rabbits.

Methods — Intramedullary titanium nails were implanted in contaminated and uncontaminated (control) proximal right tibiae of rabbits. Tibiae were quantitatively assessed with microPET for 18F-FDG uptake before and sequentially at 1, 3, and 6 weeks after surgery. Tracer uptake was assessed in soft tissue and bone in both treatment groups with an additional comparison between the operated and unoperated limb. MicroPET analysis was combined with radiographic assessment and complementary histology of the tibiae.

Results — At the first postoperative week, the 18F-FDG uptake in the contaminated implant group was significantly higher than the preoperative measurement, without a significant difference between the contaminated and unimtednated tibiae. From the third postoperative week onward, 18F-FDG uptake allowed discrimination between osteomyelitis and postoperative aseptic bone healing, as well as quantification of the infection at distinct locations around the implant.

Interpretation — 18F-FDG-based microPET imaging allows differentiation between deep infection and undisturbed wound healing after implantation of a titanium intramedullary nail in this rabbit model. Furthermore, our results indicate that 18F-FDG PET may provide a tool in human clinical diagnostics and for the evaluation of antimicrobial strategies in animal models of orthopedic implant infection.

With more prostheses and osteosyntheses being implanted every year and a suggested increase in infection rate, the absolute number of implant infections will increase (Dale et al. 2009, Acklin et al. 2011, Kurtz et al. 2012). Deep orthopedic implant infections are difficult to diagnose in the early postoperative phase, while diagnosis of infection in this period is important for optimal treatment and implant survival. A specific diagnostic tool to monitor implant infections is therefore imperative.

Current diagnostics to detect orthopedic implant infections are based on clinical symptoms, hematological parameters, radiology, and nuclear scintigraphy. However, as in low-grade infections, in the early postoperative phase changes such as periosteal reactions and cortical thickening (Calhoun and Mader 1997, Smeltzer et al. 1997, Odekerken et al. 2013) or osteolysis and calcifications (Calhoun and Mader 1997, Smeltzer et al. 1997, Vogely et al. 2000, Odekerken et al. 2013) are not specific enough to differentiate between implant/soft tissue infection and aseptic wound problems. More discriminative power is needed to distinguish aseptic wound healing from bacterial infection and to follow implant infection quantitatively over time. 18F-fluorodeoxyglucose (18F-FDG) is widely used as a positron emission tomography (PET) tracer to diagnose and monitor several pathological conditions in the clinic (Stumpe et al. 2000, Toyama et al. 2004a,b, van der Bruggen et al. 2010, Huang et al. 2012, Marsboom et al. 2012). The use of 18F-FDG as a tracer is based on a local increase in metabolic turnover of glucose. Since the presence of bacteria and increased leukocyte infiltration in an infected area generates such a local increase in glucose turnover and leads to increased 18F-FDG uptake (Stumpe et al. 2000, Koert
A comparison of hallux valgus angles assessed with computerised plantar pressure measurements, clinical examination and radiography in patients with diabetes

Daniël MC Janssen1*, Antal P Sanders2, Nick A Guldemond3, Joris Hermus1, Geert HM Walenkamp1 and Lodewijk W van Rhijn1

Abstract

Background: Hallux valgus deformity is a common musculoskeletal foot disorder with a prevalence of 3.5% in adolescents to 35.7% in adults aged over 65 years. Radiographic measurements of hallux valgus angles (HVA) are considered to be the most reproducible and accurate assessment of HVA. However, in European countries, many podiatrists do not have direct access to radiographic facilities. Therefore, alternative measurements are desired. Such measurements are computerised plantar pressure measurement and clinical goniometry. The purpose of this study was to establish the agreement of these techniques and radiographic assessments.

Methods: HVA was determined in one hundred and eighty six participants suffering from diabetes. Radiographic measurements of HVA were performed with standardised static weight bearing dorsoplantar foot radiographs. The clinical goniometry for HVA was measured with a universal goniometer. Computerised plantar pressure measurement for HVA was executed with the EMED SF-4® pressure platform and Novel-Ortho-Geometry software. The intra-class correlation coefficients (ICC) and levels of agreement were analysed using Bland & Altman plots.

Results: Comparison of radiographic measurements to clinical goniometry for HVA showed an intraclass correlation coefficient (ICC) of 0.81 (95% confidence interval, 0.76 to 0.86; p<0.001). Radiographic measurement versus computerised plantar pressure measurement showed an ICC of 0.59 (95% confidence interval, 0.49 to 0.68; p<0.001). In addition, clinical goniometry versus computerised plantar pressure measurement showed an ICC of 0.77 (95% confidence interval, 0.70 to 0.82; p<0.001). The systematic difference of the computerised plantar pressure measurement compared with radiographic measurement and clinical goniometry was 7.0 degrees (SD 6.8) and 5.2 degrees (SD 5.0), respectively. The systemic difference of radiographic measurements compared with clinical goniometry was 1.8 degrees (SD 5.0).

Conclusions: The agreement of computerised plantar pressure measurement and clinical goniometry for HVA compared to radiographic measurement of HVA is unsatisfactory. Radiographic measurements of HVA and clinical goniometry for HVA yield better agreement compared to radiographic measurements and computerised plantar pressure measurement. The traditional radiographic measurement techniques are strongly recommended for the assessment of HVA.
Arginase-1 Deficiency Regulates Arginine Concentrations and NO2-Mediated NO Production during Endotoxemia

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Abstract

Rationale and objective: Arginase-1 is an important component of the intricate mechanism regulating arginine availability during immune responses and nitric oxide synthesis (NO3) activity. In this study, Arg1mice were developed to investigate the effect of arginase-1 related arginine depletion on NO2- and NO3-dependent NO production and jejunal microcirculation under resting and endotoxemic conditions, in mice lacking arginase-1 in endothelial and hematopoietic cells. Methods and Results: Arginase-1-deficient mice as compared with control exhibited higher plasma arginine concentration concomitant with enhanced NO production in endothelial cells and jejunal tissue during endotoxemia. In parallel, impaired jejunal microcirculation was observed in endotoxemic conditions. Cultured bone-marrow-derived macrophages from arginase-1 deficient mice also presented a depressed inflammatory response to endotoxin than control wild-type counterparts. Since NO2 competes with arginase for their common substrate arginine during endotoxemia, NO2-deficient mice were also studied under endotoxemic conditions. As NO3, macrophages showed an impaired inflammatory response and the potential to serve as additional NO-producing cells. Conclusions: Reduced arginase-1 activity in Arg1mice resulted in increased inflammatory response and NO production accompanied by a depressed microcirculatory flow during endotoxemia. Thus, arginase-1 deficiency facilitates a NO2-mediated pro-inflammatory activity at the expense of NO3-mediated endothelial relaxation.

Introduction

Arginase plays an important role in the regulation of L-arginine availability for the nitric oxide (NO) production in the circulation [1–4] and the immune response [5–14]. Under normal conditions, sufficient L-arginine is available to endogenous NO-synthesizing cells to convert L-arginine to NO and L-citrulline by endothelial nitric oxide synthase (NOS3, eNOS). The enzyme arginase competes with the NOS enzymes for L-arginine and reciprocally modulates the NOS activity [15,16]. There are two isoforms of arginase, of which arginase-1 mainly expressed in the liver and arginase-2, a mitochondrial enzyme is primarily expressed in non-hepatic tissue such as the kidney, small intestine [17] and endothelial cells [18]. Inflammatory conditions result in significantly decreased L-arginine concentrations for NO3 because of a pathogen-induced upregulation of arginase-1 and NO2 (NOS2) in macrophages [1,10,13,16–20]. The enzyme-activated-mediated decrease in L-arginine concentrations and the endotoxin-induced downregulation of NOS3 further impair NO3-derived NO bioavailability in the microvasculature [11,21,22], which results in endothelial dysfunction [23–27].

Reduction or complete ablation of arginase-1 activity is known to significantly enhance NO3-dependent NO production [28,29]. Therefore, modulations of arginase-1 activity may be of anatomy and secondary loss of function after an initially adequate reduction [30], leading to discomfort, loss of range of motion and/or soft tissue complaints [1–3]. It is expected that the addition of medication or supplements, such as vitamin D or calcium can improve the clinical outcome of distal radius fractures [6]. To monitor the process of fracture healing in patients, who either received supplemental medication or not, a method that is able to evaluate bone healing in detail is necessary. In clinical practice, fracture healing is evaluated by clinical judgment of the physician in combination with plain anteroposterior (AP) and lateral radiographs. However,
1. Introduction

Synthetic, biodegradable materials are widely used for the treatment of bone defects. Depending on the operation, the usage of autologous bone is not always the best treatment, for example, in case of a tumor resection or difficult conditions at a possible donor site, like the iliac wing. Therefore the development of scaffolds consisting of synthetic materials is of great interest within the implantology research. The chemistry of a material, including element and phase composition, can determine if an implant is bioactive, biodegradable, or bioceramic [2]. Another important factor is the porosity of an implant. Preclinical studies show that porous scaffolds with good pore interconnectivity, implanted in large defects, achieve proper vascularisation and enhance the remodelling process [2]. The combination of micro- and macroporosity influences the osteointegration of an implant and determines the formation of new mineralized bone [3]. In particular, the osteointegration and vascularisation of open porous scaffolds are influenced in the first weeks by their microporosity [4].

There are several ways to generate scaffolds using rapid manufacturing methods, like powder bed based 3D printing, can determine if an implant is bioactive, biodegradable, or bioceramic [2]. Another important factor is the porosity of an implant. Preclinical studies show that porous scaffolds with good pore interconnectivity, implanted in large defects, achieve proper vascularisation and enhance the remodelling process [2]. The combination of micro- and macroporosity influences the osteointegration of an implant and determines the formation of new mineralized bone [3]. In particular, the osteointegration and vascularisation of open porous scaffolds are influenced in the first weeks by their microporosity [4].
Comparison of [18 F]FDG PET/CT and MRI in the diagnosis of active osteomyelitis

Anastas Demirev · René Weijers · Jan Geurts · Felix Mottaghy · Geert Walenkamp · Boudewijn Brans

Abstract

Objective In diagnosing osteomyelitis (OM) both MRI and [18 F]FDG PET-CT proved to be accurate modalities. In anticipation of the advent of hybrid PET/MRI scanners we analyzed our patient group to give direction to future imaging strategies in patients with suspected OM.

Materials and methods In this retrospective study all patients of a tertiary referral center who underwent both an MRI and a PET for the diagnosis of OM were included. The results of those scans were evaluated using patient’s histology, microbiological findings, and clinical/radiological follow-up. Additionally, ROC curve analysis of the SUVmax and the SUVmax ratio on the PET scans was performed. Two imaging strategies were simulated: first MRI followed by PET, or vice versa.

Results Twenty-seven localizations in 26 patients were included. Both MRI and PET were shown to be accurate in our patients for the qualitative detection of OM. A cut-off value for the SUVmax of 3 gave optimal results (a specificity of 90 % with a sensitivity of 88 %). The SUVmax ratio gave a worse performance. The two simulated imaging strategies showed no difference in the final diagnosis in 20 out of 27 cases. Remarkably, 6 equivocal cases were all correctly diagnosed by the second modality, i.e., PET or MRI. Conclusion Both MRI and [18 F]FDG PET were accurate in diagnosing OM in a tertiary referral hospital population. Simulation of imaging strategies showed that a combined sequential strategy was optimal. It seems preferable to use MRI as a primary imaging tool for uncomplicated unifocal cases, whereas in cases with (possible) multifocal disease or a contraindication for MRI, PET is preferred. This combined sequential strategy looks promising, but needs to be confirmed in a larger prospective study.

Keywords Osteomyelitis · [18 F]FDG PET · PET · MRI · Diagnosis infection

Introduction

In uncomplicated osteomyelitis (OM) the diagnosis relies on anamneses and clinical signs: fever, tenderness and red warm swelling in the area of the affected bone. Blood changes may include increased erythrocyte sedimentation rate, left differential shift, increased leucocytes, and C-reactive protein (CRP) [1]. As the diagnostic sensitivity of an increased ESR varies from 36 to 62 % and the CRP from 72 to 89 %, these parameters cannot rule out active OM [1, 2]. As the infection progresses, OM can be complicated by soft tissue infection, fistula to the skin, and/or septic arthritis, giving the disease many clinical faces. Despite the use of surgical debridement and long-term antibiotic therapy, the recurrence rate of chronic OM in adults is about 30 % at 12 months [3].

The gold standard for the diagnosis is a histological or microbiological sample of the infected bone. Alternatively, a positive blood culture with radiological findings suggestive of OM may suffice for definite diagnosis. In daily practice, ancillary diagnostics are often needed to corroborate or
Early Changes in Bone Density, Microarchitecture, Bone Resorption, and Inflammation Predict the Clinical Outcome 12 Weeks After Conservatively Treated Distal Radius Fractures: An Exploratory Study

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ABSTRACT

Fracture healing is an active process with early changes in bone and inflammation. We performed an exploratory study evaluating the association between early changes in densitometric, structural, biomechanical, and biochemical bone parameters during the first weeks of fracture healing and wrist-specific pain and disability at 12 weeks in postmenopausal women with a conservatively treated distal radius fracture. Eighty patients (aged 64 ± 8 years) were evaluated at 1 to 2 and 3 to 4 weeks postfracture, using high-resolution peripheral quantitative computed tomography (HR-pQCT), micro-finite element analysis, serum procollagen type I N-terminal propeptide (PINP), carboxy-terminal telopeptide of type I collagen (CTX), and high-sensitive C-reactive protein (hsCRP). After 12 weeks patients rated their pain and disability using Patient Rated Wrist Evaluation (PRWE) questionnaire. Additionally, Quick Disability of the Arm Shoulder and Hand (QuickDASH) questionnaire and active wrist range of motion was evaluated. Linear regression models were used to study the relationship between changes in bone parameters and in hsCRP from visit 1 to 2 and PRWE score after fracture healing, indicating better outcome, a better PRWE outcome, was significantly related to an early increase in trabecular bone mineral density (BMD) (β = 0.96 [95% CI –1.75 to –0.16], R² = 0.37), in torsional stiffness (β = –0.14 [–0.28 to –0.004], R² = 0.31), and to an early decrease in trabecular separation (209 [15 to 402], β = 0.52, R² = 0.33) in ICTP (12.1 [0.0 to 24.1], β = 0.14 [–0.14 to 0.41], R² = 0.31), and to an early increase in active range of motion (209 [15 to 402], β = 0.52, R² = 0.33) in ICTP (12.1 [0.0 to 24.1], β = 0.14 [–0.14 to 0.41], R² = 0.31). Simiar results were found for QuickDASH: Higher total dorsal and palmar flexion range of motion was significantly related to early increase in hsCRP (β = 0.96 [95% CI –1.75 to –0.16], R² = 0.37), in torsional stiffness (β = –0.14 [–0.28 to –0.004], R² = 0.31), and to an early decrease in trabecular separation (209 [15 to 402], β = 0.52, R² = 0.33) in ICTP (12.1 [0.0 to 24.1], β = 0.14 [–0.14 to 0.41], R² = 0.31). This exploratory study indicates that the assessment of early changes in trabecular BMD, trabecular microarchitecture, bone mineral density and inflammation may provide valuable information regarding the 12-week clinical outcome in terms of pain, disability, and range of motion and validates its use in studies on the process of early fracture healing. © 2014 American Society for Bone and Mineral Research.

