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1 NICE medical technologies guidance (MTG19). Published date: June 20 2014.

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FEATURE
 Rib fracture fixation under the spotlight
Mohammed Ali died on June 3 2016. Perhaps one of the most successful sportsmen of all time, Ali was widely regarded as a strong political force and human rights activist. A fearsome fighter, he was also known for his love of poetry (sometimes of dubious quality) and support for the black emancipation movement in the USA, conversion to Islam and continuous presence on the world stage throughout a long and difficult fight with Parkinson’s disease. Despite his reportedly low IQ, having scored 78 on a US army recruitment test, Ali remarked “I said I was the greatest, not the smartest”. An amazing insight into one of the world’s most colourful, successful and inspirational people.

Human beings are not good at separating personality traits and physical characteristics. Just because an individual is able to run 100 m faster than anyone ever before does not make them more insightful in politics or their views on world peace any more worthwhile than the next person’s. However, we do bestow worth to the opinions and thoughts of highly-performing individuals. It is the same in surgery, why should someone who is particularly good at an operation have special insight into the design features of an implant? Why should a professor of orthopaedics with world-leading insight into biphasic models of bone substitutes be any better at fixing an ankle fracture than the next surgeon? However, we do live in a world of celebrity, and this does extend to orthopaedic surgery as well. Our opinion leaders tend to be excellent surgeons, but are they also excellent scientists?

There are a number of papers in this month’s 360 that call into question the status quo – perceived wisdom handed down by orthopaedic greats. In an excellent feature article calling into question the rationale behind total knee arthroplasty, Mr Kos Sehat asks, is there a better way of achieving balance in the knee? Should we still be constrained by the early biomechanical and tribological limitations of implants, or is there a better, more physiological way to implant a total arthroplasty? Sticking with the total knee, the question of all polyethylene tibial components has raised its head again – previously derided based mostly on the success of the AGC knee (BioMet, Warsaw, IN), it turns out that with a modern eye, the modular components may well have the edge, but things are not as straightforward as once thought, and indeed if the metal-backed components do have an edge, it is because of the modularity rather than anything else. A similar difficulty can be seen with a paper on rationing in hip arthroplasty, although from a well-respected group, the science is poor, and hence the message of the paper that the New Zealand score can be used to ration total hip arthroplasties is far from accurate. In fact the paper does not present any data to support use in rationing, and the rather rudimentary statistics run the risk of giving a damaging message to clinicians and healthcare funders.

The difficulty with a complex specialty like surgery is that it takes more than skill with a knife to make sensible decisions not just on a patient-by-patient basis, but also on a hospital-wide and population-wide basis. Now more than ever, a marriage between clinicians and scientists is needed to move the specialty forwards. The current environment is one of thrift and value; not which option is best, but which is cheapest. Choosing economy over quality, and with an ever-increasing array of interventions, higher expectations than ever before determining which is the best intervention, who will benefit and why is becoming increasingly difficult. I cannot help thinking that we are missing something at the moment – if the days of the all-knowing chief of surgery are numbered, what are they to be replaced with? A myriad of randomised controlled trials all proclaiming ‘no difference’, In an age where we are mature enough to accept that different skills are needed for different approaches, the profession needs to embrace its scientists, and also ensure there is new direction of scientific clarity and leadership to ensure that relevant scientific messages are given as much of a platform as surgical technique. The age of sportsmen like Muhammed Ali who double as civil rights activists and the voice of social conscience are probably gone, so too probably is the day of the single ‘key opinion leader’, hopefully to be replaced with something wholly better.

REFERENCES
Surgeons want the best possible outcome for their patients and to work in a system that lets them excel. Sometimes, this ambition can be threatened by the financial or time constraints of the NHS. Yet it’s possible to give some freedom back to clinicians by implementing solutions that help minimise the impact of some of these limitations and help surgeons concentrate on their priority — the patient.

Feedback from orthopaedic surgeons shows their priorities are mitigating the risk of never events, specifically component-size mismatch; feeling reassured the implants are clinically proven; using simple digital solutions that remove procedural variation; having end-to-end support for theatre staff; and having access to insights through analytics — all in the service of improving patient outcomes.

Syncera, a business unit of Smith & Nephew, delivers a unique combination of digital solutions and clinically proven implants, designed to help reduce unwarranted perioperative variation and optimise operating theatre efficiency. We provide personalised, accessible on-site support and use technology to remove human error, not humans, from the surgical process.

Mitigating the risk of never events:
A US-based study by orthopaedic surgeons using a cohort of 1,450 patients found implant-related errors occurred with implants 5% of the time.¹ For one in every 20 surgeries, things did not proceed as planned in theatre. The authors implemented a computer-based e-tracking and compatibility system that standardised implant labelling, confirmed correct size and side (and patient), and ensured implant compatibility. The system saved valuable time and effort for surgical teams. Syncera’s automated point-of-care error checker catches potential errors before the patient goes into theatre, improving quality and potentially reducing implant-related waste by up to 85%.¹

Maximising the effort of your team:
When surgeons walk into theatre, everything should be ready: patient, implant and, just as importantly, the techs and nurses they’re scrubbing in with. Personalised training and digital set-ups from Syncera help ensure that operating theatre personnel statistically significantly improve procedural knowledge and skill acquisition.² The ‘Getting It Right the First Time’ report by Prof Tim Briggs highlighted the importance of well-trained, engaged and empowered theatre staff to positive patient outcomes.³ With Syncera, surgeons can excel because theatre staff will have been tested on each surgeon’s preferences. The first case of the day will be the same as the third, or as the fifth case next Wednesday.

