Current controversies in hip surgery
A REPORT ON THE PROCEEDINGS OF THE LONDON HIP MEETING 2011

F. S. Haddad,
S. Konan

From University College Hospital, London, United Kingdom

An international faculty of orthopaedic surgeons presented their work on the current challenges in hip surgery at the London Hip Meeting which was attended by over 400 delegates. The topics covered included femoroacetabular impingement, thromboembolic phenomena associated with hip surgery, bearing surfaces (including metal-on-metal articulations), outcomes of hip replacement surgery and revision hip replacement. We present a concise report of the current opinions on hip surgery from this meeting with appropriate references to the current literature.

At the London Hip Meeting, held at the QE2 Centre in Westminster in April 2011, an invited international faculty of 21 leading orthopaedic surgeons and over 400 delegates shared recent evidence, expert opinions and probable future developments facing hip surgeons. This paper aims to report the key messages from this meeting and provide an overview of the current thinking in hip surgery with some appropriate references to the literature.

Where are we today with femoroacetabular impingement (FAI)?
It is considered that the incongruency and static overload arising from FAI causes misalignment of the hip, predisposing to secondary osteoarthritis.1,2 FAI is a novel pathomechanical concept proposing peripheral damage to the hip from minor, often unrecognised deformities of the femoral head or acetabular rim.3 Post-traumatic alteration of the anatomy of the femoral head and neck also predisposes to FAI.4 Patients with residual cam deformity following internal fixation of intra-capsular hip fractures have a statistically significant higher incidence of failure and subsequent revision surgery (p = 0.02).5,6

In order to treat patients with symptomatic FAI surgically, it is necessary to be able to ‘map’ the area of abnormality accurately. It was proposed that the acetabular profile is the same in both cam and pincer type impingement, albeit with pincer acetabula being deeper and the cam acetabula being shallower than the ‘normal’ acetabula.7 In the cam type femoral head, the articular surface extends further than ‘normal’ from 290° to 140° (11 o’clock to 5 o’clock).8

Treatment of articular cartilage defects of the acetabulum or femoral head secondary to impingement may delay progression to osteoarthritis.9 Autologous membrane induced chondrogenesis of chondral or osteochondral defects (> 3 cm²) as an adjunct procedure while addressing the mechanical aetiology of impingement has shown promising results at early follow-up (up to 24 months) in a small selected patient series.10

Hip surgery and venous thromboembolism: do we have the answers?
Total hip replacement (THR) incites a thrombogenic response. The per-operative serum levels of thrombogenic markers increase during insertion of the femoral component.11 However, there is no significant difference in the serum levels of thrombogenic markers when comparing resurfacing with THR.12

The issue of thromboprophylaxis and lower limb arthroplasty remains controversial.13-16 However, several questions remain unanswered, including whether there is an association between screened deep-vein thrombosis (DVT) and death from pulmonary embolism (PE), if there is an increased risk of bleeding from pharmacological thromboprophylaxis, what the association is between screened DVT and the post-phlebitic limb, and the true impact of orthopaedic surgery on death from PE.

The bearing surface: an evolving challenge?
Polyethylene has been used for more than three decades as a bearing surface in THR. Highly crosslinked ultra-high-molecular-
weight polyethylene (UHMWPE) has shown much lower (0.003 mm/year) penetration rates compared with conventional polyethylene (0.136 mm/year) as measured by the median total femoral head penetration into polyethylene liners using radiostereometric analysis (RSA).

This is true for 28 mm and 32 mm heads up to ten years postoperatively. Preliminary studies show reduced wear but an increased rate of linear penetration when using large heads (36 mm and 40 mm). Analysis of retrievals suggests that degradation with oxidation and loss of crosslink density of polyethylene occur during ex vivo storage. Cyclic loading and absorbed lipids in vitro accelerate oxidation of UHMWPE. The mechanical properties and oxidative stability of irradiated and annealed or re-melted highly crosslinked UHMWPE may be enhanced by stabilisation with the addition of vitamin E, which results in superior total median penetration according to RSA data at early follow-up.

Changes in the articulating counterface might also reduce the rate of polyethylene wear. Laboratory data for Oxinium (97.5% zirconium, 2.5% niobium alloy; Smith & Nephew, Memphis, Tennessee) confirms no risk of fracture in the presence of a low coefficient of friction against UHMWPE, favourable abrasive resistance and wear properties. A randomised controlled trial comparing Oxinium-PE and stainless steel-PE showed lower median linear penetration and a lower median volumetric rate of penetration at follow-up of three years.

The size of the femoral head may influence the success of the bearings used in hip replacement. While the optimum femoral head size remains to be established, it is clear that using large modular heads is no substitute for good surgical technique and accurate positioning of the component. Currently surgeons use a variety of femoral head sizes varying from 22 mm to 40 mm and above. There is a tendency to favour larger diameter heads in order to increase the stability of the ball and socket articulation.

**Traditional solutions versus modern trends in hip replacement: cemented or cementless?**

Based on the published literature and results from National joint registries, cemented all polyethylene acetabular components continue to serve a very reliable role in hip replacement. Analysis of the joint registry data shows that, paradoxically, there seems to be a shift in surgeon preference towards uncemented implants in England and Wales, Australia, Norway and Sweden.

Increasingly, surgeons are faced with the task of reconstructing the hip to satisfy the needs of high-demand patients. The implant-related choices that the surgeon has to make to achieve optimum results are the design of the stem to restore offset, version and leg length, the bearing surface and the method of fixation. In designing implants the testing methods should simulate the anticipated in vivo fixation and loading conditions. The clinical perspectives to be taken into account for a hip expected to provide so-called high performance are body mass index, patient activity level, restoration of biomechanics and the available bone stock.

