American Academy of Orthopaedic Surgeons Highlights from the Annual Meeting 2017

This year’s Annual Meeting was held March 14–17 in San Diego, California, USA, attended by approximately 11'000 surgeons. Among the hot topics for total hip arthroplasty (THA) which were intensively and controversially discussed in symposia and podium presentations were the following:

- Impact of bundled payment on the US orthopaedic health care system, costs and the consequences for clinical practice in hospitals
  - E.g. pre-diagnostics, health status, daycare, rehab, diagnosis, peri-prosthetic joint infection (PJI), patient reported outcomes (PROM), length of stay (LoS)
  - Hospital related issues and questions
  - Best treatment of chronically infected THA (single versus dual stage)
  - Posterior versus anterior approach
  - Dual mobility liners as a primary solution in THA
  - Trunnionosis, corrosion and its consequences for clinical practice
  - General usage of ceramic heads for primary THA
  - Status of highly cross-linked polyethylene at 10-16 years follow-up

This is a short summary of several topics related to bearings in THA. Abstracts can be found at: http://aaos2017.conferencespot.org/table-of-contents

Healthcare economy: revision and readmission

In a 10-year update Rajaee et al. reported that the THA revision rate in the US has increased at a slower rate than before. Especially surgically treated dislocations have decreased significantly, which may indicate improved techniques or products reducing instability. Nevertheless, the overall revision burden has increased significantly in the 45-64 year age group while decreasing in all other age groups. In a large cohort study with 4,662 patients Meyer et al. found no difference in the survival rate between younger patients and those older than 65, which is contrary to most registry data. Acetabular component loosening and PJI were the most common indications for re-revisions. According to Yu et al. the risk of re-revision failure increases if instability was the cause for reoperation at any point during the revision history, or if only an isolated head and polyethylene liner exchange was performed during the re-revision procedure.

In a prospective cohort study of 211 revisions after bacterial diagnosis Ravn et al. confirmed that sonication increases sensitivity and specificity of PJI diagnosis and showed several revisions originally classified as aseptic loosening as actually septic. The two most common strands identified were S. aureus and S. epidermidis.

Hospital readmission – a massive economic burden on the US healthcare system – was a hot topic covered by several papers looking at the causes and at methods to reduce complications that lead to 30 to 90-day readmission. Several presenters demonstrated numerous causes and also showed varying temporal trends during the postoperative recovery period. The majority of complications leading to readmission within a 90-day period are hospital and patient related, with more than a third of the economic burden found to be medical but unrelated to any total joint procedure. For example, increasing BMI values, general anesthesia, an ASA score of 3, and discharge to an inpatient rehab facility each have been identified as independent risk factors. Infection, anemia, joint or chest pain were among the most common factors for patients to return to the hospital. As a trend, several presentations suggested to optimize the patient’s status in order to achieve better pre-operative conditions.

Dual mobility constructs

The popularity of this implant option has increased steadily from a special treatment for rare and difficult cases to standard use in primary surgery, with almost no dislocations as its main advantage. Other arguments for dual mobility are the lower risk of reoperation and re-revision for dislocation as well as the results of several studies suggesting that dual mobility constructs may reduce complication rates when compared to large femoral heads. However, a study from a European register indicates that the incidence of revision for infection compensates the advantages.
Tribocorrosion

In a case presentation session Berry highlighted the reasons for tribocorrosion, its diagnosis and treatment. For most revisions he recommended the conversion of the metal head to a ceramic one with a sleeve, if the stem taper is not dysfunctional, commenting that the latter has not caused major problems yet. In a registry analysis on MoM revisions performed for adverse reaction to metal debris (ARMD) Matharu et al. showed a significant risk of re-revision within five years after ARMD revision.

A presentation by Dearborn showed that one third of patients presenting with a painful hip arthroplasty had elevated serum cobalt levels and a large percentage had abnormal findings on metal-suppression MRI. Revision surgery performed in this population confirmed tribocorrosion and adverse local tissue reaction (ALTR) in 95%. Fillingham et al. reviewed 447 consecutive patients with serum metal levels tested at their institution and identified 66% positive for ALTR. They determined a threshold cutoff of $\geq 1.0 \text{ ng/ml}$ for Co with a sensitivity of 100% and a specificity of 90%. The threshold cutoff for Cr was $\geq 0.15 \text{ ng/ml}$ with a sensitivity of 100% and a specificity of 50%. The Co to Cr ratio was also helpful for ALTR diagnosis with a threshold cutoff of 1.4, a sensitivity of 93% and a specificity of 70%. In a presentation about wear analysis of tapers from failed metal- on-PE hips Hart et al. indicated that approximately 1.4mm/ year is a clinically significant dose of Co and Cr to induce ARMD. In their retrieval study of a single THA design Martin et al. found a volume loss of the stem taper of 2.5mm$^3$ with the greatest magnitude taking place on the distal edge of engagement. They concluded that taper mismatch, combined with the metallurgy is likely to contribute to the initiation of a crevice-driven degradation mechanism.

Noble et al. showed their findings on tribocorrosion in various presentations. They found that bending of thin necks, common today, can result in fretting damage of the contacting surfaces, increasing tribo-chemical attack and additionally cause a separation of the interfaces at the trunnion-head junction. This leads to crevice formation, triggering corrosion by exposure to the surrounding physiological environment. His group also investigated 384 explants and observed that the damage patterns on the stem taper of almost half of the trunnions are not circumferential, suggesting misalignment of the head during assembly which may be responsible for the corrosion cascade. Based on this observation the authors used an instrumented femoral stem and had 15 board-certified and trainee surgeons impacting a metal head with an instrumented hammer to measure the magnitude, direction and temporal variation of the impact force. The results showed large off-axis forces during impaction as well as a large variation in the magnitude and direction of these forces. The authors concluded that this variability might contribute to the incidence and severity of mechanically assisted corrosion in total hip replacement.

Articulation

This topic was discussed in several sessions and presentations with a specific focus on highly cross-linked polyethylene (XPE) and a general use of ceramic components. Hopper et al. compared the results of patients with conventional PE and XPE at a 15-year follow-up period using ceramic heads. Their results highlighted the fact that using mostly 32mm ceramic femoral heads they had a very low incidence of osteolysis even with conventional PE. Several groups presented their experience with XPE and a follow-up of 10 or more years. Uniformly they concluded that XPE is a solid solution for THA, even with large heads. In a retrieval study Holdcroft et al. determined that the extent of cross-linking does not seem to affect the wear rate of XPE liners.

In his presentation at the HIP Society Meeting Lombardi showed the benefits of ceramic as a resource to reduce wear, osteolysis, revision, dislocation and infection. All surgeons on the panel of this session stated that they use ceramic heads for all patients below the age of 75. In a podium discussion at the symposium “Great Debates in Total Hip Arthroplasty”, it was argued that the only reason not to use ceramic heads for all patients is cost. Yoshitoshi et al. concluded from their comparative study that the wear rate of CoC implants was significantly lower than that of MoXPE implants, although the Kaplan-Meier survival at 10 years, with implant loosening and revision THA as endpoints, did not differ significantly. They recommend longer-term studies to better understand the effects of wear rate and material bioactivity on implant longevity.