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proven implants lends surgeons peace of mind. Combined with Syncera’s digital solutions, which are designed to standardise intraoperative processes and deliver high-quality education for theatre staff, you could be on the road to eliminating unwarranted variation. Think of it as ‘personalised predictability’.

“In light of the financial austerity the NHS faces, we have a duty to make sure that we reduce unwarranted variation and complications, in order that our resources can provide patients with the high quality care they require,” says Prof Tim Briggs, National Director for Clinical Quality and Efficiency.3 We consider that standardising tried-and-tested prostheses can be a significant step to allow you to drive down costs.6

For orthopaedic surgeons striving to ensure excellent patient outcomes, to eliminate unwarranted variance, and to help address economic and wastage issues, Total Joint Solutions from Syncera, powered by Smith & Nephew, provides a simplified, straightforward route. For more, visit syncera.co.uk or email bryn.davies@syncera.com. We streamline where needed, connect where disjointed and personalise where it matters. A different kind of operation. We are Syncera.

References
Total knee arthroplasty at a crossroads: choosing the middle way

Anatomical total knee arthroplasty alignment versus conventional mechanical alignment; or a combination?

INTRODUCTION

Total knee arthroplasty (TKA) surgery faces a dilemma. The established method of alignment to the mechanical axis results in excellent implant longevity, but with less than ideal clinical functional and pain outcomes for some patients. A relatively recent development has been the concept of TKA implant positioning according to individual patient anatomy (also known as ‘kinematic’ alignment). There is evidence that anatomic individualised TKA implant positioning results in markedly improved functional outcomes. However, the methods published so far involve implant positioning that is not consistently aligned to the mechanical axis. Therefore, there is some justified concern that improved function is being achieved at the expense of compromised, long-term durability.

Conventional TKA creates resections according to the mechanical axis. Intra-operative releases and post-operative physiotherapy adapt the soft tissue to comply with the implant position and biomechanics. The outcome of this process can be variable. Anatomic individualised TKA ‘resurfaces’ the knee articulation so that the implants are in congruity with soft-tissue biomechanics at the onset. This means less need for soft tissue adaptation and less likelihood of stalled rehabilitation.

The rationale behind the concept of anatomic individualised TKA is becoming more widely accepted, and the ‘best of both worlds’ can be achieved (Table I).

BACKGROUND

Total knee arthroplasty is one of the most successful and widely-performed surgical procedures in the world. Annually, 80 000 cases are performed in England and Wales and The National Institute for Health and Care Excellence (NICE) considers interventions costing less than £20 000 per QALY to be cost-effective. A study by Dakin et al calculated TKA to cost £5 600 per QALY, which is well below this threshold; the same conclusion was reached in Scotland. Therefore, there is a justification for the increasing number of TKA performed. However, in the USA, over 700 000 TKA are performed annually, a figure that is expected to increase by 673% to 3.48 million annually by 2030. The overall health economic burden of TKA in all countries is enormous, placing further importance on the surgeons’ ability to perform the operation as well and with as little cost as possible. The success of the operation can be defined in terms of the durability of the implant and also the quality of the clinical outcome.

MEASURING THE OUTCOME OF TKA

Durability

The National Joint Registry of England and Wales (NJR) records a ten-year revision rate of less than 3% for the most commonly-used and best TKA implants aligned according to established conventional techniques. Aseptic loosening is an indication in 1.4/1000 patient years...
revisions; soft-tissue problems such as instability and stiffness are an indication in 0.73 and 0.39 revisions/1000 patient years respectively. Revisions for symptomatic TKA that have not failed are only carried out for extreme cases. The incidence of revisions for soft-tissue problems is likely to under-represent the prevalence of this type of symptomatic TKA, as revisions in this circumstance are known to have variable results and surgeons are widely hesitant to perform them.

Clinical outcome
This can be measured in terms of overall patient satisfaction and large-scale surveys in England and Wales, Canada, Sweden and the New Zealand Joint Registry have all produced similar findings of around 80% satisfaction. A more objective assessment of functional improvement can be made using a validated domain-specific scoring system such as the Oxford Knee Score (OKS). This is measured nationally in England and Wales and shows an overall improvement of 16 points at six months. This contrasts with a 20 point improvement for THA with the Oxford Hip Score (OHS). It must be remembered, however, that although the OHS and OKS are designed to be reliable and responsive, they are unlikely to be point-for-point comparable across the whole range.

Nam et al surveyed patients in the United States following TKA. They looked for the prevalence of a knee that felt ‘normal’ and found it to be 66%. There was no relationship between the type of implant or alignment method and the status of ‘normality’, with only one exception: the so-called ‘kinematic’ method of alignment. This correlates with significantly improved clinical outcomes following TKA with contemporary implants, described for ‘kinematic’ alignment by Dossett and Howell. Dossett showed a seven point OKS advantage for the ‘kinematic’ group over traditional alignment at one year. The minimum clinically important change when comparing groups of patients is five points. Thus, it appears that there is the potential to improve the clinical outcome of TKA. However, the method employed by Dossett and Howell is no longer available and it involved implanting the tibial component oblique to the mechanical axis, raising concerns over implant durability. Nonetheless, there remains a strong interest in reproducing these results by other means.

BIOMECHANICAL CONSIDERATIONS
The knee joint, in common with other joints, can be considered as a composite of the hard articulation and the soft-tissue envelope, which function together as one biomechanical unit. In the native healthy joint, there is absolute congruency between the biomechanics of the hard articulation and the soft tissue envelope. Typically there is some laxity of the lateral soft tissue in flexion and tautness of most structures in full extension. If the hard articulation undergoes prosthetic arthroplasty, it is necessary to maintain the congruency between the articulation and the soft-tissue biomechanics for good function. Soft tissue placed under tension causes pain and stiffness (Fig. 1). Excessive laxity causes symptomatic instability and also instability-related pain.