The modern modular acetabular component offers versatility in shell size, geometry, surface finish, adjuncts and augments as well as independent liner options of head size, laterisation and adjustment in orientation. In primary THR, the modular acetabular component has shown excellent clinical function, low wear rate and high long-term survival while preserving bone stock. Modular acetabular components also offer numerous options to facilitate biomechanically sound reconstruction at revision surgery.

**Metal-on-metal: beyond the controversy**

The recent concerns with metal-on-metal (MoM) articulations have highlighted the complications of the reduced arc of acetabular cover with resurfacing acetabular components and stem trunnion wear of large head hip replacements. Adverse reaction to metal debris (ARMD) is the mechanism demonstrated by most failed MoM bearings.

The use of levels of metal ions in the blood when investigating MoM articulations is limited and the results should be interpreted in the light of the clinical situation. Levels of approximately 2 ppb for either cobalt or chromium are considered normal for a well-functioning MoM hip, whether a resurfacing or replacement. The threshold between high and low ion level is uncertain, but may be approximately 7 ppb. A lower cut-off level increases the sensitivity but decreases the specificity as better-functioning replacements will have levels above this cut-off. A level of 4.97 ppb has been proposed, giving a sensitivity of 63% and a specificity of 86%.

Failure of an implant is related to three broad factors: implant-related, surgeon-related and patient-related. It has been a common observation that hip simulators do not always predict the clinically observed wear of hip replacements. Results from retrieval analysis may help us to understand the mechanisms of failure. Once the patient and the implant have been optimised, malpositioning of implants with steeply inclined acetabular components and resultant edge-loading is commonly associated with failed hip replacements.

It is acknowledged that hip resurfacing is still a viable choice and probably provides better functional outcome in young patients, especially men.

**Optimising outcomes in hip surgery**

Surgeons can deliver better value in healthcare in hip replacement surgery by better surgical training to reduce the revision burden, appropriate implant selection and improved techniques to reduce costs. Theatre efficiency may be improved by adequately planning the theatre list, having good surgical exposure with proper respect for the soft tissues, avoiding repetition in steps and ensuring effective closure.
Minimally invasive THR has the theoretical advantages of less tissue dissection, reduced rehabilitation and better outcome. Various minimally invasive approaches have been described such as direct anterior, anterolateral, posterior and the two-incision approach. However, functional improvement, length of stay, satisfaction and analgesic requirement are multifactorial and not governed by the length of the incision or surgical approach alone.

The limitations of the currently available outcome measures are that in databases such as joint registries, patient-reported outcome measures and the surveillance of surgical site infection are not linked. Additionally there is a lack of adjustment for case-complexity and real time monitoring when looking at outcomes. For example, the use of patient-reported outcome measures does not always differentiate complex surgical procedures from routine procedures. The readmissions and complications may not be reflected by national databases when reporting outcomes. Also, patient-related outcomes are not linked to joint registry data.

Technological developments have been a powerful force in the evolution of joint replacement. However, new technology can be expensive and when adopted the benefits must be demonstrable to justify costs. What’s new in revision hip arthroplasty?

Most joint registries suggest approximately a 10% incidence of revision hip surgery at ten years. However, by improving the standard of the primary procedure, the Exeter Hip Unit have demonstrated a fall in revision burden despite an increase in primary procedures.

A well-fixed cement-bone interface can last well beyond 30 years. New cement used at revision bonds to old cement with an interface, stronger than the cement-bone interface. A five-year follow-up study of 191 cases of femoral cement-in-cement revisions has shown no re-revision (2 to 7 years) of acetabular cement-in-cement revision suggesting good results with an incidence of less than 1% of aseptic loosening.

The risk factors associated with femoral failure are corrosion and metallurgy, laser etching, inadequate proximal support, high body weight, increased offset, high patient activity and impingement. In cases of revision, it is important to maintain proximal bone stock and support, which can be helped by early controlled osteotomy to avoid unforeseen damage to the available bone stock.

Constrained acetabular liners have a role in specific indications such as neuromuscular disorders, inadequate soft tissues, deficient abductor mechanism and selectively for poor patient compliance or cognitive impairment. The incidence of peri-prosthetic femoral fractures has been reported to be approximately 4.1%. The risk factors are poor bone stock, general medical disorders predisposing to falls, and implant-related risk factors. Treatment strategies depend on the stability of the fracture, the stability of the implant, the location of the fracture, the quality of bone stock and the design of the implant. Often osteosynthesis alone is adequate in stable implants while unstable implants require revision surgery. Little information is available concerning peri-prosthetic acetabular fractures. The incidence may be increasing due to the use of cementless components with a reported incidence of 0.4% compared with an incidence with cemented components of < 0.02%. The design of the component may also influence the incidence of fracture; elliptical monoblock implants have the highest risk of fracture, but it is recognised that these implants will have been required when there is a deficient acetabular bone stock. Other predisposing factors include metabolic bone disease, minimally invasive techniques, technical errors and revision operations. The management of acetabular peri-prosthetic fractures involves detailed planning and the use of techniques involving column plates and revision shells with or without augments, allograft and cage devices, and custom-made implants.

Conclusion

The past decade has seen great advances in the field of hip surgery. Hip arthroscopy is increasingly used and its role and indications will evolve further. In the field of hip arthroplasty, there will be greater awareness for the role of precision in restoring biomechanics as well as use of reliable and time-tested implants to reduce the revision burden. Revision surgery on the other hand will be aimed at decreasing morbidity and improving function by simplifying interventions, by improving fixation and by restoring bone stock. In the next few years, hip surgery will aim for further safe improvements in quality of life and patient outcomes while reducing complications, early failures and overall costs.


No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References


50. Sculco TP. The economics of new age arthroplasty: can we afford it? Orthopedics 2010;33:628.


