# MEETINGS ROUNDUP360

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## AAOS ANNUAL MEETING 2014

The Annual Meeting of the American Academy of Orthopaedic Surgeons (AAOS) continues to be one of the largest meetings focused on the practice and science of orthopaedic and trauma surgery. It is characterised by a robust international attendance, with an academic program delivered by true leaders and innovators in the field. This year, the AAOS Annual Meeting was held from March 11–15 in New Orleans, Louisiana. The educational program offered a combination of a large collection of instructional course lectures, symposia, and scientific exhibits representing a wide range of orthopaedic subspecialties.

This year, the Central Program Committee received a record number of original scientific abstracts and from a field of 5,646 abstracts submitted, a total of 825 abstracts were selected for podium presentations, and 569 abstracts were selected for poster presentations. Each subspecialty committee determined the best papers and posters presented in their respective subspecialty sections. These papers and posters were presented in a symposium moderated by Steven Frick, MD and William Mihalko, MD, entitled "Best of the AAOS." This session really represents a cross section of the finest orthopaedic research from the past year and each of these representative papers and posters deserves discussion.

## ADULT RECONSTRUCTION HIP

Five papers were selected from the program in adult hip reconstruction covering topics as varied as quality improvement programmes to bearing surfaces. An innovative use of the database of the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) was used by Meddenick et al to identify risk factors for readmission following primary total hip replacement (THR).[1] During the study period 9441 THR procedures were performed, and 345 unplanned re-admissions occurred giving an overall readmission rate of 3.65%. A number of independent predictive risk factors for re-admission were identified, including: low serum albumin, chronic steroid use, increased number of medical comorbidities, and increasing body mass index (BMI). Post-operative risk factors associated with hospital re-admission included surgical site infection, and venous thromboembolism. This sort of data from large prospective databases is valuable and should serve to improve preoperative risk stratification, helping surgeons to counsel patients regarding the anticipated risks of surgery.

A number of different papers focused on alternative bearing surfaces for THR. Investigators at one institution evaluated their revision rate for THR performed with highly cross-linked polyethylene.[2] From 1999 to 2007, 1484 THRs were performed. Out of 418 cases with 10-year follow-up data, 56 revisions were performed, but impressively with cross linked polyethylene no polyethylene-related failures were identified. Another paper presented the results of a randomized prospective trial comparing conventional polyethylene to highly cross-linked polyethylene, mated with either zirconium or cobalt chrome femoral heads.[3] Wear was calculated yearly over 5 years, using radiostereometric analysis (RSA). No advantage was identified for zirconium over cobalt chrome femoral heads, but highly cross-linked polyethylene was associated with significant decreases in wear regardless of femoral head type. These two papers add to the accumulating data strongly supporting the use of highly crosslinked polyethylene.

Changing trends in THR delivery in the US have been identified by authors using the Nationwide Inpatient Sample (NIS) collected by the US Department of Health and Human Services.[4] NIS data was cross-referenced against US census data to calculate the rates of THR and revision THR between 2000 and 2009. During this period the rate of THR increased 73%, with the greatest increase noted for patients with age 45-64 years. Meanwhile, the revision burden was noted to decrease from 17.7% to 11.6%. The revision rate decreasing despite provision of THR to younger patients warrants further investigation and may be indicative of better newer joint technology, superior surgical technique or a combination of both.

Another study demonstrated that surgeon participation in a voluntary joint registry may be associated with safer practices and decreased revision rates.[5] When surgeons participate in the Kaiser Permanente joint registry, they are provided with standard feedback regarding their relative complication rate and outcomes. Over 170 000 total joint procedures have been recorded, and the authors demonstrate a decrease in revision rates following the adoption of this voluntary registry. Furthermore, there has been a significant decrease in the rate of practices deemed to be associated with a higher rate of complications: including the use of small femoral heads, minimally-invasive TKR, hip resurfacing, metal-on-metal THA, and unicompartmental knee replacement (UKR).

## ADULT RECONSTRUCTION KNEE

The program for adult reconstruction of the knee included some particularly interesting papers concerning the diagnosis of periprosthetic infection. One study evaluated the expression of Toll-Like Receptor 1 (TLR1) in periprosthetic tissue for the diagnosis of infection in 49 patients.[6] Compared with other conventional diagnostic tests such as ESR, CRP, synovial WBC count, and PMN count, the expression of TLR1 was predictably elevated in the setting of periprosthetic infection, with a sensitivity of 94.4% and a specificity of 95.5%, perhaps making this the new gold standard. Another study explored the feasibility of using serum interleukin 6 (IL-6) levels for the screening of infected TKR.[7] In this series of 59 TKRs, elevated

serum IL6 demonstrated a sensitivity of 81% and a specificity of 63%, with a negative predictive value of 85%. When elevated IL-6 is combined with elevated synovial WBC count, the two studies demonstrate a sensitivity of 100% and a specificity of 90%, with a negative predictive value of 100%, albeit in a relatively small series.