The femur, tibia and patella have a complex dynamic spatial relationship with each other, maintained by the soft-tissue envelope, which imparts stability whilst permitting controlled motion. A well-functioning TKA would, therefore, resurface the joint without disturbing the spatial relationship between the bones of the joint, and hence without introducing excessive laxity or tension to the soft-tissue envelope.
Anatomical studies by Freeman and Monk and Eckhoff allow a conceptual mechanical model of the knee to be described. Each femoral condyle has a particular radius, and the medial condyle is larger than the lateral in most subjects with individual unique variation. Knee flexion occurs around a single axis passing through the centres of both condyles (Fig. 2).

Given that the two condyles have different and unique radii, the axis is also in a unique position, which is not, therefore, parallel with the surfaces of the condyles (unless the patient happens to have femoral condyles of equal radii; Fig. 3). For the typical patient, the medial femoral condyle with a larger radius will articulate with a lower medial tibial plateau, relative to the lateral tibial plateau.

Komistek showed that knee rotation around a longitudinal axis during flexion is a product of differential rollback of the femoral condyles, and occurs around the medial compartment (the medial pivot principle). Eckhoff demonstrated that medial pivot rotation is still consistent with femoral condyles functioning as cylinders. Komistek also showed however that only half of TKAs exhibit medial pivot motion.

In extension the femoro-tibial articulation makes maximal contact at a point approximately one-third along the anterior-posterior axis of the tibial plateau (Fig. 4).

In 90° of flexion, the point of maximal contact rolls back to approximately two-thirds along (Fig. 5). The collateral ligaments maintain physiological tension in accordance to the spatial relationship between femur and tibia through this natural path of motion. If the sagittal posterior slope of the tibial plateau or the posterior offset of the femoral condyles were altered, the spatial relationship between the femur and tibia would change, affecting the soft tissue tension in flexion.

The spatial relationship between patella and lateral femoral condyle and motion of the patella-femoral joint follows another conceptual cylinder in the distal lateral femoral condyle and trochlea, also restrained by the soft-tissue envelope of the knee. The anatomical features of the knee that drive the biomechanics follow
Bone & Joint 360 | volume 5 | issue 4 | august 2016

A unique single axis of rotation passes through the centres of both femoral condyles (not necessarily perpendicular to the mechanical axis of the limb or femur or tibia; it is only shown as such in this diagram for simplicity).

Fig. 3 Schematic representation of the natural femoral-tibial articulation. A unique single axis of rotation passes through the centres of both femoral condyles (not necessarily perpendicular to the mechanical axis of the limb or femur or tibia; it is only shown as such in this diagram for simplicity).

Fig. 4 In extension the femur articulates with the tibia at the 1/3 posterior position.

Constitutional malalignment as a risk factor for osteoarthritis and implant failure

It is a commonly-held belief that constitutional varus or valgus beyond a few degrees is a risk factor for the development of osteoarthritis (OA), and surgeons have sought to ‘correct’ alignment to the neutral mechanical axis, lest the implant succumb to the same fate. The evidence for this phenomenon is scant. Pathogenesis of OA is multifactorial, and meniscal tears earlier in life are a significant risk factor.

Parratte27 and others have studied the link between implant durability and limb alignment. They showed that contemporary TKA implant failure at 15 years is associated with alignment beyond 8° from neutral, but not smaller amounts of angulation. However, one needs to allow for the inaccuracy in instrumentation and measurement error (usually around 3°).

LIMITATIONS OF CONVENTIONAL TKA TECHNIQUE

Limb alignment

Conventional TKA technique is directed at the ‘typical’ knee and makes certain assumptions concerning coronal limb alignment:

- In extension, distal femoral and tibial resections are made perpendicular to the perceived neutral mechanical axis. It is assumed that this will produce a rectangular (i.e. balanced) extension gap. However this would only be the case if the patient truly had a neutral axis (which only a minority do) and the resections were accurate.

- If the standard resections do not produce a rectangular extension gap, this is due to ligament contracture or stretching. This may sometimes be the case, but an alternative explanation is that the patient may simply have had a constitutional varus or valgus limb or there may be some inaccuracy in the resections.

- Ligament releases are required to ‘match’ the soft tissue to the resections. In fact the surgeon is sometimes making unnecessary soft tissue releases in order to change the otherwise normal soft tissue to comply with any inaccuracy in the resections or to change an acceptable small degree of constitutional varus or valgus to comply with the resections.

Given that most limbs have a constitutional varus posture, conventionally the surgeon will make resections according to a neutral posture. However, this would only be the case if the patient truly had a neutral axis (which only a minority do) and the resections were accurate.

The limb axis

Conventionally, a neutral mechanical axis of the limb has been described passing through the centres of the hip, knee and ankle23 (Macquet’s line) and traditionally TKA surgeons have sought to position the prosthesis perpendicular to this, with the aim being symmetrical and perpendicular implant-loading, with a mostly stable compressive force being applied during stance phase at the implant-bone interface (+/- cement) (Fig. 6). There are, however, some further considerations. Healthy subjects exhibit a unimodal distribution of lower limb alignment as a typical biological variable. The mean alignment of healthy knees is in fact about 2° of varus (more varus for men)26 with several degrees of variation. Even if the mechanical axis is described in the anatomical position, during gait the limb itself is loaded in a variety of angles, mostly varus (given that when patients walk, they tend to place the feet nearer to the midline than in the anatomical position). On the other hand, obesity (increasingly a feature of patients undergoing TKA) holds the thighs apart, imparting a more valgus posture. This variation means that the TKA implant is subjected to loading within several degrees either side of the neutral mechanical axis.

well-understood principles; however, the positions of the axes are unique to each knee.
Most patients have a lateral compartment that is higher than the medial. Thus conventional technique resects less than implant thickness from the medial tibial plateau thereby raising the medial joint line with the implant (Fig. 7a). In effect the tibial implant is positioned according to the lateral compartment joint line.