KEY WORDS: Bone, QCT/Micro-CT, Injury, Fracture Healing, Biochemical Markers of Bone Turnover, Osteoporosis, Biomechanics

Progressive osseous heteroplasia (POH; OMIM 164350) is a rare autosomal dominant condition, characterized by heterotopic ossification of the skin, subcutaneous fat, and deep connective tissue. This condition is distinguished from Albright’s hereditary osteodystrophy or McCune Albright syndrome (OMIM 103580) and fibrodysplasia ossificans progressiva (OMIM 135100). We present an unusual presentation of POH in a 7-year-old female child. The clinical features included a painful swelling on the left foot, with mechanical complaints. There was no congenital hallus valgus. Family anamnesis was positive in the father. There were subcutaneous ossifications of his left upper arm, right-sided thorax, and lateral sides of the right ankle. The father did not allow any radiographs or further examinations. Radiographic examination of the patient revealed ossified subcutaneous plaques on the left foot, lumbar spine, and left scapulae. Additional blood samples were analyzed, revealing no pseudohypoparathyroidism. Sequence analysis of the gene associated with POH, the GNAS gene, revealed the heterozygous missense mutation in c.565, 568del, previously found in Albright’s hereditary osteodystrophy. Histopathological examination of the subcutaneous ossification and presence of chondrocyte clusters, a feature usually found in fibrodysplasia ossificans progressiva. The combination of the clinical features, the absence of pseudohypoparathyroidism, histology revealing chondrocyte clusters, and the specific GNAS mutation in c.565, 568del, make this patient a true presentation of POH. The findings in this case strongly indicate subdivisions of POH. The condition is associated with progressive superficial to deep ossification, progressive restriction of range of motion, and recurrence if excised. We hope to inform pediatricians and orthopedic surgeons to create more awareness of this disorder so that unnecessary treatments can be avoided and proper counseling offered. J Pediatr Orthop B 23:477–484 © 2014 Wolters Kluwer Health I Lippincott Williams & Wilkins

Patients

The index patient is the first and only child of her parents. She was born prematurely but was otherwise healthy and had normal psychomotor development. At the age of 7 years, she was a healthy girl with height at ~1SD and weight at 0SD for height. Anamnesis revealed that there was a small firm nodule in the left foot since birth, with recent increase in size. Under the left foot a localized firm nodule was palpable. There was

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Fibroma of Tendon Sheath Located within Kager’s Triangle

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Article info

Keywords: Fibroma of Tendon Sheath Located within Kager’s Triangle

Level of Clinical Evidence: 4

Abstract

The formation of a fibroma of the tendon sheath, a rare, slow-growing, benign tumor, usually occurs in the upper extremities of young adult males. We present an extremely rare case of a fibroma of the tendon sheath arising adjacent to the Achilles tendon within Kager’s triangle in a 41-year-old female. The patient presented with progressive pain localized to the posterior aspect of the left ankle. Complete excision and histopathologic analysis of the fibroma were performed. The patient experienced an uneventful recovery after the intervention and had no evidence of recurrence after 3 months of follow-up. Fibroma of the tendon sheath should be included in the differential diagnosis when a patient presents with a painful soft tissue mass in Kager’s triangle.

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Case Report

A 41-year-old female had presented at another institution with a 4-week history of spontaneous, progressive pain localized to the posterior aspect of the left ankle. Her medical history was noncontributory. The physical examination revealed a soft tissue mass between the insertion of the Achilles tendon into the calcaneus and the medial malleolus. This mass was fixed to the deep tissues and tender to palpation. Her ankle movements were limited by the pain. The findings from the strength, neurologic, and vascular examinations were normal. The initial treatment consisted of nonsteroidal anti-inflammatory drugs, antibiotics, and cast immobilization followed by physiotherapy, all without result.

After 6 weeks, the patient presented again with painful, fluid-filled, raised lesions (vesicles) on the posterior aspect of the left ankle. She had no signs of arthritis of the talocrural joint or osteomyelitis. The erythrocyte sedimentation rate and C-reactive protein levels were within normal limits. Ankle radiography and magnetic resonance imaging were performed and revealed more dense tissue just above the posterior process of the talus and a fluid collection at the posterosmedial aspect of the left ankle with infiltration of Kager’s fat pad.

Discussion: None of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of any aspect of this work. One or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could have been perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete Disclosures of Potential Conflicts of Interest submitted by authors are always provided with the online version of the article.

Improving peri-prosthetic bone adaptation around cementless hip stems: A clinical and finite element study

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Abstract

This study assessed whether the Symax® implant, a modification of the Omnifit® stem (in terms of shape, proximal coating and distal surface treatment), would yield improved bone remodelling in a clinical DEXA study, and if these results could be predicted in a finite element (FE) simulation study.

In a randomized clinical trial, 2 year DEXA measurements between the un Cementless Symax® and Omnifit® stem (both n = 25) showed bone mineral density (BMD) loss in the Symax zone of 14% and 20%, respectively (p < 0.05). In contrast, the FE models predicted a 28% (Symax®) and 20% (Omnifit®) bone loss. When the distal treatment to the Symax® was not modelled in the simulation, bone loss of 35% was predicted, suggesting the benefit of this surface treatment for proximal bone maintenance.

The theoretical concept for enhanced proximal bone loading by the Symax®, and the predicted remodelling pattern were confirmed by DEXA-results, but there was no quantitative match between clinical and FE findings. This is due to a simulation based on incomplete assumptions concerning the yet unknown biological and mechanical effects of the new coating and surface treatment.

Keywords: Cementless hip arthroplasty; Bone mineral density; Finite element analysis; DEXA

1. Introduction

Successful biologic fixation of uncemented total hip prostheses is inevitably associated with resorptive bone remodelling, because of load shifting and stress protection of bone by the implant. This has been a concern in the early generations of stems where proximal femoral bone loss up to 62% was detected, both experimentally as well as clinically [1,2]. This bone resorption may in the long term compromise implant support, cause periprosthetic bone fracture and challenge revision procedures. Therefore in the development of new total hip designs, a need is felt for diagnostic tools that can discriminate between superior and inferior implants. Such tools should be able to predict unacceptable clinical outcome like excessive bone loss, high risk of loosening and revision, in an early postoperative or even preoperative stage.

For this purpose finite element analysis (FEA) has been used to estimate loads and stresses in periprosthetic bone and interfaces [3,4]. Through Numerical Shape Optimization (NSO) the optimal geometry and material of an implant were calculated, based on predefined goals in terms of maximally acceptable strains and stresses in the bone and interfaces [5].

The major limitation of the FE-technique is that it remains a computer model that makes several assumptions on implant material properties, bone properties [6], implant–bone interface conditions [7], and loading-boundary conditions (interface loading forces during daily activities, hip and muscle forces) [8]. It is obvious that because of all these assumptions, the extent to which FE-models can realistically simulate failure mechanisms, is uncertain.

Despite these limitations, it is generally accepted that FEA can adequately predict qualitative bone remodelling around implants if these FE-models are suitable to address the relationship between mechanical stimuli and bone remodelling [9]. Bone remodelling is often expressed as the postoperative remodelling of periprosthetic bone mineral density (BMD) as measured by dual energy X-ray absorptiometry (DEXA). In recent years several studies have been performed to retrospectively correlate 2-D and 3-D FEA predictions with the effects on bone density [10–12]. Attempts were focused...
L-Citrulline Improves Splanchnic Perfusion and Reduces Gut Injury during Exercise

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ABSTRACT

VAN WIJK, K., K. A. P. WIJNANDS, D. M. MEESTERS, B. BOOIJEN, L. J. C. VAN LOON, W. A. BUURMAN, C. H. C. DEJONG, K. LENAERTS, and M. POEZE. L-Citrulline Improves Splanchnic Perfusion and Reduces Gut Injury during Exercise. Med. Sci. Sports Exerc., Vol. 46, No. 11, pp. 2039–2046, 2014. Purpose: Splanchnic hyperperfusion is a physiological phenomenon during strenuous exercise. It has been associated with gastrointestinal symptoms and intestinal injury and may hamper athletic performance. We hypothesized that L-citrulline supplementation improves splanchnic perfusion and decreases intestinal injury by enhancing arginine availability. The aim of this study was to determine the effect of L-citrulline intake on splanchnic perfusion, intestinal injury, and barrier function during exercise. Methods: In this randomized, double-blind crossover study, 10 men cycled for 60 min at 70% of their maximum workload after a L-citrulline (10 g) or placebo (L-alanine) intake. Splanchnic perfusion was assessed using gastric air tonometry. Sublingual microcirculation was evaluated by sidestream dark field imaging. Plasma amino acid levels and intestinal fatty acid binding protein concentrations, reflecting enterocyte damage, were assessed every 10 min. Urinary excretion of sugar probes was measured to evaluate intestinal permeability changes. Results: Oral L-citrulline supplementation enhanced plasma citrulline (1840.5 ± 142.3 µM) and arginine levels (238.5 ± 9.1 µM) compared with that in placebo (457.5 ± 4.8 µM and 101.5 ± 6.1 µM, respectively, P = 0.001), resulting in increased arginine availability. Splanchnic hyperperfusion was prevented during exercise after L-citrulline ingestion (reflected by enhanced plasma citrulline and arginine levels), whereas gap-gasteric CO2 (apCO2) increased with placebo treatment (P = 0.01). Accordingly, L-citrulline intake resulted in an increased number of perfused small sublingual vessels compared with that in placebo (7.8 ± 0.6 to 2.0 ± 1.3, P = 0.046). Furthermore, plasma intestinal fatty acid binding protein levels were attenuated during exercise after L-citrulline supplementation compared with that in placebo (AUC0–60 min, G0.015 = 1605.7 ± 134.2 vs 2447.4 ± 135.2, P = 0.01). No significant differences were observed for intestinal permeability. Conclusions: Pre-exercise L-citrulline intake preserves splanchnic perfusion and attenuates intestinal injury during exercise in athletes compared with placebo, probably by enhancing arginine availability. These results suggest that oral L-citrulline supplementation is a promising intervention to combat splanchnic hyperperfusion-induced intestinal compromise. Key Words: CYCLING, L-CITRULLINE, GASTROINTESTINAL DAMAGE, HUMAN, MICROcirculation

Gastrointestinal (GI) symptoms are common during strenuous physical exercise and range from mild nausea to “angina abdominal” and hemorrhagic stool

Incidence rates of such symptoms vary from 25% to 70% depending on exercise intensity and duration (24). Although the etiology of exercise-related GI symptoms is thought to be multifactorial, decreased splanchnic perfusion has been postulated as a key mechanism. During strenuous physical exercise, blood is redistributed away from the splanchnic area toward active muscles, the cardiopulmonary system, and the skin, thereby strongly reducing splanchnic blood flow (27). We have recently demonstrated that splanchnic hyperperfusion is associated with small intestinal injury and loss of gut barrier function in healthy men (33). Intestinal injury and barrier integrity loss are undesirable phenomena especially for athletes because they may lead to abdominal distress and impaired nutrient absorption, possibly interfering with early recovery and hampering athletic performance (32).

CLINICAL SCIENCES

Matrix-Applied Characterized Autologous Cultured Chondrocytes Versus Microfracture

Two-Year Follow-up of a Prospective Randomized Trial

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Background: Randomized controlled trials studying the efficacy and safety of matrix-applied characterized autologous chondrocytes (MACI) versus microfracture (MFX) for treating cartilage defects are limited. Purpose: To compare the clinical efficacy and safety of MACI versus MFX in the treatment of patients with symptomatic cartilage defects of the knee.

Study Design: Randomized controlled clinical trial; Level of evidence, 1.

Methods: Patients enrolled in the SUMMIT (Demonstrate the Superiority of MACI implant to Microfracture Treatment) trial had ≥1 symptomatic focal cartilage defect (Outerbridge grade III or IV; ≥3 cm2) of the femoral condyles or trochlea, with a baseline Knee Injury and Osteoarthritis Outcome Score (KOOS) pain value ≤50. The co-primary efficacy endpoint was the change in the KOOS pain and function subscores from baseline to 2 years. Histological evaluation and magnetic resonance imaging (MRI) assessment of structural repair tissue, treatment failure, the remaining 3 KOOS subscales, and safety were also assessed.

Results: Of the 144 patients treated, 137 (95%) completed the 2-year assessment. Patients had a mean age of 33.8 years and a mean lesion size of 4.8 cm2. The mean KOOS pain and function subscores from baseline to 2 years were significantly more improved with MACI than with MFX (pain: MACI, 37.0 to 82.5 vs MFX, 35.5 to 70.9; function: MACI, 14.9 to 60.9 vs MFX, 12.6 to 48.7; P < .001). A significant improvement in scores was also observed on the KOOS subscales of activities of daily living (MACI, 43.5 to 87.2 vs MFX, 42.6 to 75.8; P < .001), knee-related quality of life (MACI, 18.8 to 56.2 vs MFX, 17.2 to 47.3; P = .029), and other symptoms (MACI, 48.3 to 83.7 vs MFX, 44.4 to 72.2; P < .001) for patients treated with MACI compared with MFX. Repair tissue quality was good as assessed by histology/MRI, but no difference was shown between treatments. A low number of treatment failures (nonresponders: MACI, 12.5% vs MFX, 31.9%; P = .016) and no unexpected safety findings were reported.

Conclusion: The treatment of symptomatic cartilage knee defects ≥3 cm2 in size using MACI was clinically and statistically significantly better than with MFX, with similar structural repair tissue and safety, in this heterogeneous patient population. Moreover, MACI offers a more efficacious alternative than MFX with a similar safety profile for the treatment of symptomatic articular cartilage defects of the knee.

Keywords: cartilage repair; clinical outcomes; knee; matrix-applied characterized autologous cultured chondrocytes (MACI) implant; microfracture

If left untreated, cartilage lesions can become symptomatic and may progress to osteoarthritis. The first autologous chondrocyte implantation (ACI) procedure for cartilage repair was performed 25 years ago. Over time, the procedure has advanced to collagen-covered ACI (second-generation technology)12 and then to matrix-applied characterized autologous cultured chondrocytes (MACI) harvest.13 Additionally, MACI is a third-generation technology. Progression to third-generation technology...
Novel immortal human cell lines reveal subpopulations in the nucleus pulposus

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Abstract

Introduction: Relatively little is known about cellular subpopulations in the mature nucleus pulposus (NP). Detailed understanding of the ontogenetic, cellular and molecular characteristics of functional intervertebral disc (IVD) cell populations is pivotal to the successful development of cell replacement therapies and MD regeneration. In this study, we aimed to investigate whether phenotypically distinct clonal cell lines representing different subpopulations in the human NP could be generated using immunostaining strategies.

Methods: Nongenerative healthy disc material (age range, 8 to 15 years) was obtained as surplus surgical material. Early passage NP monolayer cell cultures were initially characterized using a recently established NP marker set: NP cells were immunomarked by simian virus 40 large T antigen (SV40Tag) and human telomerase reverse transcriptase expression. Nongenerative NP cells were cloned and characterized based on collagen type I, collagen type II, α1 (COL2A1), and SRY-box 9 (SOX9) protein expression profiles, as well as on expression of a subset of established NP cell line markers.

Results: A total of 54 immortal clones were generated. Profiling of a set of novel NP markers (CD24, CD12, PAI1, P7N, FOX1 and KRT19 mRNA) in a representative set of subclones substantiated successful immortalization of multiple cellular subpopulations from primary isolates and confirmed their NP origin and/or phenotype. We were able to identify two predominant clonal NP subtypes based on their morphological characteristics and their ability to induce SOX9 and COL2A1 under conventional differentiation conditions. In addition, cluster differentiation 24 (CD24)-negative NP responder clones formed spheroid structures in various culture systems, suggesting the preservation of a more immature phenotype compared to CD24-positive nonresponder clones.

Conclusions: Here we report the generation of clonal NP cell lines from nondegenerate human IVD tissue and present a detailed characterization of NP cellular subpopulations. Differential cell surface marker expression and divergent responses to differentiation conditions suggest that the NP subtypes may correspond to distinct maturation stages and represent distinct NP cell subpopulations. Hence, we provide evidence that the immortalization strategy that we applied is capable of detecting cell heterogeneity in the NP. Our cell lines yield novel insights into NP biology and provide promising new tools for studies of IVD development, cell function and disease.