The relationship between surgical time and revision rates following primary TKR has been explored using the New Zealand National Joint Registry.[8] Patient data was queried for the time period 1998-2010 and then TKR were stratified according to operative time: less than 40 minutes, 40-59 minutes, 60-89 minutes, 90-119 minutes, and 120 minutes or longer. The authors found two groups to have significant increases in the rates of revision surgery: those patients with surgical times greater than 120 minutes, and those patients with surgical times less than 40 minutes. It may come as no surprise that the patients with the longest surgery times had higher revision rates, for increased surgical time might be understood as a measure of surgical complexity. However, the increased rate of revision for patients with the shortest surgical times suggests that there is no benefit associated with moving too quickly during TKR.

## FOOT AND ANKLE

The foot and ankle section included a number of interesting papers highlighted during the "Best of the AAOS" session. Among these, two papers stand out as demonstrating vastly different approaches for the surgical management of chronic Achilles tendon tears. One study describes a new technique for interposition autograft to manage large tendon defects.[9] In ten patients with an average delay from injury of 9.5 weeks, fascia was harvested from the ipsilateral gastroc-soleus to bridge segmental defects in the Achilles tendon. All patients returned to pre-injury sports by six months, and there were no complications or re-ruptures noted after 2.5 years of follow-up. At the other end of the spectrum another study describes limited debridement with retention of scar tissue for the repair of chronic Achilles tendon tears.[10] In this counter point paper 27 patients were treated in this fashion, all with significant improvements noted in their AOFAS scores. At final follow-up no patients had a limp, there were no re-ruptures, and all 11 athletes returned to their pre-injury level of sports participation.

## CHILDREN'S ORTHOPAEDICS

The paediatric orthopaedic surgeons had four stand out presentations, three podium and one poster presentation. Investigators at two urban academic centers evaluated the use of a commercial DNA-based prognostic test proposed for use in screening patients with adolescent idiopathic scoliosis (AIS).[11] ScoliScore™ is a saliva-based DNA test that screens for a panel of 53 genetic markers used to stratify patients with AIS into three groups according to a proposed risk of curve progression: low, intermediate, and high. 126 patients with AIS were evaluated with ScoliScore™ and then observed for curve progression. The authors noted no significant difference in ScoliScore™ results for patients with curve progression compared to patients with no curve progression. Furthermore, the positive predictive value for ScoliScore™ in predicting curve progression was demonstrated to be 27%, far lower than the 97% value originally reported. From this, the authors conclude that the utility of this screening test remains unproven, a valuable paper highlighting the difficulties of generalizing results to other centres.

The rate of complications following surgical treatment of paediatric femoral neck fractures was reported in an interesting retrospective study of this rare injury. Authors compared closed reduction and internal fixation (CRIF) to open reduction and internal fixation (ORIF).[12] Eight patients treated with ORIF were compared with 15 patients treated with CRIF. Review of post-operative radiographs demonstrated that ORIF produced higher quality of reduction and further the overall complication rate was significantly higher for patients treated with CRIF: 93% versus 38% ($p = 0.037$). In particular, the rate of osteonecrosis of the femoral head was higher with CRIF: 53% compared with zero ($p = 0.010$). The authors note improved results for ORIF despite increased time delay from injury to surgery, suggesting that the accuracy of reduction is more important than the timing of surgery for this potentially devastating injury.

The risk of radiation exposure during fixation of paediatric supracondylar humerus fractures was measured for two different C-arm configurations: the 'standard' orientation (with the intensifier oriented above the patient) was compared with the 'inverted' orientation (with the intensifier used as the operating table).[13] While the standard orientation is associated with decreased radiation measured at the level of the surgeon's neck, the inverted orientation is associated with decreased radiation measured near the surgeon's waist. Still, the radiation measured in the operative field is orders of magnitude greater than the scatter radiation, no matter what orientation is used. This suggests that C-arm orientation has less of an effect on radiation exposure to surgical personnel compared to simple proximity to the surgical field.

The utility of the Kocher criteria in distinguishing septic hip arthritis from pyomyositis around the hip has been a staple of paediatric orthopaedic decision making the world over. The value of these criteria have been further investigated in a retrospective study evaluating pediatric patients presenting with painful hips.[14] The traditional Kocher criteria are typically used to distinguish between septic arthritis and transient synovitis of the hip. However, the Kocher criteria failed to distinguish patients with septic arthritis from patients with pericapsular pyomyositis. Furthermore, the rate of pericapsular pyomyositis was twice that of septic arthritis of the hip: 32% compared to 15%. Given this, the authors make strong recommendations for standard MRI evaluation to be performed in the work-up of pediatric septic hip arthritis.