Meanwhile the distal femoral resection is measured using jigs that rest against the more prominent medial femoral condyle (Fig. 7b). Thus the resections overlap (Fig. 7c) and are also subject to individual anatomy and surface wear. Joint line restoration is therefore approximate. Restoration of the joint line directly correlates with function and is not optimal with conventional TKA technique.

The distal lateral femoral condyle resection is thinner than implant thickness and leads to distalisation of the lateral femoral condyle with the femoral implant [Fig. 8]. This imparts pressure against the patella in flexion and hence the lateral soft tissue. This can contribute to lateral soft tissue tension, pain and limitation to flexion (Fig. 9).

Conventional TKA flexion gap

Typically patients have a lateral femoral joint line that is higher than the medial equivalent to 3° of angulation relative to the tibial axis. Having made a ‘flat’ tibial resection, the most commonly used conventional method (measured resection) introduces an arbitrary 3° of external rotation to the femoral component position, in order to compensate and achieve a balanced flexion gap. However, if the patient has a different coronal joint slope, the arbitrary 3° will not result in a balanced flexion gap (Fig. 10). Wear of the posterior femoral condyles also affects posterior referencing jigs as does medial or lateral release performed for the benefit of the extension gap. Balanced flexion gap resection is possible but when used in conjunction with otherwise standard conventional technique, there is no evidence to show an improved overall outcome.

Conventional TKA tibial resection posterior slope

This is usually arbitrary and surgeons will either use the implant manufacturer’s recommended slope, or have their own preference. If the tibial resection that is made is less steep than the native anatomy, the size of the flexion gap is reduced and vice versa (Fig. 11).
If the posterior femoral resection is a measured resection and hence fixed, the soft tissue tension in flexion will not necessarily be optimal.

**Computer navigation**

This uses the same principles as the conventional TKA methods but imparts greater accuracy. It has not been shown to improve the functional outcome. This suggests that accuracy of resection alone will not improve functional outcomes.

**Patient-specific instrumentation (PSI)**

Used as an alternative method of achieving conventional alignment, these devices do not offer any benefit in terms of alignment or clinical outcome. A comprehensive review concluded that available evidence did not show any overall benefit at all with PSI.

**IN SUMMARY**

Conventional TKA alignment makes certain assumptions and approximations and does not reproduce natural knee anatomy or biomechanics as faithfully as could be achieved. It also relies on soft tissue releases and post-operative soft tissue adaptation, which can be unpredictable. We can hypothesise that these limit the average functional outcome and may produce poor outcomes for some patients especially patients with atypical anatomy, whom the usual ‘recipe’ does not suit.

**THE CASE FOR ANATOMICAL LIMB ALIGNMENT**

Resection angles can be individualised to the constitutional axis of the patient. Many surgeons already resect the tibia perpendicular to the tibial axis and then vary the distal femoral resection to ‘gap-balance’ the extension gap. Some authors make anatomical tibial and distal femoral resections. In both cases the tibial and femoral components are not necessarily aligned to the overall limb mechanical axis, however, the former method appears to have greater acceptability in review articles probably because there is evidence that excessive varus tibial component positioning is a risk factor for loosening.

The limitations of this approach are as follows:

- The surgeon is assuming that the soft tissue remains in its pre-disease state. In fact in the presence of even moderate...
acquired deformity, stretching or contracture of soft tissue may have occurred and soft tissue guided alignment may not reproduce pre-disease anatomy.

- If aligning to the constitutional axis, some patients will have extreme alignment. This may result in TKA alignment outside an acceptable range. There would need to be a measure to ‘moderate’ and still make releases for outliers.

**THE CASE FOR ANATOMICAL IMPLANT POSITIONING**

The intention of anatomic implant positioning is to perform a ‘resurfacing’ and thereby position the implants according to the anatomy of the individual patient, which by definition will be congruent with the soft tissue biomechanics and hence may produce better functional outcomes.

The evidence for the improved outcome is using a technique called ‘ShapeMatch’ made available by Stryker but then withdrawn due to regulatory issues and poor outcomes in some outliers in terms of acceptable overall alignment. Nevertheless, the technique did produce markedly improved average functional outcomes, and interest remains strong in achieving this with alternate means.

The ‘ShapeMatch’ technique (also known as kinematic alignment) involved a pre-operative MRI, computed extrapolation of the pre-disease anatomy and patient-specific pinning blocks to make resections such that the implants would have the same articular surface interfaces as the pre-disease knee (Fig 12).

The limitations were:

- It assumed that the soft tissue remained in the pre-disease state such that good balance would be achieved with pre-disease hard articulation positioning. In reality it is likely that some soft tissue stretching or contracture occurs in arthritic knees and releases made for the surgical approach will also have an effect. Extent of osteophytectomy is surgeon-dependent.
- A symmetrical implant was being used to resurface an asymmetric distal femur. To achieve this, the femoral component was usually in internal rotation, placing the trochlea in a medialised position.
- ‘Sloping’ implants in the coronal plane relative to the tibial and limb axes. Marked angulation and asymmetric implants loading may be detrimental to durability.
- The methodology for the determination of the posterior slope of the tibial component and relating this to the posterior femoral offset was not explained.