Introduction

Degenerative disc disease (DDD) poses a substantial socio-economic burden in developed countries [1]. Currently, treatment of DDD is primarily aimed at relieving symptoms because effective therapy to delay or prevent DDD is not available.

The intervertebral disc (IVD) consists of a central gelatinous nucleus pulposus (NP) encased by an elastic, liga- mentous annulus fibrosus (AF) and is flanked superiority and inferiorly by cartilaginous endplates. NP cells are highly specialized and share some features with articular chondrocytes in terms of aggrecan (ACAN), collagen type II, α1 (COL2A1), and SRY-box 9 (SOX9) protein expression [2]. However, compared to articular cartilage (AC), the NP maintains a unique extracellular matrix (ECM) with a higher glycosaminoglycan to hydroxyproline (GAG/ OH-pro) ratio, and its native cells display distinctive gene expression. Immortalized cells were clonally expanded and characterized based on collagen type I, collagen type II, α1 (COL2A1), and SRY-box 9 (SOX9) protein expression profiles, as well as on expression of a subset of established NP cell line markers.

Results: A total of 54 immortal clones were generated. Profiling of a set of novel NP markers (CD24, CD12, PAI1, P7N, FOX1 and KRT19 mRNA) in a representative set of subclones substantiated successful immortalization of multiple cellular subpopulations from primary isolates and confirmed their NP origin and/or phenotype. We were able to identify two predominant clonal NP subtypes based on their morphological characteristics and their ability to induce SOX9 and COL2A1 under conventional differentiation conditions. In addition, cluster differentiation 24 (CD24)-negative NP responder clones formed spheroid structures in various culture systems, suggesting the preservation of a more immature phenotype compared to CD24-positive nonresponder clones.

Conclusions: Here we report the generation of clonal NP cell lines from nondegenerate human IVD tissue and present a detailed characterization of NP cellular subpopulations. Differential cell surface marker expression and divergent responses to differentiation conditions suggest that the NP subtypes may correspond to distinct maturation stages and represent distinct NP cell subpopulations. Hence, we provide evidence that the immortalization strategy that we applied is capable of detecting cell heterogeneity in the NP. Our cell lines yield novel insights into NP biology and provide promising new tools for studies of IVD development, cell function and disease.

Study Design. In vivo analysis in an ovine model.

Objective. To evaluate the feasibility of radiopaque ultrahigh molecular weight polyethylene (UHMWPE) sublaminar wires in a growth-guidance spinal system by assessing stability, biocompatibility and, growth potential.

Methods. Twelve immature sheep received posterior segmental spinal instrumentation; pedicle screws were inserted at L5 and radiopaque UHMWPE ( Biosuth trisidex) wires were passed sublaterally at each level between L5 and T2 and fixed to dual cobalt-chromium rods. Four age-matched animals that were not operated were evaluated to serve as a control group. Radiographs were obtained to measure growth of the instrumented segment. After 24 weeks, the animals were killed and the spines were harvested for histological evaluation and high-resolution peripheral quantitative computed tomographic analysis.

Results. No neurological deficits occurred and all instrumentation remained stable. One animal died from an unknown cause. Substantial growth occurred in the instrumented segments (LS-T12) in the intervention group (27 ± 2 mm), which was not significantly different to the control group (30 ± 4 mm; P = 0.42). High-resolution peripheral quantitative computed tomographic analysis clearly showed safe routing and fixation of the UHMWPE wires and instrumentation. Despite the noted growth, ectopic bone formation with the formation of bony bridges was observed in all animals. Histology revealed no evidence of chronic inflammation or wear debris.

Conclusion. This study shows the first results of radiopaque UHMWPE sublaminar wires as part of a growth-guidance spinal system. UHMWPE sublaminar wires facilitated near-normal longitudinal spinal growth. All instrumentation remained stable throughout follow-up; no wire breakage or loosening occurred and no adverse local-tissue response to these wires was observed.

Key words: early-onset scoliosis, growth-guidance system, radiopaque UHMWPE sublaminar wire, large animal study, ectopic bone formation.

Level of Evidence: N/A

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Spine

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Should a native depth-dependent distribution of human meniscus constituent components be considered in FEA-models of the knee joint?

**Abstract**

The depth-dependent matrix composition of articular cartilage is important for its mechanical behavior. It is unknown whether the depth-dependent matrix composition of a meniscus is similarly important for its load-bearing function. The present objective was to determine whether it is necessary to account for the native distribution of matrix components in the cross-sectional plane of the meniscus, when studying its mechanical behavior in numerical models. To address this objective, measured depth-dependent distribution of matrix contents in the human meniscus, and fitted visco-elastic mechanical properties of the collagen were used as input in FEA simulations of a knee joint. The importance of including the depth-dependent matrix component constitution in the meniscus was determined by comparing simulations with an axisymmetric representation of the knee joint, which incorporated either the depth-dependent matrix composition or homogenized matrix.

Depth-dependent differences in water, collagen, and proteoglycan contents were observed, but these were not significantly different. The anterior region, with significantly higher collagen content, was statistically stiffer than the posterior region. However, depth-wise, stiffness did not correlate to the constitution of the tissue. GAG content was significantly higher in the posterior than in the anterior region. Visco-elastic properties of meniscus collagen were fitted against tensile test data.

Simulations show that the distribution of stresses and strains in the cartilage is slightly lower when the meniscus contains a depth-dependent constitution, but this difference is only modest. Therefore, this study suggests that knee joint mechanics is rather insensitive to the distribution of constitutive components in the cross section of the meniscus, and that the depth-dependent matrix distribution of the meniscus is not essential to be included in axisymmetric computational models of the knee joint.

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Systemic biochemical markers of joint metabolism and inflammation in relation to radiographic parameters and pain of the knee: data from CHECK, a cohort of early-osteoarthritis subjects


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Abstract

Objective. To investigate associations of biochemical markers of joint metabolism and inflammation with minimum joint space width (JSW) and osteophyte area (OA) of knees showing no or doubtful radiographic osteoarthritis (OA) and to investigate whether these differed between painful and non-painful knees.

Design. Serum (s-) and urinary (u-) levels of the cartilage markers uCTX-II, sCOMP, sPIIANP, and sCS846, bone markers uCTX-I, uNTX-I, sPINP, and sOC, synovial markers sPIIINP and sHA, and sPIIINP and sHA, and inflammation markers hsCRP and erythrocyte sedimentation rate (ESR) were assessed in subjects from CHECK (Cohort Hip and Cohort Knee) demonstrating Kellgren and Lawrence grade ≤ 1 OA on knee radiographs. Minimum JSW and OA area of these knees were quantified in detail using Knee Images Digital Analysis (KIDA).

Results. uCTX-II levels showed negative associations with minimum JSW and positive associations with OA area. sCOMP and sHA levels showed positive associations with OA area, but not with minimum JSW. uCTX-I and uNTX-I levels showed negative associations with minimum JSW and OA area. Associations of biochemical marker levels with minimum JSW were similar between painful and non-painful knees, associations of uCTX-II, sCOMP and sHA with OA area were only observed in painful knees.

Conclusions. In these subjects with no or doubtful radiographic knee OA, uCTX-II might not only reflect articular cartilage degradation but also endothelialization in osteophytes. Furthermore, sCOMP and sHA relate to osteophytes, maybe because synovitis drives osteophyte development. High bone turnover may aggravate articular cartilage loss. Metabolic activity in osteophytes and synovial tissue, but not in articular cartilage may be related to knee pain.

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Introduction

Knee osteoarthritis (OA) is among the most disabling diseases in the developed world and its societal burden is only expected to increase further due to aging of the population, higher life expectancy, and the ongoing obesity epidemic. Many approaches are followed to unravel the pathogenesis of OA and identify therapeutic targets. Biochemical markers have been proposed to be tools that could help along the challenging road to this point. They can inform about the molecular events underlying the structural joint changes that characterize knee OA. Also, they can suggest what metabolic processes may be involved in the development of knee pain. In earlier studies, especially biochemical markers of cartilage degradation and synthesis, synovial activity (synovitis), and inflammation were associated with knee pain in OA. Yet, how the presence of knee pain influences associations of biochemical markers with individual radiographic OA features was not investigated.

1. Introduction

Currently, posttraumatic and postoperative osteomyelitis remains to be one of the most severe complications after bone trauma or surgery. During the last decades, much research has been conducted into prevention, diagnostics, and treatment modalities for orthopaedic infections. Most research studies focus on treatment or prevention and not on the diagnosis of bone infection. However, novel imaging modalities are made available in the clinical evaluation of osteomyelitic lesions, that is, combined 18F-FDG PET and MRI [1].

The preclinical evaluation of any diagnostic tool requires a stable and consistent experimental preclinical model with a broad collection of relevant read-out parameters to yield reliable data with a precise follow-up. In this way, preclinical osteomyelitis models can be highly informative on the development of the disease and the accompanying diagnosis by novel tools like 18F-FDG PET [2,3].

To investigate the development of a nonimplant related osteomyelitis over time and to define a stable preclinical model, we aimed to establish an osteomyelitis lesion in the tibia of rabbits, without the use of a searing agent, since this destructs the local vascularisation of the bone and reduces the local immune capacity [4,5].

To investigate the potential of novel diagnostic approaches, we evaluated the sequential use of 18F-FDG as an infection specific micro-PET tracer on multiple time points during follow-up.

Research Article

The Longitudinal Assessment of Osteomyelitis Development by Molecular Imaging in a Rabbit Model


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Introduction. Osteomyelitis is a severe orthopaedic complication which is difficult to diagnose and treat. Previous experimental studies mainly focused on evaluating osteomyelitis in the presence of an implant or used a searing agent to promote infection onset. In contrast, we focused on the longitudinal assessment of a nonimplant related osteomyelitis. Methods. An intramedullary tibial infection with S. aureus was established in NZW rabbits. Clinical and haematological infection status was evaluated weekly, combined with X-ray radiographs, biweekly injections of calcium binding fluorophores, and postmortem micro-CT. The development of the infection was assessed by micro-PET at consecutive time points using 18F-FDG as an infection tracer. Results. The intramedullary contamination of the rabbit tibia resulted in an osteomyelitis. Haematological parameters confirmed infection in mainly the first postoperative weeks (CRP at the first 5 postoperative weeks, leukocyte differentiation at the second and sixth postoperative weeks, and ESR on the second postoperative week only), while micro-PET was able to detect the infection from the first postoperative week onward until the end of the study. Conclusions. This study shows that osteomyelitis in the rabbit can be induced without use of an implant or searing agent. The sequential follow-up indicates that the diagnostic value of each infection parameter is time point dependent. Furthermore, from all parameters used, the diagnostic value of 18F-FDG micro-PET is the most versatile to assess the presence of an orthopaedic infection in this model.
UHMWPE sublaminar wires in posterior spinal instrumentation: stability and biocompatibility assessment in an ovine pilot study.

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Letter to the editor:


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Current Knowledge on Exostoses Formation in Hereditary Multiple Exostoses: Where do Exostoses Originate and in What Way is their Growth Regulated?

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Abstract

Multiple hereditary exostoses is an autosomal dominant inherited disorder causing exostoses: growth on the bones of children. The disease is mainly caused by mutated exostosin (EXT)-1 or EXT-2 genes. These mutations yield non-functional EXT-gene products. Lack of functional proteins affects the proteoglycan synthesis, thus affecting the proteoglycan modification and cell signalling. It is assumed that a subset of chondrocytes form an exostoses, through a growth and differentiation process which is partially understood. The place of origin of these exostoses-forming chondrocytes is still unknown. We also do not know in detail which processes influence the exostoses growth, and what shelters the exostoses from being resorbed by osteoclast activity. In this paper we systematically review the major pathophysiologcial theories of exostoses, with a focus on the aforementioned knowledge gaps.

Keywords: Osteochondroma; Exostoses; Hereditary multiple osteochondroma (HMO); Hereditary multiple exostosis (HME)

Abbreviations:

BMP: Bone Morphogenic Protein; EXT: Exostosin; FGF: Fibroblast Growth Factor; HME: Hereditary Multiple Exostosis; HMO: Hereditary Multiple Osteochondroma; HS: Heparan Sulphate; Ihh: Indian hedgehog; LOH: loss of heterozygosity

Introduction

The World Health Organisation (WHO) defines exostoses as a cartilage-capped bony outgrowth on the external surface of long bones. Per definition it contains a bone marrow cavity continuing in the normal cavity of the long bone [1,2]. With a proportion of 30-50% of all benign bone tumours, it is the most frequently occurring bone lesion. Hereditary multiple exostoses (HME) constitutes a separate, but clinically and radiographically indistinct disease entity that encompasses 10-15% of all exostoses patients. Approximately 1:50,000 people suffer from HME [3,4]. The disease is also termed hereditary multiple osteochondroma, diaphyseal aclasis, osteochondromatosis and multiple cartilaginous exostoses [5].

The diagnosis of HME is based on radiological and clinical presentation of multiple outgrowths (Figure 1), supplemented with, if available, histological evaluation. Approximately 65% of all patients have a positive family anamnesis [6]. HME is an autosomal dominant inherited disease mainly caused by mutated exostosin (EXT)-1 or EXT-2 genes. This causes a lack of functional proteins influencing heparan-sulphate synthesis, thus affecting the proteoglycan modification and cell signalling which play a role in exostoses growth [7].

The direction of growth of the exostoses is pointed away from the adjacent growth plate and away from the adjacent joint [14]; they are not in line with the axis of the bone and are therefore not submitted to the axial load. We know from normal bone formation that non-loaded bone will remodel according to the laws of Wolff. This implicates that we expect the exostoses to be remodeled by creeping substitution and eventually disappear as a result of ostearthrosis @15,16@. Until now it is still unknown why exostoses after formation do not disappear.

Apart from the unknown mechanism of growth, the place of origin of the exostoses also remains unclear. Most exostoses are found in the metaphysis under the peristoom, suggesting a metaphyseal origin. However, epiphyseal-like cartilage is found on top, suggesting an epiphyseal origin [15]. There is no medication to cure exostoses or to slow its growth. Non-resorbcion on site is only ensured after radical surgical removal of the exostoses. However, removal of exostoses in a skeletally immature patient may lead to epiphyseal damage and growth deformities [16,17].

The aim of this review is to explore the literature in the light of the following clinically raised questions: What factors influence the
First results of the Maastricht brace in the treatment of adolescent idiopathic scoliosis

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From 11th International Conference on Conservative Management of Spinal Deformities - SOSORT 2014 Annual Meeting Wiesbaden, Germany. 8-10 May 2014

Background
The Maastricht brace (M-brace) was developed to improve compliance and associated efficacy of brace treatment in adolescent idiopathic scoliosis (AIS). Initial pressure measurements in the M-brace revealed a higher corrective pressure as compared to the Boston brace, and a better patient-reported quality of life, as measured with the SRS 22 and Brace questionnaire. We present the first results of the efficacy in terms of curve correction of the M-brace in AIS.

Aim
The aim of this study was to evaluate the in-brace curve correction of the Maastricht brace and to determine the effect of increased wearing comfort on treatment efficacy.

Methods
A total of 46 patients (mean age of 13 years) with mild to moderate AIS, who have been treated with the M-brace since January 2011, were included. The correction effectiveness of the brace was evaluated by comparing the primary curve angle measured in Cobb degrees was 34.7° ± 11.3°. The average primary curve angle in bending x-rays was 15.5° ± 8.3°. In the M-brace the primary curve was 25.4° ± 10.1° (p<0.01). This is an in-brace correction of 48%. The control group had an in-brace correction of 49.7% in the Boston brace versus 45.1% in the M-brace (p=0.21).