## HAND AND WRIST

The long-term clinical outcome for non-operative treatment of distal radius fractures was investigated by a retrospective study.[15] Patients were placed into three groups according to the quality of reduction. Group 1 ($n = 15$) included patients with an anatomic reduction. Group 2a ($n = 25$) included patients with an acceptable reduction. Group 2b ($n = 25$) consisted of patients treated non-operatively despite a poor reduction that might otherwise serve as an indication for surgical management. Poor reductions were defined as any of radial shortening > 3 mm, dorsal tilt > 10°, volar tilt > 20°, or articular displacement >2mm. At a follow-up of 15 years, patients were evaluated with a number of functional outcome scores, and the contralateral wrist was used as a control to assess for the development of radiographic signs of arthritis. While patients in Group I demonstrated higher PRWE scores, there were no differences in other outcome scores, including the Quick-DASH and SF-36. When combined with no observed significant differences in radiographic outcome or clinical range of motion between groups this has led the authors to call into question the validity of the radiographic parameters typically used to indicate surgery for distal radius fractures.

A similar related study evaluated more profound malunions of the

distal radius following operative treatment of fractures.[16] Investigators grouped patients into 3 groups. Group 1 (n = 303) consisted of patients who had union with acceptable alignment. Group 2 (n = 63) consisted of patients with evidence of a malunion in one plane. Group 3 (n = 16) consisted of patients with a malunion in two planes. Patients were evaluated with a standard outcome measures, including DASH, SF-36, and VAS pain scores. No significant differences in functional outcome scores were noted between groups. Furthermore, no significant differences in range of motion or grip strength were noted between groups.

## TRAUMA

The rate of re-operation following ORIF of midshaft clavicle fractures is becoming increasingly relevant as more and more clavicle fractures are treated operatively. Investigators undertook a retrospective review of an administrative database recording surgical treatment of clavicle fractures from 2003 to 2009.[17] This study identified a population of 1350 patients, with the primary aim of identifying re-operation for any reason within two years. The overall rate of re-operation was 24.6% with hardware removal occurring in 18.8% of patients, with females demonstrating an increased risk for this indication. The rate of re-operation for infection and nonunion was 2.6% for each indication and during the study period, a steady increase in the annualised rate of clavicle ORIF was noted. The authors question whether the indications for clavicle ORIF should be revisited given the fact that one in four patients require a repeat surgery.

The clinical significance of syndesmotic screw retention following ankle ORIF was investigated with a randomized prospective trial.[18] Patients requiring syndesmotic fixation were randomized to one of two groups: planned screw removal or screw retention. At one year following surgery the two groups were compared using a number of validated outcome measures, including OMAS, AOFAS, AAOS, and Pain VAS scores. No significant differences were noted between groups in any outcome measure or with regards to ankle range of motion. The screw removal group demonstrated a trend for increased complications including diastasis, infection, and superficial peroneal neurapraxia, but this did not reach statistical significance. The authors conclude that routine syndesmotic screw removal confers no benefit and may be unnecessary following ankle fracture fixation.

The safety and efficacy of the suprapatellar approach for tibial nailing was demonstrated by another study.[19] A total of 21 patients treated with a suprapatellar approach for IM nailing of a tibia fracture were compared to 24 atients treated with a standard infrapatellar approach. There was no significant difference in functional outcome as measured by the Oxford knee score. While there was no significant difference in total operative time, there was a significant reduction in fluoroscopy time demonstrated for the suprapatellar group. Also, in the suprapatellar group the surgical team were able to achieve superiorfracture reduction in the sagittal plane. The authors conclude that the suprapatellar approach is a safe alternative for IM nail fixation of tibia fractures, suggesting that it may enable better access to the appropriate starting point in the proximal tibia.

## SPORTS MEDICINE/ARTHROSCOPY

The efficacy of formal oculomotor testing in the evaluation of sport concussions has been evaluated by investigators in a cohort of 292 American football players.[20] Measurement of baseline oculomotor function as assessed by the horizontal saccade tracking a visual stimulus was recorded at the beginning of the study. There were ten patients who suffered concussions, and repeat oculomotor function testing was performed within 48 hours of injury. All cases demonstrated measurable differences at least 2 standard deviations outside of baseline values. These results suggest that oculomotor testing can be used as a reliable objective tool for the assessment of sports concussions. Unlike other criteria used to evaluate the severity of a concussion, oculomotor testing is not subjective, and it seems unlikely that players could fake their responses or diminish their symptoms.