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**Fig. 10** The larger radius medial femoral condyle articulates with the lower medial tibial plateau in extension (left) and flexion (right). A tibial resection perpendicular to the tibial axis (dotted line) resects less bone from the medial tibia. In flexion the femoral component is conventionally placed in 3° external rotation relative to the posterior femoral condyles in order to compensate, however, this is only accurate for the typical patient and not every patient as there is individual variation in the discrepancy between the joint level heights.

**Fig. 11** The flexion gap: the spatial relationship between femur and tibia in flexion is a product of the femoral AP size (including posterior femoral offset) and a matching tibial plateau height and posterior slope (green). If the tibial plateau is made more steep (red line) laxity results, less steep (blue line) results in tension.
Symmetric femoral component placed obliquely to replicate the distal and posterior surface landmarks of the two condyles

The two condyles are considered effectively as a cone

Distal femoral axis of rotation

Sloping tibial component corresponding to the differing heights of each compartment

Fig. 12 Schematic representation of ‘kinematic’ alignment. The femoral and tibial component are placed obliquely for distal and posterior surface landmarks to conform to the native anatomy. The lateral femoral condyle is not distalised, avoiding patella and soft tissue tension. The single axis of rotation still continues to function in the usual range of movement with the implants behaving as a true resurfacing within the range.

Fig. 13 The surgeon has three means of joint line restoration. a) ‘kinematic’ – sloping resections passing through both joint lines; b) perpendicular resections centred on the lateral joint line (the medial femoral condyle is downsized to match the lateral); c) conventional TKA resections centred on the medial joint line (the lateral femoral condyle is upsized to match the medial femoral condyle).

‘KINEMATIC’ TKA POSITIONING BY OTHER MEANS

In a bid to replicate these results surgeons have devised alternative methods. Unconventional application of conventional instruments and modified computer navigation technique have been described and some manufacturers (including Stryker) are developing new instruments for kinematic alignment. Such techniques can be successful but ‘off-piste’ surgery adopted by non-experts can be expected to carry a higher error rate. Femoral-tibial biomechanics are relatively easy to achieve with these techniques, but not patella-femoral biomechanics. Overall, some patients still achieve poor outcomes.

CONSENSUS ON ‘KINEMATIC’ ALIGNMENT

A majority of review articles have concluded that there is insufficient evidence for the safety of ‘kinematic’ implant positioning in terms of the potential detrimental effect on durability, and advise against the application of such methods until further evidence is available.

Currently there is only one published follow-up of six years.

CUSTOM IMPLANTS

For a ‘true resurfacing’ of the knee which is an individual and asymmetric structure, Conformis offer a custom-made TKA implant coupled with PSI kinematic alignment. However, this process adds to the cost of the procedure and has been carried out in relatively small numbers.

MORE ANATOMICAL MASS-PRODUCED IMPLANTS

Some manufacturers have produced new TKA implants which claim to improve biomechanics by virtue of being closer replications of normal anatomy. An implant design better based on the anatomy of the typical patient may improve the ‘hit-rate’ of conventional TKA technique; however the magnitude of this benefit is not known as clinical outcomes have not yet been published for these implants. Even with a superior implant, anatomical individualised alignment may further reduce or eliminate biomechanical outliers.

THE WAY FORWARD

The benefits of anatomical individualised alignment on soft tissue handling should be achievable without deviating greatly from the reassurance of symmetrical implant positioning and loading.

IDENTIFYING THE BENEFICIAL COMPONENTS OF ANATOMIC ALIGNMENT

The aim is achieving congruency between the biomechanics of the hard articulation and the soft tissue envelope. This means performing TKA with minimal disruption to the spatial relationship between patella, femur and tibia, hence minimising reliance on soft tissue releases and post-operative soft tissue adaptation.

The components are:

- Aligning to the individual, within an acceptable range of up to 3° from the neutral mechanical axis.
- Accounting for the differing joint lines of each compartment.
- Allowing for ‘wear’ when measuring resection thicknesses.
- Equal and accurately balanced extension and flexion gaps.
interface between the articular surfaces) allows implants to be positioned in a stable manner, perpendicular to the tibial axis.

**ADDRESSING THE DIFFERING JOINT LINES OF THE TWO COMPARTMENTS**

To position the implant in correspondence with both joint lines means *oblique* positioning (‘kinematic alignment’) (Fig. 13). To avoid this, the surgeon needs to either:

a) Lower the higher lateral joint line (i.e. upsize the lateral femoral condyle radius). This is conventional TKA. It tensions the patellofemoral joint (PFJ) and lateral soft tissue.

b) Elevate the lower medial joint line (i.e. downsize the radius of the medial femoral condyle). Coupled with a flat tibial resection (elevated medial tibial plateau), this maintains the anatomical spatial relationship between femur and patella.

**ACCURATE FLEXION GAP - RELATING POSTERIOR FEMORAL OFFSET AND TIBIAL POSTERIOR SLOPE**

Conventional TKA and even previously described ‘kinematic’ TKA have not achieved this priority to an optimum. In part this is because femoral component anterior–posterior (AP) sizes are incremental. Therefore, a stepless adjustment to flexion gap size is necessary to maintain an optimal flexion gap.

**ANATOMIC INDIVIDUALISED METHOD OF TKA ALIGNMENT (ADVANTICS)**

The ADVANTiCS project (http://advanticstka.com/) is designed to address some of the current constrains in total knee arthroplasty and proposes a novel surgical approach:

1) Osteophytectomy is performed and the knee is distracted in extension prior to any resections being made.

2) The joint gaps are thus opened up where articular cartilage has been lost. Joint gap guides (gauges) in 1 mm thickness increments are inserted into each compartment to ‘fine tune’ the tension in extension to feel physiological (Fig. 14). This means 1 mm incremental accuracy as is used for unicompartmental arthroplasty.