Results
There were 38 patients with a primary thoracic curve, and 8 patients with a primary lumbar curve. The average primary curve angle measured in Cobb degrees was 34.7° ± 11.3°. The average primary curve angle in bending x-rays was 15.5° ± 8.3°. In the M-brace the primary curve was 25.4° ± 10.1° (p<0.01). This is an in-brace correction of 48%. The control group had an in-brace correction of 49.7% in the Boston brace versus 45.1% in the M-brace (p=0.21).

Conclusions
These preliminary results demonstrate an adequate in-brace correction of the M-brace, which is comparable to corrections found in current literature and similar to the in-brace correction of the Boston brace in the control group. Given the relationship between compliance and wearing comfort, the M-brace is, without compromising treatment efficacy, a promising new brace treatment for adolescent idiopathic scoliosis.

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Provocative diskography: safety and predictive value in the outcome of spinal fusion or pain intervention for chronic low-back pain

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Abstract: There is still no clear definition of diskogenic low-back pain and no consensus on a generally agreed test, such as provocative diskography (PD), to diagnose painful disk degeneration, and probably more importantly, to predict the outcome of therapy intended to reduce pain that is presumed to be diskogenic in nature. Nevertheless, PD is the most specific procedure to diagnose diskogenic low-back pain. Its accuracy, however, is rather low or at best unknown. Although rare, the most prevalent complication, postdiskography diskitis, can be devastating for the individual patient, so all measures, like strict sterile conditions and antibiotic prophylaxis, should be taken to avoid this complication. It is advised to perform the procedure in a pressure-controlled way with a constant low flow, and optionally computed tomography imaging. PD should not be performed in morphologically normal disks. A standardized execution of the test should be established in order to perform high-quality studies to determine its accuracy to lead to meaningful interventions, and find best practices for diagnosis and treatment of diskogenic back pain. Possibly, PD may have detrimental effects on the disk, causing early degeneration, although it is unknown whether this will be related to clinical symptoms. Especially with these possible adverse side effects in mind, the risk-benefit ratio with the lack of clear benefits from treatments provided, and possible complications of disk puncture, the rationale for PD is questionable, which should be stressed to patients in the process of shared decision making. Diskography as a stand-alone test is not recommended in clinical decision making for patients with chronic low-back pain.

Keywords: provocative diskography, chronic low-back pain, prognostic accuracy, spinal fusion, pain intervention

Introduction
Chronic low-back pain (CLBP) is a major health problem in modern society, with lifetime prevalence up to 84%. The economic burden of low-back pain (LBP) is huge and consists of direct costs of health care utilization (hospitalization, medication, tests, and therapies) and indirect costs of lost productivity due to work absenteeism and early retirement. In a small Western European country, such as the Netherlands, the total annual costs of back pain were estimated at €4.4 billion (mainly employer-related costs). The total annual costs in the US have exceeded $100 billion.

Roughly, LBP can be categorized as pain caused by spinal pathology, such as tumors, infection, trauma, nerve root or radicular pain, and a large heterogeneous group of patients (about 85% of total cases) suffering from LBP in whom imaging reveals signs of degeneration of one or more intervertebral disks (disk-space narrowing, vertebral end-plate changes, annular disruption, and/or facet joint arthropathy). These degenerative findings can also be observed in asymptomatic subjects, and thus
AUTHOR'S REPLY

Answer to the Letter to the Editor of F. M. Kovacs et al. entitled “Overviews should meet the methodological standards of systematic reviews” concerning “The evidence on surgical interventions for low back disorders, an overview of systematic reviews” by Wilco C.H. Jacobs et al.; Eur Spine J, doi:10.1007/s00586-013-2823-4

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An overview is not a review

We thank the authors for the interest they show for our systematic overview of the evidence on surgical interventions for low back disorders. We appreciate their critical remarks on our study and we would like to elaborate on the issues raised.

First, the authors state that we overlooked reviews complying with the stated inclusion criteria. The referenced study of Urrutia et al. [3] was in our search results, but could not meet our inclusion criterion of extensive search. Urrutia et al. [3] used only five search terms without obvious variations, entered as text word ([tw]) only, which resulted in only 182 hits in two databases while there was no check on the cross-references. On replication of this search we could for example not retrace the study of Bogduk and Karasek [1] in this search. This might be explained by the slightly different terminology by Bogduk and Karasek (anuloplasty versus annuloplasty; IDETA versus IDET). The authors might have had knowledge of this study in other ways or used the search string slightly different, but this illustrates the low sensitivity of the search.

Second, the authors state that we did not distinguish between “quality of reporting” and “quality of the systematic review”. On the contrary, we evaluated only the quality of the included systematic reviews with the Amstar score. The quality of reporting is important, but for our purpose, evaluating the existing evidence, the right approach is to assess the quality of the methodology of the reviews.

Third, we need to disagree with the authors that both systematic reviews and overviews need to follow the same strict methodology. We believe that it is even more important for overviews to use accepted and evidence-based methods because of the impact and the possible use of this evidence in guidelines or directly by care providers.

Fourth, we are aware of the arguments put forward by Kovacs et al. [2] (page E1349, first two paragraphs) for having contradictory statements in their data presentation. Their main argument for rating compliance as “Yes” and blinding as “not applicable” is that meeting these quality criteria is difficult in surgical studies. We strongly oppose such reasoning. The scientific community does a better job in accepting that randomized studies in surgical interventions have these limitations and explore the value of other methodologies rather than over-qualifying the value of the randomized controlled trial by unjustly upgrading their quality.

In conclusion we believe we have, with the best available methodology, produced a comprehensive overview of the evidence on the surgical interventions for low back disorders. We concur with the authors that more work need to be done on evidence-based methodology for systematic overviews of the literature.

Conflict of interest None.

References


Unfortunately these methodologies have not been developed and so far we have to rely on the methodology that was developed for systematic reviews. While these appear valid, there are many aspects that do differ between the two study designs. Interesting aspects concerning the methodology of overviews are outdated reviews, indirect comparisons, overlap of included studies, and different selection criteria. We agree with the authors that contacting authors could be a valuable addition to resolve inconsistencies as we have experienced that even in high quality systematic reviews these can still exist. However, the methodology of this effort, the associated effect on the risk of bias, and the peer-reviewed status of the information obtained are not yet clear.
4. Wetenschappelijke publicaties in nationale tijdschriften (wn)

SCI not found

SCI not found
Blount’s disease, bowlegs or tibia vara, is characterized by proximal tibial bowing and endotorsion. It is a well-known condition in North America and Africa. The etiology is still unclear. Mechanical loading and genetic predisposition are possible causes. The treatment often requires surgical intervention such as a proximal tibial osteotomy.

The deformity can be unilateral as well as bilateral with an even distribution of approximately 50%. Consequences of the deformity of the limb, besides the obvious cosmetic aspects, are further deformation of the leg with possible gait deviations and limb shortening. This can lead to early onset arthritis of the knee. The disease involves the epiphysis, physis and metaphysis of the proximal tibia and results in a varus position, flexion and internal rotation of the lower limb (Figure 1). It was first described by Erlacher in 1917 and a more detailed description followed by W.P. Blount in 1937.

Based on the age of onset different types of Blount’s disease can be distinguished. Onset of the disease before the age of 4 is named infantile Blount’s disease. Onset after this age, late-onset, can be divided into a juvenile (onset between age four to ten) and an adolescent type (onset after ten years of age). A predisposition has been reported in children of African descent.

The radiographic progression of the disease can be classified according to Langeskiöld into six stages (Figure 2), ranging from mild involvement with a beaked medial metaphysis (Stage 1) to the presence of a bony bar (Stage 6). The classification is used to aid diagnosis, to monitor the progression and to guide treatment.

**DIFFERENTIAL DIAGNOSIS BOWLEGS**

The combination of the varus deformity and the internal torsion of the tibia is a consistent finding in Blount’s disease. This distinguishes Blount’s disease from its main differential diagnosis in toddlers, the physiological genu varum, in which there is no increase of the internal torsion of the tibia. General conditions such as rickets can also cause varus deformity in the tibia but on the conventional radiographs Blount’s disease causes a sharp angulation at the site of the epiphysis, indicating a focal epiphyseal problem. A more gradual bowing is seen in general conditions such as rickets. To differentiate between the two, blood chemistry may help by showing low serum calcium, low serum phosphorus and high serum alkaline phosphatase in Rickets and normal blood counts in Blount’s disease.

**AETIOLOGY**

The etiology of Blount’s disease remains unknown up to now, but different hypotheses have been proposed and are discussed below.

- **Increased Mechanical Pressure on the Knee Joint**

  Development of the disease as a consequence of increased
mechanical force is one of the most mentioned hypotheses of infantile Blount’s disease. It is based on the observed correlation between Blount’s disease and obesity. Furthermore, Blount’s disease is seen more often in children who walk at an earlier age. This theory, however, does not explain the existence of a unilateral occurrence of tibia vara or the high incidence in African countries where there is a low prevalence of obesity.1–11

NUTRITION
Some studies show that children with vitamin D deficiency are at a higher risk of developing Blount’s disease.12 In a study conducted in Nigeria a variety of biochemical parameters in the serum of patients with Blount’s disease was compared with healthy subjects. They did not find significant differences in calcium, inorganic phosphate or copper concentration. Serum zinc levels and alkaline phosphatase, however, were significantly decreased in Blount’s.13

GENETICS & HEREDITY
Since in different cases a familial occurrence was found and Blount’s is more often seen in African and Afro-American children, a genetic component is also hypothesized. A genetic basis for Blount’s disease is mentioned in some case reports. The reports show siblings with Blount’s disease and no known risk factors, and healthy parents. The reports may lead in the direction of recessive inheritance.

INTRA-ARTICULAR CHANGES AND HISTOLOGY
Magnetic Resonance Imaging (MRI) of the knee in patients with Blount’s disease show a thicker layer of epiphyseal cartilage and increased height of the medial meniscal region. No difference was found in the comparison of MRI findings reflect the compensation mechanism of the medial column of growing. Histological analysis shows islands of densely packed hypercellular cartilage and abnormal clusters of capillaries resulting in necrosis of the epiphyseal cartilage. There is disorganization of all structures on the medial side of the proximal tibial physis, but no bony physeal cartilage. There is disorganization of all structures on the medial side of the proximal tibial physis, but no bony physeal cartilage. There is disorganization of all structures on the medial side of the proximal tibial physis, but no bony physeal cartilage.

TREATMENT OF BLount’s DISEASE
Very mild deformities may resolve without treatment but for slight varus deformities (stages 1 and 2 Langenskiöld’s) conservative treatment with bracing or by repetitive plaster correction can be started. The pressure is transferred to the lateral compartment of the knee, stimulating the epiphyseal growth in the medial compartment.

Surgery is advised in the more severe stages (stages 3 or 4 Langenskiöld). Hemiphiphysiodesis (permanent or reversible) is used to slow the growth on the lateral side and thereby correcting the deformity by the patient’s own growth. For reversible hemiphiphysiodesis the 8-plate (Orthofix) is used. The method is relatively easy, requires limited operative time, limited operative access and allows postoperatively full weight bearing. A figure-of-8 device is screwed above and below the epiphysis of the proximal tibia on the lateral side thus correcting the varus malalignment by allowing faster growth on the medial side. The internal rotational deformity is not corrected. In Blount’s disease a pretty high amount of implant failure is reported (40%).

For the stages 5 and 6 different types of osteotomies are described. Opening- and closing-wedge osteotomies are both used, together with dome and Chevron-type osteotomies (V-type). Most of these osteotomies require internal fixation and the possibility of implant infection exists. Furthermore after consolidation implant removal is required. These techniques do not always successfully correct the rotational deformity that accompanies the angular, varus, deformity in this condition. The tibial W/M serrated osteotomy, first described in 1995 by Khermosh et al., enables simultaneous correction of the varus component as well as the torsional deformity, without the necessity for internal fixation.9 The osteotomy is performed by making an M-shaped opening in the proximal tibia. Then the “teeth” of the M are disengaged and twisted correcting the varus and the rotational deformity. When the osteotomy is not stable a temporary Kirschner-wire can be introduced until the postoperative cast is set. A long-leg cast is worn for 8 weeks.

Besides the different osteotomies gradual corrections with external frames are described as well with the advantage of adjustability, early weight-bearing and the ability to lengthen the limb.10 The disadvantages of this technique are a longer consolidation time and the need for expensive, complex devices.

Complications include pin-track infections and postoperative neuropathy. This technique appears to be more suitable for adolescents or adults in First World countries, because of the need for expensive devices and the pin-track problems.

COMPLICATIONS OF TREATMENT
After high tibial osteotomies the general complication rate is 13% and the recurrence rate is 77%. Several complications have been described varying from non-union to nerve palsy. Specially the peroneal nerve is at risk in the lateral closing wedge osteotomies and in the corrections with an external frame. Non-union and delayed union occur often related to patient factors affecting his healing like sickle-cell anemia and malnutrition. Osteomyelitis can come about after wound healing problems or surgical side infections. The odds of suffering an infection will depend on the circumstances in which the patient is operated. Certainly we have to take into account the hygienic circumstances of the hospital and the general health of the patient. Other complications are malunion, compartment syndrome, deep venous thrombosis, hemotoma.

RECURRENCE OF THE DEFORMITY
After appropriate surgical correction of the varus malalignment in children with Blount’s disease sometimes the malalignment reoccurs even after years. The recurrence rate seems to be related to the preoperative severity of the varus and to being overweight. Since we do not know what causes the disease and we do not treat the cause with the osteotomy the recurrence rate might be due to the on-going disease. Therefore monitoring of limb alignment and length is required until skeletal maturity. Future research should be focused on the underlying cause of Blount’s.

CONCLUSION
Blount’s disease is a well-defined deformity of the proximal tibia. It occurs mostly in children of African descent. It might be related to mechanical factors such as early walking age and obesity. Treatment is mainly surgical. Follow-up until skeletal maturity is mandatory.

REFERENCES
Non-tuberculous chronic osteomyelitis in Low- and Middle-Income Countries

Osteomyelitis is a very common problem in Low- and Middle-Income Countries (LMICs) as a result of exposure to multiple organisms, endogenous or hematogenous (children) as well as exogenous (adults: infected implants). Intravenous antibiotics can be curative in the acute stage of an endogenous infection (the first 36 hours), but antibiotics are not always available and the patients are seen later. Immediately after the first 36 hours a combination of debridement and antibiotics is mandatory. However, once the infection has become chronic other strategies are required (for instance: implant removal). In children it is advisable to wait for 8 months, as spontaneous resorption is possible, even resorption of sequestrae. Moreover, it is advisable to wait for the formation of an involucrum: living bone which bridges the infected area, so that necrotic tissue can be safely removed. Older people might simply “live” with their fistula, rather than being exposed to a series of operations; lifelong suppressive antibiotics may be indicated. Generally speaking, the first question should always be “Am I going to improve this patient?” Infected implants can be left in place as long as they provide stability, leading to bone union. In all cases the patient should know that recurrences are frequent and that often 3 or 4 reinterventions can be expected.

INCIDENCE

Epidemiological data on osteomyelitis in LMICs is scarce. Incidence increases with concomitant malnutrition or immunosuppression, associated with parasitic infection. Also osteomyelitis is often misdiagnosed or undertreated. The increase in trauma, notably from road traffic accidents, has resulted in an increase in open fractures and their complications. Therefore, osteomyelitis remains an important problem with important impact on mortality, morbidity and quality of life.

ORIGIN AND CLINICAL FINDINGS

The origin of osteomyelitis can be endogenous (= hematogenous) or exogenous. Osteomyelitis can be acute, subacute or chronic.