The results of one of the largest randomised prospective trials investigating techniques for ACL reconstruction were presented by another paper from the sports section.[21] Investigators randomised patients into one of three groups (n = 110 per group): patellar tendon autograft, quadruple hamstring autograft, and double bundle technique. The patellar tendon autograft group had a significant decrease in the rate of traumatic re-injury at 2 years: 3% compared with 11% and 10% for the other techniques (p = 0.047) no other significant differences were noted between groups. Specifically, there were no differences in ACL-QOL scores at two years of follow up and all groups demonstrated a similar rate for injury of the contralateral ACL: 5%.

## SHOULDER AND ELBOW

The Laterjet procedure is a reliable salvage operation for recalcitrant shoulder instability, however does risk damage to the musculotendinous nerve. The risk for nerve injury during the Latarjet procedure was investigated using intra-operative neurologic monitoring, including both somatosensory evoked potentials (SSEPs) and transcranial motor evoked potentials (tcMEPs).[22] The investigators divided the Latarjet procedure into 9 distinct steps, and recorded the frequency of so-called "nerve alerts" at each stage during a total of 34 procedures. A nerve alert was defined as a 50% drop in amplitude or a 10% increase in distal latency. A total of 45 nerve alerts were noted during the 34 procedures. 26 patients had at least one nerve alert, and 13 demonstrated two nerve alerts. The most at-risk stages of the procedure were identified as glenoid exposure with 12 nerve alerts and graft insertion/fixation with 17 nerve alerts. Most commonly affected nerves were the axillary and musculocutaneous nerves. Seven patients had post-operative axillary palsies, but all resolved.

The natural history of asymptomatic degenerative rotator cuff tears (RCTs) is one of the 'great shoulder surgery mysteries' and has here been investigated using ultrasound.[23] A total of 174 patients with ultrasound-proven asymptomatic RCTs were identified from a cohort of 224 patients with contralateral symptomatic RCTs. 118 full-thickness tears (FRCTs) and 56 partial tears (PRCTs) were followed for a minimum of five years. 44% of PRCTs progressed to full-thickness tears. 61% of FRCTs enlarged at least 5 mm. Pain developed in 46% of PRCTs and 50% of FRCTs. Tear progression was noted in 63% of painful shoulders, while only 38% of pain-free shoulders demonstrated tear progression. Supraspinatus muscle degeration was noted for 30% of shoulders with tear progression. For shoulders without tear enlargement, the rate of muscle degeneration was only 4%. The authors found no association between tear progression and age, gender, or smoking status.

## TUMOURS

Two presentations were highlighted as outstanding from the tumour section of the Academy. One paper describes a cost-effective technique for managing metastatic disease in the acetabulum.[24] The technique involves a cemented polyethylene cup, with reconstruction of pelvic defects using PMMA cement reinforced with rebar screws. The authors demonstrate

significant cost savings with this technique, suggesting that it provides a construct with durability suitable for these patients with a limited life expectancy. Taking a more basic science approach another paper describes the use of Angiotensin-(1-7) to reduce radiation-induced muscle fibrosis.[25] Using a murine model, the authors demonstrate that prophylactic administration of this peptide prior to radiation results in a significant reduction in post-radiation perivascular and interstitial muscle fibrosis.

## SPINE

The potential toxicity of local vancomycin delivery during spinal surgery was investigated using human mesenchymal cell culture.[26] The investigators noted significant cell death when cultured mesenchymal cells were exposed to concentrations of vancomycin exceeding 800 mcg/mL. While the clinical effect of vancomycin on ultimate fusion rates remains unknown, the authors caution against routine application of local vancomycin powder during spine fusion surgeries, as application of 2g of vancomycin powder produces concentrations exceeding 2500 mcg/mL.

Taking a look at non-operative management of spinal infection researchers presented a paper aiming to establish the feasibility of medical management for spinal epidural abscesses (SEAs).[27] All patients admitted for management of SEA between 1993 and 2011 were entered into their retrospective study and their charts reviewed. During this time, medical management without surgery was reserved for patients with no significant neurologic compromise. 124 patients treated medically were compared to 57 patients treated with surgical debridement. The medical treatment group demonstrated a significantly higher failure rate, 40.23% compared with 17.54% ($p = 0.0023$). The majority of medical failures were caused by inadequate control of the infection requiring surgical management, while the majority of surgical failures being the need to return to the operating room. At final follow-up there were no significant differences noted between groups regarding neurologic outcome, and all surviving patients had demonstrated clearance of infection. Given this, the authors suggest that surgical treatment of SEA without neurologic compromise can be reserved for patients that have failed an initial trial of medical management.

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