3) Measurement of limb alignment and correlation of gap sizes with cartilage loss allows the surgeon to determine if the knee...
has an outlier alignment. This may be either due to ligament stretching/contracture or excessive constitutional limb malalignment. Releases may be performed if required to bring such knees into an acceptable range.

4) Pins for distal femoral and tibial resections are inserted simultaneously, ensuring a balanced rectangular extension gap centred on the lateral joint line (identified by the joint gap guides). The resections are by default perpendicular to the tibial axis but with the function to dial in controlled small degrees of varus to optimise for knees with constitutional limb varus (Figs 15 and 16).

5) The knee is then distracted in 90° of flexion. Pins are inserted for the femoral posterior and anterior resections, parallel with the tibial pins for a balanced flexion gap. This is coupled to an adjustment to the posterior slope of the intended tibial resection, ensuring a balanced flexion gap of the correct size for the nearest incremental size of femoral component for appropriate posterior femoral offset for the individual knee (Figs 17 and 18).

The net result is that the femoral component is positioned aligned with the distal femoral axis of rotation (Fig. 19) and the implants are positioned perpendicular to the tibial axis for symmetrical loading. The larger medial femoral condyle radius is effectively reduced to match the lateral condyle with a corresponding elevation of the medial tibial plateau. (Fig.20). Femoral component internal rotation is avoided. This maintains the cylindrical biomechanics of knee flexion and achieves the benefits of anatomical implant positioning without oblique implant positioning being necessary but with the possibility for controlled and moderated coronal angulation to account for individual anatomy.

**CONFLICT OF INTEREST**

The author is directly involved in the development of ADVANTicS instrumentation. Both the author and institution have a commercial interest in this development.

**NOTE**

Surgeons interested in reading a more detailed explanation of the ADVANTicS technique or who wish to be involved with the project can visit: www.advanticstka.com for further information.
Fig. 19 Schematic representation of the new anatomic individualised (ADVANTICs) technique. The larger medial femoral condyle radius is reduced to match the lateral condyle radius. Tension on the patella and soft tissue is avoided. The single axis of rotation passing through the centres of both femoral condyles remains unchanged and obsolete implant positioning is avoided.

Fig. 20 Reducing the radius of the medial femoral condyle and raising the medial tibial plateau proportionately does not alter the axis of rotation. The spatial relationship and the biomechanics between femur and tibia remain the same.

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© 2016 The British Editorial Society of Bone & Joint Surgery. DOI: 10.1302/2048-0105.54.360451
Are generic implants really the future of orthopaedics?

A few experts at last year’s British Orthopaedic Association (BOA) Annual Congress in Liverpool seemed to think so. But that’s because they were choosing between a false dichotomy: generic implants that cost less, and branded implants that cost more. On that basis, the decision seems a no-brainer.

However, they didn’t consider another way, one that understands high-value patient care is multifactorial – and that it doesn’t have to sap precious resources. “The path to safer care is the same one as the path to lower cost,” Dr Gary Kaplan, the chairman and CEO of the Virginia Mason Medical Center in Seattle, USA, has been quoted as saying. He should know: Virginia Mason is recognised as one of the safest hospitals in the US. Hospitals in the NHS shouldn’t have to choose between cost and quality. It’s time to adapt the conversation to how hospitals can have both.

Syncera: Adapting the conversation

Instead of talking about cost, we should be talking about changing orthopaedic service delivery to embrace continuous improvement that identifies the good, helps remove unnecessary waste, and improves clinical efficiency without compromising patient care. New supplier models can contribute to multifactorial orthopaedic service delivery without entering a debate of the clinical efficacy of new to market unproven products. Syncera by Smith & Nephew (see Myth-busting Q&As) offers the NHS a viable alternative to current offerings. We believe achieving high-value patient care will benefit patients, payers, providers and suppliers. Here are the two key components to Syncera’s new supplier model.

1. Clinically proven implants

Syncera understands that surgeons want implants proven to deliver predictable, standardized, positive patient outcomes. Hospitals should focus on how to acquire clinically proven implants at a better value. Using the old standby of evidence-based medicine, Syncera delivers clinically proven implants, according to the Orthopaedic Data Evaluation Panel’s ratings, which are based on quality research, data, joint registries and publications:

- POLARSTEM™ – 5A*
- CPCS™ – 7A*
- GENESIS™ II – 10A*
- REFLECTION™ Cup – 10A*

Using proven implants lends surgeons peace of mind. Combining implant offerings with Syncera’s digital solutions, which are designed to standardise intraoperative processes, could help lead to an elimination of unwarranted variation and improved outcomes.
2. Interactive digital solutions
Syncera is more than an implant supplier. We offer you digital solutions (with a clinical transition specialist to support staff and surgeons along the way) with transparency on what you pay for – and what you don’t – so you can make a clear, informed choice. A quick look at the ways interactive digital solutions could help change the way orthopaedics are delivered:

• **Streamlined.** Customisable, surgeon-specific training helps staff know what's needed and when. Efficient tray inspection and tracking could result in up to 61% fewer instruments and a 60% reduction in processing costs.5

• **Connected.** With error-checker technology, an up-to-85% reduction in implant-related waste could be achieved while reducing the incidence of 'near-miss' events.6 Error-free ordering, automated product replenishment, and documentation of assembled cases and trays show what's available or missing, decreasing the chance you'll be caught short.

• **Personalised.** Staff training modules are designed to reduce staff orientation time by up to 40% which in turn has been shown to increase surgeon confidence in staff by providing scoring, instant feedback and rapid improvement with real-time metrics.5

Surgeons and hospitals should have ‘personalised predictability’, and that’s why Syncera wants to collaborate with Trusts to find savings they desire.