ENDOGENOUS (HEMATOGENOUS) OSTEOMYELITIS (MOSTLY CHILDREN)

Acute osteomyelitis is characterized by pain, lethargy, fever (often deemed as caused by malaria), and local inflammatory signs. In Africa mainly the infants are exposed (poorly groomed umbilical cord; drips for several weeks). Staphylococcus aureus is responsible in the majority of cases, but its preponderance is declining, in favour of Gram negatives. The proximal metaphyses of the femur and tibia are the areas of choice, but the infection can extend towards the diaphysis. In infants up to the age of 12 months, capillaries cross the growth plate and can therefore cause septic arthritis. In the older child these capillaries no longer exist, but an intracapsular metaphysis can also allow the infection to spread to the joint. This is the case for the proximal humerus, the proximal radius and the proximal femur.

Chronic osteomyelitis arises as a result of inadequate treatment, and is already established after 36 hours. The tibia is most often involved, followed closely by the femur. The periostium will form an envelope of living bone (Figure 1), the involucrum, around the medullary space in order to separate it from the rest of the bone. This envelope thus prevents the dispersion of infected emboli throughout the body, but at the same time also prevents antibiotics to penetrate into the marrow. The involucrum bridges the infected area, thus allowing safe removal of all necrotic bone and sequestra. Osteomyelitis lasts a lifetime, because one is never sure that it is completely eradicated. Long remissions can alternate with periods of exacerbation. The term “years without relapse” is therefore more accurate than the term “cure”. Differential diagnosis should always include TBC, Ewing sarcoma and Sickle Cell disease. A fistula can always lead to malignant degeneration.

Subacute osteomyelitis presents as vague pain and a mild fever for 1 to 3 months, after which it becomes chronic. The subacute form is rising in numbers, also in Africa, at the expense of the acute form, probably because antibiotics are given more easily. A special form of subacute osteomyelitis, under 25 years of age, is the Brodie abscess (Figure 2). In 45% of cases it forms after antibiotic therapy, which has tampered the evolution. Treatment consists of debridement and antibiotics. There is only granulation tissue, no pus.

EXOGENOUS OSTEOMYELITIS (MOSTLY ADULTS)

Exogenous osteomyelitis forms by adjacency of a wound, foreign body, an osteosynthesis or arthroplasty. As the two latter are also on the rise in LMICs (just like in developed countries), osteomyelitis as a result is becoming more and more frequent. In Africa it is less frequent than the hematogenous form. Here the infection is often more superficial, which improves the prognosis.

CLASSIFICATION

The classification of Cierny-Mader is universally accepted, at least for adults (Figure).

Type 1: medullary osteomyelitis.
Type II: superficial osteomyelitis: involves only the cortical bone and most often originates from direct inoculation or contiguous focus infection.

Type III: localized osteomyelitis: involves both cortical and intramedullary bone. In this stage the bone remains stable and the infection does not involve the entire bone diameter.

Type IV: diffuse osteomyelitis: involves the entire thickness of the bone, with loss of stability, as in infected non-union.

This classification also takes into account the resistance of the patient:

A = normal host resistance.
B = locally reduced resistance (B2) (e.g. vascular ischemia) or systemically (B1) (e.g. diabetes).
C = severely compromised patient; not a good candidate for surgery because the intervention could be worse than the disease.

WHEN TO OPERATE

One has to consider a conservative attitude when there is neither pain nor loss of stability, as in infected non-union.

In doubtful cases, one should consider referring the patient to a colleague with extensive expertise in treating orthopedic infections.

HOW TO OPERATE

Methylene blue can be injected into the fistulae, 24 hours before surgery, in order to aid complete resection of all infected soft tissue: the necrotic tissues remain blue because they cannot eliminate the product.

Pneumatic tourniquet, after hypervascularization of the limb, without the use of an Esmarch bandage: in order to facilitate the paprika sign: bleeding bone at debridement with a bone biting forceps.

Debridement and sequestrectomy should include all necrotic (blue) bone until one sees bleeding bone (paprika sign). Lavage is convenient: “dilution is the solution to pollution”. Plates and screws can be left in situ if they stabilize the unhealed fracture.

In older patients, not fit to undergo operative treatment, suppressive antibiotic therapy can be considered. A fracture should be allowed to heal first.

In most other cases surgical debridement is the key to the treatment. However, a careful risk/benefit analysis should be performed on the basis of the complete medical history beforehand. In doubtful cases, one should consider referring the patient to a colleague with extensive expertise in treating orthopedic infections.

Dead space can be filled by muscle (saccerization), but nowadays other alternatives are coming on the market, like antibiotic-laden bone cements (Ceramend, Bensupport, Lund, Sweden) and bioactive glass (Bonalive©, Bonalivre, Turku, Finland). These are, however, still expensive options and not yet readily available in developing countries. Antibiotic loaded beads should have their place in the treatment but necessitate removal in a second operation. The author does not advise to leave them in because over time all antibiotics will have diluted out and the beads will become foreign material and covered by biofilm.

Fistulae should be excised and sent for anatomopathology. However, some authors simply curet them or leave them untouched, especially in dangerous areas.

Wounds should be closed primarily if possible. If impossible to do so, granulation must be promoted as much as possible, either by appropriate wound care or open techniques like the Papineau technique. Flaps are also possible.

Theoretically, no antibiotics should be administered until deep tissue cultures are taken, in order to determine the causative germ and its sensitivity to antibiotics. But this is rarely possible in Africa. So, if cultures are not possible a combination of amoxicillin/clavulanic acid with gentamycin will cover most Grams- and Gram-germs, as well as anaerobes. They should be continued for a total of six weeks (2 weeks IV and 4 weeks orally).

PROGNOSIS

Recurrence is always possible during the remaining lifetime, but most often in the first postoperative year. Generally the recurrence rate is about 40% (also up to 50% in the western world). Thus the initial healing rate is in the order of 60%. The experience of the surgeon is the only really significant factor, especially as regards the complete debridement. However, in doubtful cases, the cure rate rises to 95% if reintervention is performed (up to 4 times!). Also involvement of plastic surgeons through muscle flaps, local or free, increases this percentage, so healing rates above 90% are achieved more often than in the past.

Factors favouring the healing are: female gender, location in the humerus, subacute onset, delay in presentation of less than one year, normal or elevated lymphocytosis, normal or lowered polynucleosis, small involvement size and above all: the experience of the surgeon. Results can be further improved by total eradication, but without weakening the bone, causing fractures. If necessary, administration of combined antibiotic therapy and also stopping the smoking habits of the patient.

CONCLUSION

Osteomyelitis continues to be a pathology that causes much morbidity and disability in LMICs, as well as in the western world. Adequate diagnosis and treatment can greatly improve outcome and therefore the aim should be to treat this condition as quickly and thoroughly as possible.
5. Wetenschappelijke publicaties boeken en boekbijdragen

1.
Developing Insights in Cartilage Repair
Emans, Pieter J., Peterson, Lars (Eds.)
2014, XIV, 329 p. 74 illus., 65 illus. in color.

  - Chapter 1: General Introduction
    Emans PJ and Peterson L.
  - Chapter 3: Targeting inflammatory processes for optimization of cartilage
    homeostasis and repair techniques.
    Caron MM, Welting TJ, van Rhijn LW, Emans PJ.

2.
Handboek Pijngeneeskunde
Huygen FJ, van Kleef M, Vissers KC, Zuurmond WW (Eds.)
2014, Uitgeverij De Tijdstroom 9789058982407

  - Lage rugpijn en lumbosacraal radiculair syndroom.
    Willems PC, Geurts JW, van Boxem K, van Kleef M.

6. Vakpublicaties nationaal of internationaal

1.
Een Splinter. Van der Wijk J, Staal HM. Rubriek Gezien,
Medisch Contact, April 2014: 717
NO SCI

2.
Het Consult “Vanwaar die golfsgewijze pijn bij arthrose?” Willems PC.
Rubriek Gezondheid & Zorg, Trouw, vrijdag 25 april 2014
NO SCI

3.
Lean levert echt betere organisatie op. van Rhijn LW, Feczko P, Heeren E, van Merode F.
Medisch Contact, June 2014: 1326-1328
NO SCI
None
Een splinter?

Op de polikliniek van het ziekenhuis in Duayaw-Nkwanta (Ghana) zagen wij een jongen van 12 jaar oud met een verbranding van de hand en een MP-fragment in het borstbeen. Hij had geen recent trauma. Bijafbeelding (Ghana) zagen wij een jongen van 12 jaar oud met een verbranding van de hand en een MP-fragment in het borstbeen. 

Vanwaar die golfsgewijze pijn bij artrose?

Artrose is blijvende, maar vaak heeft hij dan soms wel en soms geen pijn in mijn nek, vraagt een lezer.

Pijn in de nek kan worden veroorzaakt door een spierverkramping of een kruisbandontsteking, meestal is de pijn wisselend en kan er wisselend in meer of mindere mate last van hebben. Dit komt door de ontstekingsreactie die doorgaans met artrose gepaard gaat. We weten niet precies waar dat door wordt veroorzaakt. "Omdat er ook een acute beweging voor een tweede kruisband of andere beschadiging in een tussenwervelhals, legt Willems uit. "Daar wordt meneer niet beter van. Zeker niet meer als een totaal losuur kracht, de artritis, en slijten ze niet zo snel. Hij noemt zijn pijn als de echte klachten. Nu bijvoorbeeld steeds naar links of naar rechts kijken, zijn volgens Willems vooral bij chronische klachten nuttig, omdat zo de spieren in de nek minder verkrampen. Bijvoorbeeld steeds naar links of naar rechts kijken, zijn volgens Willems vooral bij chronische klachten nuttig, omdat zo de spieren in de nek minder verkrampen.

Volgens de orthopedisch chirurg is bij acute klachten meer gebaat bij manuele therapie - een vorm van fytsiotherapie - of een lichte ontstekingsremmer, waardoor de pijn wordt gedempt. Maar die behandeld door een lokale traditionele medicijnman, een 'bonesetter'. Maar die behandeld door een lokale traditionele medicijnman, een 'bonesetter'. Maar die behandeld door een lokale traditionele medicijnman, een 'bonesetter'.
ORGANISATIE

prof. dr. Lodewijk van Rhijn
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ORTHOPEDIE VAN HET MUMC+ HALVEERDE WACHTTIJDEN

Lean levert echt betere organisatie op

Consequentie toepassing van de Lean Six Sigma-methoden levert, als onderdeel van een totaalinzicht op kwaliteit, voor-
delen voor zorgverleners én patiënten. Dat toont een casus op de afdeling Orthopedie van het Maastricht Universitair
Medisch Centrum.

In dit tijdschrift is verscheidene ma-
len, positief en negatief, bericht over
Lean en Six Sigma (LSS).1 Wij doen in
 dit artikel verslag van onze ervarin-
gen met deze methoden in een complexe
situatie. Bij de afdeling Orthopedie in het MUMC+
was sprake van een gestaag afnemende
tevredenheid van patiënten en medewer-
kers, die niet eenvoudig te duiden was. Pa-
tiënten klaagden over lange wachttijden
en onduidelijkheid over wie hun dokter
was. Medewerkers dreigden vast te lopen
op een ‘stapellen’ van taakoverdracht,
waarmee de specifieke taak niet effec-
tief en in samenhang met andere taken
uitgevoerd kon worden. Daar moest iets aan gebeuren. Om de
problemen vanuit de werkvloer aan te
pakken, kozen we voor LSS-methoden.

Deze problemen zijn typisch voor een
afdeling Orthopedie en Lanskap, waarbij
medewerkers vaak moet optreden als
nieuwste klus voorkomt. Als de taak
niet snel en eenvoudig kan worden
uitgevoerd, ontstaat er onrust onder de
medewerkers. Het is dan ook belangrijk
om te tekenen om deze problemen in
stay op te lossen en de tevredenheid
van patiënten en medewerkers te ver-
hogen.

In dit artikel maken we een aantal
aanpakken van de problemen die we
in de afdeling Orthopedie van het MUMC+
hebben gezien. Wij maken gebruik van
Leeuwen en Six Sigma (LSS) om deze
problemen op te lossen en de tevredenheid
van patiënten en medewerkers te ver-
hogen.

Tegenstrijdige belangen
Het vaststellen van een visie op de toekomst was het belangrijkste vertrekpunt
voor het LSS-traject. Zonder een duidelijke visie ontstaat er geen samenhang en
daarmee geen ontwikkeling van de organisatie. We
begonnen dus, in overleg met al die betrok-
ken partijen, met vast te stellen waarvoor
we verbetering wilden realiseren. We
formuleerden ons doel als volgt: het leveren
van goede en betaalbare zorg, waarbij
patiënten in staat gesteld worden om
moet betere mogelijk in beweging te blijven. Dit door

Een gezamenlijke ‘dagstart’ kost een kwartier, maar levert gedurende de dag een flinke tijdsbesparing op.
van den Akker GG, Surtel DA, Cremers A, van Rhijn LW, Welting TJ, Voneken JW. Novel immortal cell lines reveal subpopulations in the nucleus pulposus. Dutch Orthopaedic Association (NOV) year meeting 6/7-02-2014, Rotterdam, NL

Bessems JH, Witlox MA. Het manklopende kind: ‘wat kan het nog meer zijn?’ Dutch Orthopaedic Association (NOV) year meeting 6/7-02-2014, Rotterdam, NL

Bolink SA, Senden R, Grimm B, Heyligers I. Patient-reported outcome measures vs. performance-based inertial sensor measures A follow-up study in patients undergoing total knee arthroplasty. European Orthopaedic Research Society (EORS) 2/4-07-2014, Nantes, France

Bolink SA, Naisas H, Senden R, Grimm Objectief meten van functie na TKP als aanvulling op PROMS. Dutch Orthopaedic Association (NOV) fall meeting 2/3-10-2014, Veldhoven, NL


Boonen B, Schotanus M, Kerens B, Kort NP. Intra-Operative Results And Radiological Outcome Of Conventional And Patient-Specific Surgery In Total Knee Arthroplasty: A Multicentre RCT. European Federation of National Associations of Orthopaedics and Traumatology (EFORT) 4/6-06-2014, London, UK

ten Broeke RH. Diagnostic tools for early evaluation of total hip performance. Dutch Orthopaedic Association (NOV) fall meeting 2/3-10-2014, Veldhoven, NL

Emans PJ. Eerste resultaten met eigen ervaring TKP vs KJD. Dutch Orthopaedic Association (NOV) fall meeting 2/3-10-2014, Veldhoven, NL

de Haan J. Value of pre-operative aspiration diagnosing a prosthetic joint infection of the hip based on microorganisms. European Bone & Joint Infection Society (EBJIS) 10/13-09-2014, Utrecht, NL

Hulsen DJ, Geurts JA, van Rietbergen B, Arts JJ. Subsidence of bioactive glass granules, morselized cancellous allograft, and tricalcium phosphate granules in an in situ defect model. European Orthopaedic Research Society (EORS) 2/4-07-2014, Nantes, France

Hulsen DJ, Geurts JA, van Rietbergen B, Arts JJ. Mechanical properties of a bioactive glass granules/ morselized allograft mixture in confined compression. European Orthopaedic Research Society (EORS) 2/4-07-2014, Nantes, France


Jacobs E, Roth AK, Willems PC, Arts JJ, van Rijn LW. Correction of thoracolumbar (hyper)kyphosis using polyurethane rod instrumentation. Dutch Orthopaedic Association (NOV) year meeting 6/7-02-2014, Rotterdam, NL


Peters M, Brans B, Beijer E, Wiers R, ten Broeke RH, Arts JJ. Visualisation of bone mineralization around two different cup designs after total hip arthroplasty using 18F-fluoride PET/CT-scans. European Orthopaedic Research Society (EORS) 2/4-07-2014, Nantes, France


Roth AK, van der Veen A, Willems PC, Arts JJ, van Rijn LW. Influence of stepwise removal of UHMWPE sublaminar wires on segmental stability in long segment instrumentation for early onset scoliosis correction. European Orthopaedic Research Society (EORS) 2/4-07-2014, Nantes, France


