

Award Paper Session

AP01

Composite Model to Predict Curve Severity of Adolescent Idiopathic Scoliosis: A 6-Year Longitudinal Study beyond Skeletal Maturity

JJ Zhang, KY Cheuk, ALH Hung, TP Lam, JCY Cheng, WYW Lee

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong

Introduction: The aetiopathogenesis of adolescent idiopathic scoliosis (AIS) remains unclear. Early risk evaluation of curve severity for timely intervention is important. We previously reported miR-145-5p in AIS osteoblasts impairing osteocytogenic differentiation and we have discussed the clinical implication of serological markers in a small sample size cohort. In the present study, we aimed to evaluate the prognostic value of a composite model in predicting curve severity.

Methods: This was a 6-year longitudinal cohort study. Girls with AIS (n=100) were recruited at their first visit to our clinic. We took blood samples and measured anthropometry and curve severity. The patients with AIS were followed up clinically every 6 months for 6 years. Severe AIS was defined as Cobb's angle >40°. Serum CTX/P1NP and plasma miRNA level were determined.

Results: Thirty patients had severe AIS at the end of the 6-year study. Patients with severe AIS had significantly higher serum levels of P1NP and significantly lower plasma levels of miR-145 compared with patients with AIS with Cobb's angle <40°. Plasma miR-145 levels showed negative correlation with Cobb's angle (p=0.002). Using clinical anthropometric parameters, serum P1NP, and plasma miR-145, our composite model showed outstanding power to predict curve severity with R² 0.575 and hazard ratio of 14.506.

Conclusion: The composite model constructed in this study can guide decision making and disease management at an early stage of AIS to help prevent progression of spinal deformity.

AP02

Vibration Therapy Improves Postural Stability and Prevents Falls after Distal Radius Fracture in Elderly Patients: A Randomised Controlled Trial

RMY Wong,¹ WT Ho,¹ N Tang,² RWK Ng,² SKH Chow,¹ WH Cheung¹

¹*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*

²*Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong*

No copyright transfer for abstract printing.

AP03

Robotic Arm-Assisted Total Hip Replacement: Assistant and Mentor

H Fu, A Cheung, MH Cheung, PK Chan, CH Yan, KY Chiu

Department of Orthopaedics and Traumatology, Queen Mary Hospital, Hong Kong

Introduction: Acetabular cup placement is vital in minimising dislocation and ensuring implant longevity in total hip arthroplasty (THA). After preoperative planning on computed tomography scans, robotic arm assistance (Mako) enables accurate acetabular bone removal and allows precise cup placement. This study compared the accuracy of cup placement between manual and robotic arm guidance.

Methods: Twenty-five consecutive patients undergoing robotic THA by a single surgeon were included. All surgeries were performed using posterior approach with robotic arm-assisted acetabular reaming done by the surgeon. The surgeon, fellows, and trainees were then asked to manually position an acetabular trial into the acetabulum, attached to the robotic arm but with measurements covered. They were instructed to aim for an inclination of 40° and anteversion of 20° free of constraints. True acetabular cup was then impacted. Postoperative radiographs, intra-operative verification, and preoperative planning were compared for consistency.

Results: Seventy-five manual trial cup positioning attempts were made by the surgical team. Manual cup positioning yielded a mean inclination of 40° (standard deviation=6.98°) while mean anteversion was only 16.2° (standard deviation 8.1°) despite aiming for 20°. The surgeon improved in consistency and accuracy after a learning curve of nine cases. Intra-operative verification of cup position correlated strongly with preoperative planning in both inclination ($r=0.67$, $p=0.0003$) and anteversion ($r=0.75$, $p=0.0002$). After exclusion of six rotated radiographs, postoperative anteversion correlated strongly with planning ($r=0.56$, $p=0.018$) and intra-operative verification ($r=0.6$, $p=0.014$).

Conclusions: Manual acetabular cup positioning tends to produce small anteversion and a robotic arm is an excellent teacher to improve accuracy. Robotic assistance guarantees accurate cup position according to plan.

AP04

Low-magnitude High-frequency Vibration Restores Inflammatory Response and Modulates Macrophage Polarisation to Facilitate Osteoporotic Fracture Healing in Rat Model

YN Chim, WH Cheung, SKH Chow

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong

Introduction: Vibration enhances ovariectomy-induced osteoporotic fracture healing in rats. Fracture healing begins with the inflammatory stage, and all subsequent stages are regulated by the release of inflammatory cytokines. We hypothesised that vibration treatment may enhance the inflammatory response leading to accelerated healing of osteoporotic fracture.

Methods: Ovariectomy-induced osteoporotic closed-femoral fracture Sprague-Dawley rats were randomised into control (OVX-C) or vibration group (OVX-V) [n=24, n=6 per group per time point]. Local expressions of tumour necrosis factor-alpha (TNF- α), interleukin (IL)-6 and IL-10 were detected by immunohistochemistry and quantified by colour threshold in ImageJ, assessed at weeks 1 and 2 post-fracture. Callus morphometry was determined by callus width from weekly radiography.