**Putting it all together with Syncera**
From Syncera’s perspective, value shouldn’t be a unit-price discussion but, rather, a focus on delivering high value patient care through multiple channels. Syncera offers a different service – combining high-quality implants with efficiency-enhancing interactive digital solutions – from other, traditional orthopaedic implant providers. We don’t think surgeons should have to step outside their comfort zones to provide more efficient and value-based care. And, now, they don’t have to.

For orthopaedic surgeons striving to ensure excellent patient outcomes, to eliminate unwarranted variance, and to help address economic and wastage issues, Syncera, powered by Smith & Nephew, provides a simplified, straightforward route. For more, visit uk.syncera.com or email Syncera: bryn.davies@syncera.com.

**Myth-busting Q&As**

1. **Syncera’s model is ‘rep-less’. What if we need support?**
The Syncera team includes salespeople and clinical transition specialists who have worked in orthopaedics for decades and know, understand and can deliver on managing change in theatres. Syncera’s experienced team help manage change safely, carefully and in person with full-time, on-site support. In addition, everyone in theatre has on-demand access to the information they need: Log on, and you get surgeon preferences, set-up needs, video clips of procedural set-up and surgical technique sequences. Syncera is dedicated to giving hospitals control for those primary hip and knee cases where reps aren’t required.

2. **Is the combination of interactive digital solutions and implants compulsory?**
Access to the lowest prices naturally arises from the combination of interactive digital solutions and implants. It’s estimated that Syncera’s digital solutions plus implants could save a Trust £1 million (based on UK implant costing data for 2015) over 700 implant procedures performed over a 3-year period.

3. **How do we know we’re getting the best pricing?**
Syncera is transparent about prices – we tell hospitals what is and isn't included, and work with them to determine the best fit. We charge the same price across the NHS for our procedures and have harmonised our costs such that implant costs are the same for hospitals, regardless of volume. Syncera truly aims to simplify everything about orthopaedic service delivery, from pricing to the practicalities of theatre life.

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Revision following metal-on-metal hip arthroplasty for pseudotumour formation associated with inferior patient reported outcomes and high complication rates. 2

OXFORD, UK

Revision following metal-on-metal hip arthroplasty for pseudotumour formation associated with inferior patient reported outcomes and high complication rates. 2

BREDA, THE NETHERLANDS

PIPJ resection versus fusion for hammertoe correction gives equivalent clinical outcomes but improved toe alignment in favour of fusion. 3

ZURICH, SWITZERLAND

Elective removal of posterior instrumentation following post traumatic spinal fixation gives improved flexibility and pain, at the cost of high wound complication rates. 8

PASADENA, CA

Supine versus standing AP Pelvic radiographs give significantly different rates of the crossover sign. 11

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Factors predictive of chondrosarcoma versus enchondroma identified including pain on palpation, cortical erosion and Tc99 bone scan uptake above that at the iliac crest. 12

SAO PAULO, BRAZIL

PET CT SUVmax exceeding 2.0 suggested as a potential threshold for exploration for potential malignancy in cases of suspected chondrosarcoma. 15

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A quick glance at recent orthopaedic developments around the world

**COPENHAGEN, DENMARK**
Combined inter-articular and intra-venous tranexamic acid following unilateral TKA significantly reduced postoperative blood loss with no incidences of thromboembolic events.4

**GOYANG-SI, SOUTH KOREA**
RCT of treatment for non-infected olecranon bursitis reveals no difference between compression and NSAIDs, aspiration alone or aspiration and steroid injection.5

**KUWAIT CITY, KUWAIT**
Risk of breaching the spinal canal high when using two screw anterior fixation of odontoid peg fractures.9

**HIROSHIMA, JAPAN**
Intervertebral-vacuum PMMA cement therapy for elderly patients with degenerative scoliosis report suggests excellent pain relief and functional outcomes versus non-operative treatment.6

**SHANGHAI, CHINA**
Meta-analysis of open versus endoscopic carpal tunnel release demonstrated higher complication rates associated with endoscopic technique.10

**KHLONG NUENG, THAILAND**
Viscosupplementation versus corticosteroid intra-articular joint injection for early knee osteoarthritis gives equivalent clinical outcomes at 6 month follow up.13

**TAIPEI, TAIWAN**
Minimally invasive versus standard ORIF for unstable ankle fractures demonstrates no difference in outcome measures by fixation method.14

**MELBOURNE, AUSTRALIA**
Rates of complications following plate fixation of acute mid-shaft clavicle fracture not insignificant.16

**AUSTRALIA**
Contemporary large series of paediatric tibial osteomyelitis demonstrates improved diagnostic ability of MRI and nuclear imaging in a serious diagnosis.17
Cracking dysplastic hip arthroplasty X-ref

There is increasing interest in publishing studies that have long term follow-up, and this is all the more important when interventions are being undertaken in young patients expecting a long and active life following surgery. Focussing on the outcomes following total hip arthroplasty (THA) in patients with Crowe Type II dysplasia, the team at the Mayo Clinic, Rochester (USA) have been able to report the outcomes of their cohort at 36 years. When performing THA, there is an erroneous concept that, particularly in dysplastic patients, raising the hip centre is in some cases necessary to achieve full coverage of the femoral head; or that reducing the hip to the anatomic hip centre may result in limb length discrepancy or neuropaxia from overlengthening as the loss of superolateral acetabular coverage results an eccentrically placed femoral head. This study reports the outcomes of 145 THAs undertaken in 117 patients, all with Crowe Type II dysplasia. The authors aim to establish the outcomes of total hip arthroplasty at follow up at a mean of 3 years following index surgery. The leading indications for revision were pseudotumour formation (30%) and femoral neck fracture (40%).