Schrander D, Hermus JP, Voets H, van den Boogart M, Willems PC, van Rijn LW. First Results of the Maastricht Brace in the treatment of adolescent idiopathic scoliosis. SOSORT 08/10-05-2014, Wiesbaden, Germany


Timur UT, van der Windt A, Haak E, Caron MM, Welting TJ, Visser J, Emans PJ, Weinans H, Jahr H. TGFβ2 knockdown under physiological osmolarity improves COL2 expression in chondrocytes in vitro. EORS, 2/4-07-2014, Nantes, France


Wijnen WM, Witlox MA, van Rijn LW, Staal HM. Tips and Tricks; ponseti treatment in club foot, managed by the specialized nurse. Dutch Orthopaedic Association (NOV) year meeting 6/7-02-2014, Rotterdam, NL


Willems PC. Implementation of the Dutch Spine Surgery Registry. Dutch Orthopaedic Association (NOV) year meeting 6/7-02-2014, Rotterdam, NL

Invited keynote lectures

Arts JJ. Bone substitute materials for spinal surgery, how to do it. Eurospine biomaterials workgroup meeting 29-05-2014, Zurich, Switzerland

Arts JJ. Radiopaque UHMWPE sublaminar wires made with Dyneema Purity for the treatment of early onset scoliosis. Biomedia 17-06-2014, Maastricht, NL

Arts JJ. Setup of clinical research according to Good Clinical Practice and ISO 14155. Technology for Health 10-09-2014, Den Bosch, NL

Arts JJ. Status cooking book biomaterials. Dutch Orthopaedic Association (NOV) Fall meeting 03-10-2014, Veldhoven, NL

Arts JJ. An overview off achievements in the BMM Nantico and BMM Spineguide research programs 2010-2014. BMM Collaboration day 20-10-2014, Urmond, NL
Emans PJ. Cartilage repair options. Biomet Symposium 15-01-2014, Maastricht, NL

Emans PJ. Cartilage and cartilage repair options. Dutch Society for Dance and Music Medicine 29-03-2014, Maastricht, NL

Emans PJ. Cartilage repair and challenges. Biomedica 17-06-2014, Maastricht, NL

Emans PJ. Cartilage and cartilage repair options and rehabilitation. Dutch Society for Physiotherapy (KNGF) 26-09-2014, Utrecht, NL

Emans PJ. PROM’s. Current concepts in orthopaedic pathology (IMUKA) 2015, 20/21-11-2014, Maastricht, NL

Hermus JP. De Charcotvoet in de handen van de chirurg. Dutch Podotherapeutic Society (NVvP) year meeting 19-09-2014, Eindhoven, NL


Willems PC. Evaluation spinal apteints and surgical treatment of scoliosis. Dutch Orthopaedic Association (NOV) secretary meeting 06-02-2014, Rotterdam, NL

Willems PC. Implementation of the Dutch Spine Surgery Registry. Dutch Orthopaedic Association (NOV) year meeting 6/7-02-2014, Rotterdam, NL

Willems PC. Spinal trauma: Accreditatie spinaalchirurg met minimumeisen voor setting? Spring symposium BSS/BVOT 29-03-2014, Gent, Belgium

Willems PC. Spinal surgery in the Netherlands. Nederlandse Vereniging van Rugpatiënten (NVVR) 17-05-2014, Ede, NL


Jacobs E, Roth AK, Willems PC, Arts JJ, van Rhijn LW. Thoracic hyperkyphosis correction in Osteoporotic Patients: Polycarbonate urethane Spine implants. Orthopaedic Research Society (ORS) 15/18-03-2014, New Orleans, USA


de Jong JJ, Willems PC, Arts JJ, Bours SP, Brink PR, van Geel TA, Geusens PP, van Rietbergen B, van den Bergh JP. An Exploratory Study on Bone Densitometric and Micro-Architectural Changes During Distal Radius Fracture Healing: Fractured vs. the Non-Fractured Region. ASBMR 2015, 12/15-09-2014 Houston, USA

Koole LH, Saralidze K, Jacobs E, Roth AK, Willems PC. Gold-Containing PMMA Microspheres. A Route to New Highly Radiopaque Cements for Vertebroplasty. European Society for Biomaterials (ESB) 31-08-03-09-2014, Liverpool, UK


Roth AK, Bogie R, Willems PC, van Rhijn LW, Arts JJ. Novel radiopaque UHMWPE sublaminar wires in a growth-guidance system for the treatment of early onset scoliosis: feasibility in a large animal model. European Society for Biomaterials (ESB) 31-08-03-09-2014, Liverpool, UK
Cortical Breaks and Bone Erosions in the Hand Joints: a Cadaver Study comparing Conventional Radiography with High-Resolution and Micro-Computed Tomography

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Background. Conventional radiography (CR) is considered the gold standard for diagnosing bone erosions in rheumatic diseases. However, High-Resolution peripheral Quantitative Computed Tomography (HR-pQCT) and microCT (µCT) allow analysis of bone erosions in finger joints at micro level.

Objectives. To quantify cortical breaks and erosions in hand joints assessed from CR, HR-pQCT and µCT images.

Methods. Eight metacarpal phalangeal and four proximal interphalangeal joints from eight female human cadaveric index fingers with unknown medical history were scanned by HR-pQCT (82 µm, Scanco XtremeCT) and µCT (18µm, Scanco µCT 80). Also radiographs were taken. A modified SPECTRA (Study group for xtrEme Computed Tomography in Rheumatoid Arthritis) algorithm was used by one reader to assess all cortical breaks and erosions. A cortical break was defined as an interruption of cortical bone on two consecutive slices on two orthogonal planes for HR-pQCT, and similarly, but on eight consecutive slices, on µCT. An erosion was defined as a definite cortical break, with irregular shape, and loss of underlying trabecular bone on two consecutive slices on two orthogonal planes on HR-pQCT, and similarly, but on eight consecutive slices, on µCT. An erosion was defined as a definite cortical break, with irregular shape, and loss of underlying trabecular bone on two consecutive slices on two orthogonal planes on HR-pQCT, and similarly, but on eight consecutive slices, on µCT. All radiographs were independently scored for erosions by two rheumatologists. Descriptive, paired samples t-test, Wilcoxon signed-rank test, kappa and intraclass correlation coefficients (ICC) were calculated (p<.05 was considered significant).

Results. Figure 1 shows a picture obtained from the three imaging modalities used in this study. In total, twelve joints (mean± SD age 82.6±9.1 years) were imaged by HR-pQCT and µCT. In total, 79 cortical breaks were detected on HR-pQCT (6.5±2.5 per joint) and 163 on µCT (13.5±4.9 per joint). A total of 11 erosions were detected on HR-pQCT (0.9±0.9 per joint) and 47 on µCT (3.9±3.0 per joint). The ICC for number of cortical breaks was .122 (p=.150), and for number of erosions -.090 (p=.699). On CR, the total number of erosions scored was four by Reader 1, and two by Reader 2. Kappa was fair (κ=.250).

Conclusion. Three times more erosions were detected on HR-pQCT than CR and four times more erosions were detected on µCT than HR-pQCT. Furthermore, twice the number of cortical breaks was scored on µCT compared to HR-pQCT. These results indicate that further research, such as histological and longitudinal studies, will be necessary to reveal the prevalence, incidence and significance of cortical breaks and erosions as found by HR-pQCT and µCT of hand joints.

Figure 1. CR of MCP joint in posterior-anterior position (A), arrows indicating a cortical break on dorsal side on transversal slice of HR-pQCT (B) and corresponding µCT (C) image.
Background
Healing of distal radius fractures is currently assessed by conventional radiography. However, these radiographs do not provide detailed information regarding bone density, micro-architecture and bone strength. High resolution peripheral quantitative computed tomography (HR-pQCT) scanners with a resolution of 82 μm do offer the possibility to assess in-vivo bone density and structure on the micro-scale. Furthermore, 3D-models representing the cortical and trabecular structure can be created and used in finite element analysis (FEA) to assess bone strength.

It is not known, however, if morphology and mechanical parameters calculated with this approach provide relevant results in case of fractured bone.

Subjects and Methods
• Eighteen post-menopausal women with a stable distal radius fracture.
• HR-pQCT of the fracture at 1-2 (baseline), 3-4, 6-8 and 12 weeks post-fracture to assess bone density and micro-architecture.
• HR-pQCT of the contra-lateral wrist at 1-2 and 12 weeks post-fracture.

Results (1)
Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 weeks (Figure 2 and 4).

The purpose of this exploratory study is to:
• compare the effect of medication on fracture healing in vivo in humans at a high resolution, and hereby separately taking into account the cortical and trabecular density and bone mass.
• develop a fracture healing model that is able to predict the outcome of fractures and treatments that might be given. Ultimately, this model could assist the clinician in giving a more patient specific and optimized treatment.

The high resolution 2D-slices are used to create a 3D-model that is suitable for bone strength analysis. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4). Fracture gap and longitudinal changes can be observed very accurately on the high resolution 2D-slices. In the 3D-models, locations of bone gain and loss show that the cortex is bridged after 12 week (Figure 2 and 4).
A prospective study on the W/M Serrated Osteotomy for correction of varus deformities in Ghanaian patients

Heleen M. Staal, Joseph Korpsiash, Freek Hollman, Paul J.J.M. Rompa, Lodewijk W. van Rhijn

Medical or Research Professionals/Clinicians

Topic area: Clinical topics by area of research
Specific topic: 31. Diagnostics and imaging procedures

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CORTICAL BREAKS AND BONE EROSIONS IN THE HAND JOINTS: A CADAVER STUDY COMPARING CONVENTIONAL RADIOGRAPHY WITH HIGH-RESOLUTION AND MICRO-COMPUTED TOMOGRAPHY

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My abstract has been or will be presented at a scientific meeting during a 12 months period prior to EULAR 2014: No

Is the first author applying for a travel bursary?: Yes

Is the first author of this abstract an undergraduate medical student?: No

Background: Conventional radiography (CR) is considered the gold standard for diagnosing bone erosions in rheumatic diseases. However, High-Resolution peripheral Quantitative Computed Tomography (HR-pQCT) and microCT (µCT) allow analysis of bone erosions in finger joints at micro level.

Objectives: To evaluate cortical breaks and erosions in 16 hand joints imaged by CR, HR-pQCT and µCT.

Methods: Eight female human cadaveric index fingers with unknown medical history were scanned by HR-pQCT (82 µm, XtremeCT, Scanco Medical AG, Switzerland) and µCT (18 µm, µCT 80, Scanco Medical AG, Switzerland). Also radiographs were taken. A modified SPECTRA (Study group for xtrEme Computed Tomography in Rheumatoid Arthritis) algorithm was used by one reader to assess all cortical breaks and all erosions. A cortical break was defined as an interruption of cortical bone on two consecutive slices on two orthogonal planes on HR-pQCT, and similarly, but on eight consecutive slices, for the µCT. Erosion was defined as a definite cortical break, with irregular shape, and loss of underlying trabecular bone on two consecutive slices on two orthogonal planes for HR-pQCT, and similarly, but on eight consecutive slices, for the µCT. Erosion was independently scored for erosions by two rheumatologists. Descriptives and intraclass correlation coefficients (ICC) were calculated.

Results: In total, eight metacarpal phalangeal (MCP), four proximal interphalangeal (PIP) and four distal interphalangeal joints of 16 cadaveric index fingers (mean ±SD age 82.6 ± 9.1 years) were imaged by HR-pQCT and µCT. In total, 123 cortical breaks were detected on HR-pQCT (7.0 ± 2.7 per joint) and 237 on µCT (14.5 ± 5.0 per joint). A total of 24 erosions were detected on HR-pQCT (1.3 ± 1.0 per joint) and 72 on µCT (4.0 ± 2.6 per joint). The ICC for total number of cortical breaks was .399 (p = .056), and for number of erosions .142 (p = .706). On CR, twelve joints, eight MCPs and four PIPs, were scored. The total number of erosions scored on CR was four by Reader 1, and two by Reader 2. On the same joints, 16 and 45 erosions were scored on HR-pQCT and µCT, respectively.

Conclusions: HR-pQCT detected four times more erosions than CR. The µCT detected even three times more erosions than HR-pQCT. Furthermore, almost twice the number of cortical breaks was scored on µCT than HR-pQCT. These results indicate that further research, such as histological and longitudinal studies, will be necessary to reveal the prevalence, incidence and significance of cortical breaks and erosions as found by HR-pQCT and µCT of hand joints.

Disclosure of Interest: None declared
ELISA-based detection of Gentamicin and Vancomycin

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Introduction
Gentamicin and vancomycin are antibiotic drugs frequently used to treat orthopaedic infections. In many cases these antibiotics are used in local release systems due to their potential systemic toxicity. The most commonly used release system used in the clinic is antibiotic containing bone cement, which allows a local delivery of the antibiotic compound for a period of up to several weeks. Monitoring the systemic and local antibiotic load is an important clinical monitoring step. Current clinical diagnostics mainly offer two possible approaches, a fluorometric assay or detection by liquid chromatography. The fluorometric approach has an approximate range of 1 - 10 µg/ml for gentamicin and is prone to be influenced by high protein content within a sample. The liquid chromatographic method is more sensitive with an approximate detection limit of 50 ng/ml. Also this method is heavily influenced by proteins present in a sample. Due to these technical limitations in detection methods, detection of antibiotic compounds in serum or wound exudate is troublesome. To circumvent the technical limitations that go along with currently detection techniques, we explored the use of an enzyme linked immunosorbent assay (ELISA)-approach for detection of gentamicin and vancomycin.

Materials and methods
A gentamicin- or vancomycin-protein conjugate was established by cross-linking either gentamicin or vancomycin to bovine albumin using 1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide (EDC). The non-crosslinked antibiotic fraction was removed from the conjugate by several repetitive dialysis steps. Purified conjugate coated overnight to the surface of a microtiter plate (10 ng gentamicin/BSA or 1 µg vancomycin/BSA) in a 50 mM bicarbonate buffer (pH 9.6). After washing the plate four times with PBS containing 0.05% Tween-20, the microtiterplate wells were treated, for 1 hour, with PBS containing 5% BSA as an additional blocking step. The calibration curve for both antibiotics was prepared in PBS containing 5% BSA with a range of 0.1 ng/ml - 500 ng/ml for either gentamicin or vancomycin. The 1 hour incubation period of the calibration curve in the microtiter plate was combined with the incubation of the antibiotic specific primary antibody (the monoclonal anti-gentamicin antibody was diluted 7000x in PBS/BSA, the polyclonal anti-vancomycin antibody was diluted 5000x) in the same well. After incubation the wells were washed as described above, after removal of the washing liquid the wells were incubated, for 1 hour, with the secondary antibody (for gentamicin: RAMPO, 5000x diluted in PBS/BSA, for vancomycin: SWARPO, 2000x). Subsequently the wells were washed as described above. After washing, the antibody fraction attached to the coated surface was detected by the use of an HRP-conjugated secondary antibody and subsequent conversion of a tetramethylbenzidine (TMB) substrate (measured at 450 nm in an ELISA plate reader). The intensity of the 450 nm signal is inversely correlated to the concentration of the antibiotic in a sample.

Results
BSA-gentamicin and BSA-vancomycin haptens were generated to immobilize both antibiotics to the microtiterplate wells. Using fixed concentrations of the anti-gentamicin or anti-vancomycin antibodies in combination with increasing concentrations of free antibiotic as a calibration series (range: 0.1 ng/ml – 500 ng/ml), lead to an A450 signal that was dose dependently inversely correlated to the antibiotic concentration. The results were calculated in a log/log fashion, and the detection range was determined by polynomial regression. The established calibration curve allowed a detectable range between 2 - 300 ng/ml for gentamicin (Figure 1A) and 10 - 500 ng/ml for vancomycin (Figure 1B). To determine whether this ELISA setup supports the detection of gentamicin and vancomycin in high-protein containing samples (wound exudate and human serum), we spiked wound exudate with 5 µg/ml gentamicin and human serum with 50 µg/ml vancomycin. After sample dilution we were able to measure gentamicin to 10 µg/ml and vancomycin to 53.5 ng/ml in the diluted sample. Importantly, no cross-reactivity or interference was observed for vancomycin in the gentamicin ELISA and vice versa.