Results: Significantly higher TNF- α and IL-6 expressions but lower IL-10 expression were found at the bony callus in OVX-V rats at week 1 compared with OVX-C. Callus width was higher in OVX-V group than that of OVX-C group at weeks 1 and 2.

Conclusion: Enhanced pro-inflammatory TNF- α and IL-6 expressions and suppressed anti-inflammatory IL-10 expression in OVX-V group suggest that vibration treatment significantly enhanced inflammatory response in OVX bones, thus leading to accelerated fracture healing as evidenced by promoted callus formation during the early healing phase.

Acknowledgement: This project was supported by OTC (2015-SCNT) and NSFC (81472097).

AP05

Enhancing Osteoporotic Metaphyseal Fracture Healing with Low-magnitude High-frequency Vibration — Profound Roles of Osteocytes in Responding to Mechanical Stimulation
RMY Wong, VMH Choy, MC Li, JCY Cheng, SKH Chow, WH Cheung
Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong

No copyright transfer for abstract printing.

AP06

Artificial Intelligence in Hip Fracture Prediction Following Distal Radius Fracture
JSH Wong,¹ CXS Fang,¹ Y Hu,¹ TCT Pun,¹ TW Lau,² FKL Leung¹
¹*Department of Orthopaedics and Traumatology, The University of Hong Kong, Hong Kong*
²*Department of Orthopaedics and Traumatology, Queen Mary Hospital, Hong Kong*

No copyright transfer for abstract printing.

AP07

Ultrasound for Screening Scoliosis to Reduce Unnecessary Radiation: A Prospective Diagnostic Accuracy Study on 442 Schoolchildren from the Scoliosis Screening Programme in Hong Kong
H Pang,¹ YS Wong,² WCW Chu,³ YP Zheng,⁴ JCY Cheng,² TP Lam²
¹*Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong*
²*Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong*
³*Department of Imaging and Diagnostic Radiology, The Chinese University of Hong Kong, Hong Kong*
⁴*Department of Biomedical Engineering, The Hong Kong Polytechnic University, Hong Kong*

Introduction: Schoolchildren in Hong Kong are screened for scoliosis, and those screened positive for suspected scoliosis will receive X-ray assessment. Subjects with Cobb's angle $\geq 20^\circ$ are referred to a specialist. However, there were screen positive cases with Cobb's angle smaller than referral threshold of 20° , who are therefore subjected to unnecessary radiation exposure. Our objective is to determine if ultrasound can identify subjects "not for specialist referral" to reduce unnecessary radiation exposure.

Methods: A total of 442 schoolchildren screened positive for suspected scoliosis in scoliosis screening programme were prospectively recruited. Ultrasound of the spine was performed in addition to whole spine radiography. Three parameters were determined, namely X-ray-based referral status (Cobb's $\geq 20^\circ$ for specialist referral or Cobb's $< 20^\circ$ not for specialist referral, the gold standard), ultrasound-based referral status (based on ultrasound spinous process angle [SPA]) and ATR.

Results: In all, 243 girls and 199 boys (mean age 13.2 ± 1.8 years) were recruited with mean major Cobb's angles of $14.0 \pm 6.6^\circ$ and mean ATR of $5.7 \pm 2.4^\circ$. In total, 78 (17.6%) patients had Cobb's angle $\geq 20^\circ$. Patient-based logistic regression analysis showed the area under receiver operating characteristic curve was 0.735 when only SPA was used, as compared with 0.832 when both SPA and ATR were used. At a probability cut-off of 0.11, the sensitivity and specificity of ultrasound were 92.3% and 51.6% while the positive and negative predictive values were 29.0% and 96.9%, respectively.

Conclusion: Ultrasound is accurate for identifying schoolchildren with Cobb's angle $\geq 20^\circ$ before subjecting to confirmatory radiography. Incorporation of ATR could further enhance the prediction accuracy.

AP08

Oral Magnesium Supplementation and Low-magnitude High-frequency Vibration Treatment Attenuate Age-related Muscular Changes in Sarcopenia

SKH Chow, C Cui, ZY Bao, L Qin, LWH Cheung

Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong

Introduction: Sarcopenia is an age-related geriatric syndrome which is associated with subsequent disability and morbidity. Low-magnitude high-frequency vibration (LMHFV) is non-invasive biophysical modality providing mechanical cyclic loading to whole body. Magnesium (Mg) is associated with better indices of skeletal muscle mass, strength, and power in elder adults. The study aimed to investigate the effects of LMHFV, Mg, and their combination on sarcopenia skeletal muscles and explore the related mechanisms in vivo.