Discussion
Our results show that ELISA provides in a highly sensitive method to measure antibiotic levels in both wound exudate and serum. In contrast to the in literature described fluorescent detection methods, the herein described ELISAs are about 50x more sensitive. Since our ELISA-based method is compatible with high-protein containing samples, measurements in wound exudate and serum are no longer a practical obstacle as they are for liquid chromatographic methods. The application of these ELISAs may contribute to an improved antibiotic regimen in the clinic for osteomyelitis treatment.

Conclusion
Gentamicin and vancomycin concentrations in various types of samples can be determined by the use of commercially available antibodies in a hapten-supported ELISA-based approach. Both ELISAs are highly sensitive and for the individual antibiotics and in both ELISAs no cross-reactivity was found for other antibiotics.
ELISA-based detection of gentamicin and vancomycin

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Disclosure: no conflict of interest

Introduction
Gentamicin and vancomycin are antibiotic drugs frequently used to treat orthopaedic infections. These antibiotics are used in local-release systems to avoid their potential systemic toxicity. The most commonly used release system in the orthopaedic clinic is antibiotic containing bone cement, which allows a local delivery of the antibiotic compound for a period of up to several weeks to treat the infection. Monitoring the systemic and local antibiotic load is an important clinical monitoring step. Current clinical diagnostics mostly rely on two possible approaches, a fluorometric assay or detection by high performance liquid chromatography (HPLC). However, the fluorometric approach has an approximate range of 1 - 10 µg/ml for gentamicin and is prone to be influenced by high protein content within a sample. The HPLC-method is more sensitive with an approximate detection limit of 50 ng/ml. Also this method is heavily influenced by proteins present in a sample. Due to these technical limitations in detection methods, detection of antibiotic compounds in serum or wound exudate is troublesome. To circumvent the technical limitations of the currently used detection techniques, we explored the use of an enzyme linked immunosorbent assay (ELISA) approach for the detection of gentamicin and vancomycin.

Materials and methods

Results
The calibration curves of the gentamicin and vancomycin ELISAs show a dose dependent response. The results are presented in a log/log scale, and the detection range was determined by polynomial regression. The established calibration curve allows a detectable range between 2 - 300 ng/ml for gentamicin (Figure 2A) and 10 - 500 ng/ml for vancomycin (Figure 2B). The ELISAs allow detection of gentamicin and vancomycin in spiked patient material (Figure 2A/B stars).

Conclusion
Our results show that ELISA is a sensitive method to measure antibiotic levels in both wound exudate and serum. As compared to the established fluorescent detection methods, the described ELISAs are about 50x more sensitive. Our approach shows that measurements in wound exudate and serum are no longer a practical obstacle as they are for the HPLC-methods. Furthermore, the application of these ELISAs may contribute to an improved antibiotic regimen in the clinic, to optimize patient treatment and outcome. Especially since there are currently no reports on the clinical implementation of such ELISAs in the healthcare system or its related research.

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BACKGROUND Cup migration is a possible complication in total hip arthroplasty (THA) patients. Recently, new uncemented implant designs facilitating ingrowth of bone have entered the market besides the established hydroxyapatite (HA) coated ongrowth cups. These new ingrowth cups allow ingrowth of bone into their open metallic structure, stabilizing the prosthesis in an early stage after the operation. To date, radiostereometric analysis (RSA) is used to quantify prosthesis migration to predict long-term fixation. Positron emission tomography (PET) is a high-resolution imaging technique that can be used to quantify biological processes. 39F-fluoride ion is a positron-emitting isotope which is predominantly deposited at the surface of bone with the greatest activity of remodeling and turnover. AIM This study investigates the role that 18F-fluoride PET/CT-scanning could play in understanding the biological failure process underlying the prosthesis migration of cups in THA patients. A novel analysis method was used to visualize the bone activity around the cup and to compare the bone activity around an ongrowth and an ingrowth cup.

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MATERIALS AND METHODS Ten patients from an ongoing RSA THA study (METCnr: 10-1-068) were prospectively included in a pilot 39F-fluoride PET/CT scan study and were randomly assigned to either the un cemented Trident HA coated ongrowth cup (Stryker, Mahwah, USA) or the uncemented Trident Tritanium ingrowth cup (Stryker, Mahwah, USA). RSA images were made at 4, 12, 26 weeks post-op. PET/CT scans were made at 12 and 26 weeks post-op using intravenous administration of 39F-fluoride (mean: 189 MBq). CT images were used to produce attenuation corrected PET images. A PET visualization method called polar maps was modified and used to display and analyze the activity around the 3D cup as a 2D activity map. For each of the 20 polar map regions, the mean standardized uptake value (SUV), a semi-quantitative measure for the bone metabolism, was calculated. SUV distributions over the cup were visually compared between the two different cup designs. RESULTS In this study, a topographical representation of the bone activity around the spherical cups of the THA patients was produced. In all scans, a high uptake of fluoride was visible on the superolateral side of the cup at both 12 and 26 weeks. The polar maps showed that the higher SUVs for the Trident HA cup were mainly present on the superolateral outer ridge, the Trident Tritanium cup showed high SUVs over a much larger superolateral area of the cup, including the dome. A typical example is presented in figure 1.

CONCLUSIONS AND CLINICAL IMPLICATIONS Differences in bone activity patterns between the cup designs may be explained by different fixation technologies. The Trident cup with its HA coating and ridges at the peripheral end, will initiate bone activity along the edge of the cup in first instance and activity over a larger surface in a later stage. While the Trident Tritanium cup will immediately after the operation initiation bone activity into the 3D pure titanium porous coating over a larger surface. This analysis method has the potential to contribute towards a better diagnosis of the ingrowth process of a cup in bone over time and in the clinical evaluation of new cup designs. Methodology improvements will focus on the correlation of RSA and PET results for better interpretation.
Novel radiopaque UHMWPE sublaminar wires in a growth-guidance system for the treatment of early onset scoliosis: feasibility in a large animal model

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Thoracic kyphosis correction in osteoporotic patients - Polycarbonate urethane spine implants

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growth-guidance system and a modern L-angle trolley are examples of such systems, both used on gliding pelvic screws and/or sliding titanium sublaminar wires. However, the unknown consequences of metal-on-metal wear debris are reason for concern in young patients. Another disadvantage of gliding pelvic screws is that thoracic pedicle screw placement can be difficult due to the distorted vertebral anatomy often seen in scoliosis. Easy placement of sublaminar wires offers superior a radiopaque alternative to pedicle screws in these technically challenging cases. Ultra high molecular weight polyethylene (UHMWPE) or other polymeric sublaminar cables have already been introduced for spinal deformity surgery; the soft and flexible structure of woven UHMWPE wires decreases the risk of neurological injury, while the broad shape distributes contact force over a greater area, thus allowing for higher correction forces. Despite the increased contact surface, internal data has shown that UHMWPE cables exhibit lower friction during longitudinal sliding along spinal rods as compared to titanium sublaminar wires in an in vivo set up, indicating the potential for allowing continuation of longitudinal spinal growth. Until now, radiolucency of UHMWPE wires has limited the possibility for postoperative radiographic assessment and subsequent clinical use. The development of novel radiopaque UHMWPE wires, with bismuth-oxide particles blended into each fiber, allows for clinical application. The goal of this study consists of two parts: (1) to test the stability and biocompatibility of novel radiopaque UHMWPE wires as sublaminar wire, and (2) to assess the potential of using UHMWPE sublaminar wires in a growth guidance system for EOS.

An intervention group of twelve immature sheep (18 weeks old) received posterior segmental spinal instrumentation; pedicle screws were inserted at L5 and UHMWPE wires were passed sublaminarily at each level between L5 and T1. Dual cobalt-chromium rods were placed along the spine between levels L5 and T1 and fixed by set-screws at the pedicle screw attachment sites. The UHMWPE sublaminar wires were secured used a double-loop sliding knot, tightened to 100N, and secured with multiple granny knots. The control group consisted of four age-matched, unoperated animals in order to determine "normal" spinal growth. Lateral radiographs were taken at 4-week intervals to evaluate growth of the instrumented segment. After 24 weeks, all animals were sacrificed and the spines harvested for histological and biomechanical evaluation. Results revealed a novel radiopaque UHMWPE sublaminar cable with sufficient stability and biocompatibility for growth guidance and spinal deformity surgery. The results showed that the novel radiopaque UHMWPE sublaminar cable significantly improved growth compared to the control group. The sublaminar wires did not interfere with bone formation or growth in the instrumented segment. The radiopaque UHMWPE sublaminar cable was successfully used in the instrumented spinal segments, demonstrating its potential for use in growth guidance systems for EOS.

Figure 1: (A) Direct postoperative and (B) 24-weeks postoperative lateral X-ray of the instrumented sheep spine. Marked growth of the instrumented segment is clearly visible in the lateral X-ray. (C) 3D HR-pQCT reconstruction of the harvested spine, illustrating posterior ossification. Intralaminar bone formation and facet joint changes are clearly visible on coronal and axial plane slices in the intervention group (D) as compared to control spines (E).

Figure 1. Complications associated with thoracic kyphosis correction using rigid instrumentation include dural indentation and the development of new vertebral compression fractures.

Materials and methods For this pilot study, porcine lumbar spine specimens were used (L1-L5) of which all soft tissues was carefully removed. Twenty-four spinal segments were instrumented with rod and pedicle screw systems (titanium, and two different PCU compositions (Bionate® 65D, Bionate® 75D, DSM Biomedical B.V., Geleen, the Netherlands)). Six spinal segments remained uninstrumented (control). The tests were conducted in a custom designed flexion-compression test set-up placed in a saline bath at 37°C in order to mimic body temperature and to account for the temperature dependent properties of the PCU rod. A combined flexion-compression load was applied to the spinal segments by means of an eccentric force in a materials testing machine (ZwickRoell, ZMART PRO). As recommended for spinal implant testing, a 7.5 Nm load was applied to each spine without preload. The load was applied cyclically at a speed of 400-mm/min for a total of 3,000 cycles (Figure 2). Intradiscal pressure (IDP) was continuously monitored within the nucleus of the L2-L3 disc, and peak pressure during each loading cycle was used as the output parameter.

Discussion Subcutaneous treatment options for severe thoracic kyphosis in osteoporotic patients are limited. Spinal fusion using rigid instrumentation has a substantial risk of failure in these patients. The concept of stabilization with a flexible rod might be an alternative to fusion with rigid instrumentation, with the aim of decreasing stress on the bone/screw interface and on the most proximal or distal instrumented levels. Less rigid instrumentation may subsequently lead to a decrease in the incidence of screw pull-out and future vertebral body fractures.

Materials and methods For this pilot study, porcine lumbar spine specimens were used (L1-L5) of which all soft tissues was carefully removed. Twenty-four spinal segments were instrumented with rod and pedicle screw systems (titanium, and two different PCU compositions (Bionate® 65D, Bionate® 75D, DSM Biomedical B.V., Geleen, the Netherlands)). Six spinal segments remained uninstrumented (control). The tests were conducted in a custom designed flexion-compression test set-up placed in a saline bath at 37°C in order to mimic body temperature and to account for the temperature dependent properties of the PCU rod. A combined flexion-compression load was applied to the spinal segments by means of an eccentric force in a materials testing machine (ZwickRoell, ZMART PRO). As recommended for spinal implant testing, a 7.5 Nm load was applied to each spine without preload. The load was applied cyclically at a speed of 400-mm/min for a total of 3,000 cycles (Figure 2). Intradiscal pressure (IDP) was continuously monitored within the nucleus of the L2-L3 disc, and peak pressure during each loading cycle was used as the output parameter.

Figure 2. Flexion-compression load setup: the material testing machine's actuator is displaced vertically, a wheel transmits a load, producing a combined flexion-compression load. Intradiscal pressure (IDP) is measured using a pressure transducer needle in the L2-L3 disc.

Figure 2. New vertebral compression fracture

Results The peak IDP increased after instrumentation with a titanium and a PCU-75D rod. After 3,000 cycles, the largest increase compared to the uninstrumented spine was found in the titanium instrumented group (Figure 3). The uninstrumented and PCU-65D instrumented spines produced consistently lower IDP throughout the test compared to the titanium instrumented spine.
Novel radiopaque UHMWPE sublaminar wires in a growth-guidance system for the treatment of early onset scoliosis: feasibility in a large animal model

A.K. Roth, R. Bogie, P.C. Willems, J. de Jong, J. Van den Bergh, J.J.C. Arts, L.W van Rhijn
Department of Orthopaedic Surgery, Research School Caphri, Maastricht University Medical Center

Introduction

Growth-guidance or self-lengthening rod systems are an alternative to subcutaneous growing rods for the surgical treatment of early onset scoliosis (EOS). The main advantage in comparison to growing rods is the marked decrease in subsequent operative procedures. Ultra high molecular weight polyethylene (UHMWPE) or other polymeric sublaminar wires have already been introduced for spinal deformity surgery; the soft and flexible structure of woven UHMWPE wires decreases the risk of neurological injury, while the broad shape distributes contact forces over a greater area, thus allowing for higher correction forces. Radiolucency of UHMWPE wires has limited the possibility for postoperative radiological assessment and subsequent clinical use. The goal of this study consists of two parts: (1) to test the stability and biocompatibility of novel radiopaque UHMWPE sublaminar wires as sublaminar wire, and (2) to assess the potential of using UHMWPE sublaminar wires in a growth guidance system for EOS.

Materials and methods

In 12 immature sheep, thoracolumbar spines were instrumented with radiopaque (Bismuth Oxide additive) UHMWPE sublaminar wires (made with Dyneema Purity® fibers, DSM Biomedical, Geleen, the Netherlands). Wires were placed at 5 levels (T11-L3), while pedicle screws at L5 held dual CoCr rods in place. A control group consisted of 4 age-matched animals. Radiographic control was performed at 4 week intervals. After a follow-up period of 24 weeks, the animals were sacrificed and the spines were harvested. HR-pQCT scans were made of the harvested spines and vertebrae were embedded in PMMA for histological evaluation.

Results

No neurological deficits occurred during the postoperative period. One animal died during follow-up (7 weeks postoperatively) due to unknown cause. At sacrifice, none of the wires had loosened and all instrumentation remained stable.

Substantial growth occurred in the instrumented segments (L5-T11) in the intervention group (2.87 ± 0.16 cm). Spinal growth was slightly higher in the control group, (2.96 ± 0.35 cm), but this difference was not statistically significant (p=0.42).

Histological analysis revealed fibrous encapsulation of the novel radiopaque UHMWPE sublaminar wires in the epidural space (typical physiological response to foreign materials), with no evidence of chronic inflammation or wear debris. Manual palpation indicated that a solid, spontaneous fusion across all instrumented levels had occurred. HR-pQCT analysis showed interlaminar ossification, possibly a result of periosteal stripping during opening of the flaval ligament. Typical bone formation encircling the posterior rods coupled with degenerative facet joint changes were also seen.

Discussion

Despite the occurrence of heterotopic ossifications in all cases, UHMWPE sublaminar wires allowed for almost normal continued growth of the instrumented spinal segments during follow-up. Extrapolation of these results to the pediatric patient population is difficult due to a much higher growth velocity in animals, but also due to the exaggerated bone formation response typical for quadrupedal animal models in which higher spinal loads lead to stronger mechanical stimuli to form new bone. Fibrous encapsulation of the wire and preservation of instrumentation stability during the course of this study show that the application of these novel radiopaque UHMWPE sublaminar wires in spinal deformity correction surgery is safe. Further research into the fate of bismuth-oxide particles however is ongoing.

Fig 1. (a) 4mm wide, woven radiopaque UHMWPE sublaminar wire (© DSM) close-up image of radiopaque UHMWPE wire showing homogenous bismuthoxide particle distribution. (b) double-loop sliding knot (© DSM) intra-operative view of UHMWPE sublaminar wires looped around the laminae and after tensioning the knots.

Fig 2. Lateral radiograph of the instrumented spine (a) direct post-operative (b) after 24 weeks. The red circle clearly illustrates growth by sliding of the wire along the rod.

Fig 3. Quantification of spinal length shows no significant difference between the operated and control groups. (b) Histological slice of PMMA-embedded vertebrae (Hematoxylin & Eosin stained) showing fibrous encapsulation of the wire, which is a typical physiological reaction to foreign materials (also seen around rods, arrow).

Fig 4. (a) 3D HR-pQCT reconstruction of a harvested spine, illustrating posterior ossification. Intralaminar bone formation and facet joint changes are clearly visible, on coronal and axial plane slices in the intervention group (b) as compared to control spine (c).

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Department of Orthopaedic Surgery, Research School Caphri, Maastricht University Medical Center

NOV annual meeting 2014
Rotterdam, the Netherlands
Influence of stepwise removal of UHMWPE sublaminar wires on segmental stability in long segment instrumentation for early onset scoliosis correction

Abstract: (Your abstract must use Normal style and must fit into the box. Do not enter author details)

Background: Growth-guidance or self-lengthening rod systems are an alternative to subcutaneous growing rods for the surgical treatment of early onset scoliosis (EOS). Growth-guidance systems are especially suitable for neuromuscular EOS patients, who often suffer from significant comorbidities, as the number of subsequent operative procedures is drastically decreased. We propose the use of ultra-high molecular weight polyethylene (UHMWPE) sublaminar wires in a growth-guidance system for EOS. In this concept, continued longitudinal growth is facilitated by sliding of the UHMWPE wires along a correctional rod. The optimal number of segments instrumented with UHMWPE wires at the proximal or distal instrumentation end needs to be elucidated; sufficient number of levels should be instrumented in order to provide adequate stabilisation and correction, but each additionally placed wire will increase resistance to longitudinal growth and also increase the risk of spontaneous fusion.

Aim: Determine the range of motion of the (porcine) thoracic spine with varying number of levels instrumented with UHMWPE sublaminar wires

Methods: Four porcine thoracic spines (T6-T14) were potted and instrumented with bilateral pedicle screws at T13, dual cobalt chromium rods (4.75mm) and UHMWPE sublaminar wires at 5 levels (T7-T12). Range of motion (ROM) was determined in flexion/extension, side bending and axial rotation in a pure-moment test setup. Tests were performed for the uninstrumented condition, in a fully instrumented condition, and in four conditions where sublaminar wires were stepwisely removed at intermediate levels.

Results: Instrumentation with sublaminar wires provides substantial reduction in ROM in flexion/extension (figure 1c) and in side bending (results not shown, trend similar as seen in flexion/extension). Stepwise removal of sublaminar only leads to loss of stabilization when a single sublaminar wire remains in place. Time required for all tests did not affect mechanical properties of the spine, as results for test condition 1 are similar to test condition 7. In order to calculate statistical differences, the number of tested spines needs to be increased.

Conclusions and clinical implications: Stepwise removal of sublaminar wires between the proximal sublaminar wire and distal pedicle screws only leads to a decrease in the total stabilisation effect when a single proximal UHMWPWE sublaminar remains in place. UHMWPE wires at minimally two distal or proximal levels are required in long segment constructs for EOS correction in order to provide adequate stability. The proximal wire can potentially slide off the rod during growth and therefore UHMWPE wires at three end levels may be required for maintaining stability during the course of growth.

Figure 1. (a) pure-moment test setup, (b) different test conditions, (c) total ROM in flexion/extension for the seven different test conditions
Transcriptional regulation of the non-coding snoRNA RMRP during chondrogenic differentiation; a role for NFκB/p65?

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Maastricht University Medical Centre
Maastricht, the Netherlands

1. Introduction

The ribonuclease mitochondrial RNA processing (RMRP) gene encodes the RNA component of a multi-protein-RNA complex called RNase MRP. This small nucleolar ribonucleoprotein particle is implicated in various cellular processes, including ribosomal biogenesis, mitochondrial RNA cleavage, cell cycle regulation and has been linked to telomerase. Mutations in the RMRP gene are responsible for the human disease called CHH (chondrodysplasia punctata, hereditary hypochondroplasia).

Figure 1. A C

2. Cardiac Hypothesis and PHase NMR

Figure 2. A

3. Mice RMRP is predominantly detected in hypertrophic and late in proliferation-chondrocytes

Figure 3. A

4. Chondrogenic differentiation and increased Nkx3.2 open RMRP gate

Figure 4. A

5. NFκB/p65 activator and hypertrophic inducer BMP-2

Figure 5. A

6. NFκB/p65-activating IL1β increases BMP expression during hypertrophic differentiation

Figure 6. A

Viperin; a novel chondrogenic regulator

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3. Introduction

The chondrogenic hypertrophic marker Col10a1 has been associated with cell cycle progression and cell size increase in chondrocytes. The finding that Col10a1 expression is regulated by NFκB/p65 and chondrocyte hypertrophy is associated with cell stress signaling is in line with previous studies. In this study, we investigated the effect of NFκB/p65 on RMRP expression during chondrogenic differentiation.

4. Methods

RMRP RNAi was performed using an RMRP-specific siRNA in the chondrogenic progenitor cell line ATDC5. Knockdown (KD) of RMRP RNA leads to deregulation of the chondrogenic differentiation of ATDC5 cells. Importantly, we found that NFκB/p65 is required for induction of RMRP expression. In contrast, forced hypertrophic differentiation by Bapx1/Nkx3.2 expression did not result in significant RMRP expression increase.
Title: TGFβ2 knockdown under physiological osmolarity improves COL2 expression in chondrocytes in vitro

Abstract:

Background: In vitro expansion of human articular chondrocytes (HACs) is required for cell-based therapies to treat cartilage pathologies. During standard expansion culture (i.e. plasma osmolarity, 280 mOsm) chondrocytes inevitably lose their specific phenotype and de-differentiate, which makes them inappropriate for autologous chondrocyte implantation. It has been shown that physiological osmolarity (i.e. 380 mOsm) increases collagen type II (COL2) expression in vitro [1, 2], but the underlying reason is unknown. However, transforming growth factor beta (TGFβ) is an accepted key regulator of chondrocyte differentiation and known to stimulate COL2 production. In this study we aimed to elucidate the role of TGFβ signalling as a molecular mechanism potentially driving the COL2 expression under physiological culture conditions.

Material and methods: HACs were cultured in cytokine-free medium of 280 or 380 mOsm, respectively, under standard 2D in vitro conditions, with or without lentiviral TGFβ2 knockdown (RNAi). Expression of TGFβ isoforms, superfamily receptors, BMPs and chondrocyte marker genes was evaluated by QPCR. TGFβ2 protein secretion (ELISA) and bioactivity, using an established reporter cell line, was determined.

Results: Physiological osmolarity differentially altered TGFβ isoform expression in a time- and passage-dependent manner. Specifically, TGFβ2 expression and protein secretion as well as TGFβ activity was increased (Fig. 1A, B) by 380 mOsm. Upon TGFβ2 isoform-specific knockdown (KD, Fig. 1C), TGFβ superfamily targets ID-1 and CTGF were induced, as was COL2 expression (Fig. 1D). Physiological osmolarity and TGFβ2 RNAi also induced several BMPs and ALK5.

Conclusions and clinical implication: We showed that TGFβ2 knockdown increases COL2 expression in human osteoarthritic chondrocytes in vitro, most likely through a regulatory feedback loop involving BMP induction. This is the first study indicating that TGFβ signalling is involved in osmolarity-induced chondrocyte marker gene expression. Pharmacological targeting of this pathway holds potential to further improve osmolarity-mediated phenotypic stabilization in advanced future cell-based cartilage repair strategies.

References:
9. Symposia
SYMPOSIUM

"Bekken-heup Traumatologie"

Donderdag 23 januari 2014

Maastricht UMC+

Uitnodiging

Na twee geslaagde heupsymposia in 2011 en 2012 over de arthrotische heup komt dit jaar de bekken- en heuptraumatologie aan bod. Proximale femurfracturen vormen een belangrijk deel van de acute letselsoorzaak die door orthopedisch chirurgen en trauma-chirurgen worden behandeld. Door vergrijzing neemt het aantal patiënten met deze problematiek toe. Door alle veranderingen binnen ons zorgsysteem zullen deze patiënten steeds meer in eigen omgeving moeten worden opgevangen. Behandeling in de huisstijl van de fysiotherapeut wordt hiermee onontbeerlijk. Bekken- en acetabulum fracturen vormen een grote bedreiging voor de prognose t.a.v. mobiliteit op korte en langere termijn. Tijdens dit symposium komt een overview aan technische aspecten van de behandeling van deze letselsoorzaak aan bod en vooral ook het traject na de chirurgische behandeling. Ook wordt de problematiek van post-traumatische pijnssyndromen na een bekkenfractuur besproken. Aan de hand van een aantal lezingen leiden we elk van deze onderwerpen in en vervolgens wordt de link gelegd naar casus. In de lezingen wordt een open manier gediscussieerd over interessante voorbeelden uit de praktijk. Wij nodigen de deelnemers dan ook van harte uit een casus mee te nemen om te kunnen bespreken. En een centrale vraag hierbij zal zijn: "Wat is de strategie van de fysiotherapeut en wat verwacht u van de specialist?"

Graag nodigen wij alle geïnteresseerde eerstelijns zorgverleners uit voor dit symposium.

Dit symposium wordt mede tot stand gebracht in samenwerking met de afdeling Fysiotherapie MUMC+.

Speakers & Workshopgivers

Drs. R. ten Broeke, Orthopedisch chirurg
Drs. J. Geurts, Orthopedisch chirurg

Inschrijfgelden:
Pantone 287 cPantone 116 c

Inlichtingen:
Marieke Prins
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Programma

Donderdag 23 januari 2014 van 9.15 u tot 17.00 u

REGISTRATIE EN ONTVANGST MET KOFFIE
08.30 - 09.15

Welkomstwoord
08.30 - 09.20

Koffiepausa
09.15 - 09.20

Workshop 1-2-3-4
11.00 - 11.45

Workshop 1-2-3-4
11.45 - 12.30

Lunchpausa
12.30 - 13.30

Workshop 1-2-3-4
13.30 - 14.30

Heeft u verkeerd betaald?
14.00 - 14.30

Workshop 1-2-3-4
14.30 - 15.00

Afsluiting, vragen & conclusie in plenaire ruimte
17.00

Workshops

Workshop 1: Casustiek door fysiotherapeuten van het aZM
"Wat verwacht de fysiotherapeut van de arts en vise versa?"

Workshop 2: Casustiek door René ten Broeke
Workshop 3: Revalidatiebehandelingen na fractuur in het bekkengebied
(onder voorbehoud)

Workshop 4: Casustiek door Jan Geurts
**Doelgroep**

Het symposium is bedoeld voor iedereen uit de 1ste lijn die beroepshalve betrokken is bij de behandeling van kinderen met scoliose.

**Accreditatie**

Accreditatie op basis van 6SBU wordt aangevraagd voor de volgende specialismen: Algemene fysiotherapie, Kinderfysiotherapie en oefentherapie Cesar en Mensendieck.

**Locatie**

NH Conference Centre Koningshof
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Uitnodiging
Basisvaardigheden
Totale Knie Arthroplastiek - Kadavercursus
24 april 2015
Op vrijdag 24 april 2015 organiseert MUMC+ in samenwerking met de andere regionale opleidingsziekenhuizen van ROGO Zuid een basiscursus Total Knie Prothesiologie (TKP) voor arts assistenten orthopaedie. Het doel van de cursus is om kennis te maken met de theorie achter de TKP en de basisvaardigheden van het implanteren van een TKP. Bovendien worden er de nieuwste operatie technieken geïntroduceerd, zoals computer navigatie en individuele zaagmallen.

Jaarlijks worden er in Nederland ongeveer 18.000 knieprotheses geplaatst. De operatie behoort tot de dagelijkse praktijk van een orthopedisch chirurg. Plaatsen van een TKP is een zeer complexe ingreep en vraagt om zeer goed gefundeerde kennis. Ter voorkoming van complicaties behoeft deze ingreep veel oefening want een tevreden patiënt is uiteindelijk het beste resultaat. Gezien het inzicht en de ervaring die vereist zijn voor het plaatsen van een TKP moeten de assistenten pas vanaf de 3e jaar van de opleiding deze ingreep verrichten. Om assistenten in opleiding beter voor te bereiden op de implantatie van een TKP zal er in het MUMC+ een basiscursus Totale Knie Prothesiologie gegeven worden.

In het eerste theoretische deel van de cursus worden er voordrachten gepresenteerd over de anatomie van de knie, de operatietechnieken, de theorie achter het design van een knieprothese en alle voorkomende problematiek bij plaatsing van een TKP.

In het tweede praktische deel mogen de assistenten op 4 kadavers onder begeleiding opereren, daarna mogen ze oefenen op saw-bone modellen om kennis te maken met de nieuwste technieken.

De cursus wordt mede mogelijk gemaakt door Biomet, Smith & Nephew, Stryker en Zimmer.

Faculty

Peter Feczko, MUMC+
Pieter Emans, MUMC+
Arno Lataster, MUMC+
Nanne Kort, Orbis Medisch Centrum Sittard
Patrick Deckers, Atrium Medisch Centrum Heerlen
Marijn vd Besselaar, Maxima Medisch Centrum Veldhoven
Sjoerd Kaarsemaker, VieCurie Medisch Centrum Venlo

Locatie cursus

MUMC+
Locatie Universiteit Maastricht
Universiteitsring 50 (UNS 50)
6229 ER Maastricht
Afd. Anatomie & Embryologie
Zona F2

Presentaties in studiezaal (Ruimte 2.142)
Kadaver oefening in snijzaal (Ruimte 2.138A)

Programma

Ochtend programma:
09.00 - 09.30 Anatomie en benaderingen
Arno Lataster
MUMC+
09.30 - 09.45 Basisprincipe
Pieter Emans
MUMC+
09.45 - 10.00 Releases and balancing volgens Whiteside
Marijn vd Besselaar
Maxima MC Veldhoven
10.15 - 10.30 CR vs PS
Sjoerd Kaarsemaker
VieCurie Venlo
10.30 - 10.45 Mobile vs fixed bearing
Patrick Deckers
Atrium MC Heerlen
10.45 - 11.00 Traditionele uitleijing vs navigatie
Pieter Emans
MUMC+
11.00 - 11.15 Met of zonder patella?
Peter Feczko
MUMC+
11.15 - 11.30 Pre -operatieve navigatie
Nanne Kort
Orbis MC Sittard
11.30 - 11.45 Postoperatieve pijnbestrijding en Fast-track
Peter Feczko
MUMC+
11.45 - 12.15 Discussie
12.15 - 13.00 Lunch

Middag programma:
13.00 - 16.00 Kadaver sessie
16.15 Afsluiting en certificaat

Aanmelden

Aanmelden/inschrijven per mail: marieke.prins@mumc.nl. Wij vragen €100,- inschrijfgeld. Gelieve dit bedrag over te maken naar IBAN rekeningnummer: NL97 INGB 067 97 85 914 t.n.v. Stichting Kliniek en Wetenschap Orthopedie o.o.v. TKP cursus 2015 en uw naam. Op vrijdag 11 april 2015 dient de betaling binnen te zijn, pas dan is uw deelname definitief.