Methods: Senescence-accelerated mouse P8 (SAMP8) mice at month 6 were randomised into control, vibration (VIB), Mg, or Mg+VIB groups. The mice in the VIB group were given LMHFV (0.3 ×g, 35 Hz, 20 minutes/day, 5 days/week). Magnesium was administered through oral gavage of 0.2 mL Mg solution (200 mg/kg/day, 5 days/week). Both LMHFV and Mg supplement were given in the Mg+VIB group. Ex vivo functional assessment, staining of myofibres, and dual-energy X-ray absorptiometry were performed at month 1, 2, 3, and 4 post-treatment for all groups. Data analysis was done with one-way analysis of variance, and the significance level was set at $p < 0.05$.

Results: At month 4 post-treatment, partial lean mass in the Mg, VIB, and Mg+VIB groups was higher than that in the control group. The Mg and VIB groups showed more type II muscle fibres than did the control group. The Mg+VIB group showed significantly higher muscle strength than did the control group ($p = 0.0436$). Contractibility was significantly improved in the Mg ($p = 0.0138$) and combination ($p = 0.04$) groups, compared with that in the control group.

Conclusion: This study showed that Mg and LMHFV individually could increase muscle strength and muscle function in vivo, which indicates that Mg and LMHFV could attenuate sarcopenia changes in skeletal muscle.

AP09

Three-dimensional Acetabular Morphology of Chinese Population: A Computed Tomography-based Study

Q Zhu,¹ CH Yan,² KY Chiu²

¹Department of Orthopaedics and Traumatology, The University of Hong Kong–Shenzhen Hospital, China

²Department of Orthopaedics and Traumatology, The University of Hong Kong, Hong Kong

Introduction: Acetabular morphology plays an important role in the development of various hip pathologies and the design for total hip arthroplasty prostheses. We studied the three-dimensional acetabular morphology in a Chinese population and compared our results with existing data from Caucasian populations.

Methods: Volumetric computed tomography pelvis data of 57 individuals (24 male, 33 female) without hip symptoms were utilised for three-dimensional construction. Acetabular sphere was established. Intersection arcs of 35 planes and acetabular sphere were defined. Angles of the arcs uncovered by the acetabulum were measured. Such angles reflect the morphological features of acetabular rim. The most prominent and depressive part of acetabular rim can be represented as the smallest and largest angle.

Results: All angles of the arc uncovered by the acetabulum were $>90^\circ$, meaning the Chinese acetabulum is a sub-hemispherical structure. The acetabular rim has three prominences and two depressions. The peak of the anterosuperior prominence is located at 58.3° , the peak of the anteroinferior prominence is located at 139° , the peak of the posteroinferior prominences is located at 234.3° , the peak of the anterior depression is located at 102.3° , and the peak of the posterior depression is located at 323.1° . There were no significant difference between male and female acetabula ($p>0.05$). When compared with the Caucasian data, Chinese acetabula are smaller and shallower.

Conclusion: The complex geometry of the concave acetabulum benefits from three-dimensional visualisation and quantification. A shallow acetabulum may be the cause of low incidence of pincer-type femoroacetabular impingement and primary osteoarthritis. It may also call for the need of special Asian prostheses in total hip arthroplasty.

AP10

Failure Mode of Total Hip Replacement: A 21-Year Retrospective Study of over 300 Revision Total Hip Replacements

KCH Fok,¹ MH Cheung,² H Fu,¹ A Cheung,¹ CH Yan,² KY Chiu²

¹*Department of Orthopaedics and Traumatology, Queen Mary Hospital, Hong Kong*

²*Department of Orthopaedics and Traumatology, The University of Hong Kong, Hong Kong*

Introduction: In 1999, our department published data regarding the cause, complication, and survival of revision total hip replacement (THR). Since then, highly cross-linked polyethylene has been introduced, potentially changing the survival of THR. Therefore, we aimed to review our latest data in order to determine any change in the mode of failure of THR and survival after revision THR and to compare the latest results with our previous study.

Methods: All revision THR surgeries at a tertiary teaching hospital from 1998 to 2018 were reviewed. Kaplan-Meier survival analysis was performed to predict the cumulative rate of success for revision THR. The results were compared to our previously published data collected from 1984 to 1997.

Results: A total of 331 revision THR surgeries were performed on 277 patients. The average time interval between primary and revision was 13.2 years and the average follow-up after revision was 8.7 years. The commonest reason was mechanical loosening (41.7%) followed by articular bearing surface wear (39.0%), infection (10.0%), and periprosthetic fracture (3.9%). There were 92 (27%) cases of complication including dislocation (9.4%), infection (5.1%), and periprosthetic fractures (3.6%). There were 39 (11.8%) hips that underwent re-revision. The Kaplan-Meier survival analysis predicted cumulative survival of 95.2% at 5 years and 88.9% at 10 years.

Conclusion: We demonstrated a significant increase in revision for polyethylene wear as mode of failure in late revisions, despite the introduction of highly cross-linked polyethylene which eliminates the issue of polyethylene wear.