Metal-on-metal in the longer term

As the metal-on-metal debate continues to run, definition of what exactly is an acceptable outcome continues to ping-pong back and forth between supporters and detractors from the metal-on-metal (MOM) camp. This, the most recent study from Oxford (UK), is a further report from one of the most publicised series in the orthopaedic literature. With the longest follow-up published to date, the Oxford group have reviewed the outcomes following revisions after metal-on-metal hip resurfacings (MoM HR). This series really does make grim reading. The reasons for failure following MoM arthroplasty are well documented, with certain designs reporting ten year revision rates of between 10%-13%. In total, 53 MoM HRs underwent revision with a mean patient age of 55 years, 62% of whom were women. The most commonly revised implant was the Birmingham Hip Resurfacing (BHR) (55%) at a mean post-implantation interval of 1.6 years. The leading indications for revision were pseudotumour formation (30%) and femoral neck fracture (40%). Less commonly, cases of aseptic loosening, infection and recurrent dislocation were also revised. The majority of revisions were performed through a posterior approach, and both components were revised to a non-MoM bearing the majority (62%) of the time. All femoral stems were cemented and all acetabular components were uncemented. In the remaining 38%, only the femoral stem was revised for fracture, loosening or head collapse, for example. The femoral stem-only revisions were performed pre-2008 before complications with large head MoM THA bearings were known. A total of 24 patients (45%) undergoing MoM HR revision surgery sustained a complication and 20 patients (38%) underwent re-revision. Re-revisions were performed at a mean of 3 years following index revision and were most commonly for pseudotumours (40%), recurrent dislocation (20%) and deep infection (20%). The ten-year survival free from re-revision for all revised MoM HRs was just 63%. From the results of this study it was clear that those patients who had revisions for pseudotumours had inferior patient-reported outcomes compared with other revision indications, and the authors freely accept that the results of the femoral-only revisions were adversely affected by the use of large-diameter MoM bearings which have the worst implant survivorship. Like all retrospective cohort studies, the data should be taken with a small pinch of salt. Small numbers in subgroup analyses, surgical learning curves and not inconsiderable selection biases all have their roles to play here. However, this is the first long-term follow-up study of its kind, which gives it a certain significance and challenges some of the early studies reporting on the short-term results and patient-reported outcomes after MoM HR revision which suggested outcomes were comparable to conventional THA.

Hip injection – just what is the risk?

Any casual conversation in the theatre coffee room will clearly establish that different periods of time between an intra-articular steroid injection and a total hip arthroplasty (THA) are allowed by different clinicians. Intervals ranging from six weeks to 12 months could all be described as routine practice. Hip injections with local anaesthetic and steroid or viscosupplements can be both useful therapeutically to provide pain relief in hip arthritis, but also diagnostically if the patient has additional lower back pain as well as hip pain. However, there is always the concern that we may be increasing patients’ risk for a periprosthetic joint infection (PJJ) when performed...
pre-operatively. It is therefore with great interest that we read this article at 360 – one of the few that cross the editorial desks with the capacity to change practice instantly. The authors in Charlottesville, Virginia (USA) set out to establish what a safe interval was following injection into the hip and THA with increasing the risk of infection.3 The difficulty of course, given the low event rates here, is the massive numbers needed to inform the study. The authors reviewed a total of 34,597 records of patients who underwent THA. These patients had been identified from an insurance-based database in the USA. These patients were then divided into three groups; THA within three months following an ipsilateral hip injection (829 patients), THA between three and six months after ipsilateral hip injection (1379 patients) and THA between six and 12 months (1160 patients) after ipsilateral hip injection. In addition, there was a control group of patients (31229 patients) who had a THA but had never had an ipsilateral hip injection. There were no significant differences between the cohorts in all but one of the patients’ demographics, with a statistically significant higher percentage of female patients in the 0-3 month group compared to the control group. The incidence of infection after THA at three months and six months was significantly higher in patients who underwent hip injection within three months before THA compared with the controls. There was no significant difference in infection rates in patients who underwent THA between three and six months or six and 12 months after an ipsilateral hip injection compared with the controls. The literature to date has produced some conflicting evidence. There are a number of studies demonstrating no association between pre-operative hip injection and PJ. After THA, but also similar numbers demonstrating higher rates of PJ. The biggest problem with all of these studies is the low numbers of patients involved, resulting in them being inadequately powered. Accepting the limitations of the study design, the quality of data extracted from the database and coding inaccuracies, this is the first study of this size that has given some clear guidance on when it is safe to proceed with a THA after an ipsilateral hip injection. Bottom line: wait at least three months.

**Optimal evaluation of pincer type impingement**

It is widely recognised that pelvic motion is a dynamic thing, and that pelvic tilt can affect positioning of the acetabulum and hence may impact on impingement. Authors from Pasadena, California (USA) undertook plain film evaluation of the pelvis in both standing and supine positions.4 The authors undertook radiographs on all new patients being evaluated for hip pain under 60 years of age. They then formally calculated the usual measures for femoroacetabular impingement, specifically intrapelvic distances (sacroccocygeal to symphysis [SC-S] and coccyx tip to symphysis [T-S]), crossover sign, LCE angle, inclination, and ischial spine sign. There were 46 paired radiographs suitable for inclusion in the study, and radiographs were evaluated by two independent observers. Pelvic tilt reduced from sitting to standing, with reduced T-S and SC-S distances. When evaluating both views there were no real differences in CE angle; however the ischial spine and crossover signs were seen significantly less frequently in the standing images.

While films in the standing position are potentially more reflective of function, another consideration is that supine images are more reliably obtained by radiographers. There is certainly however food for thought here, as it does appear that at least a proportion of measures such as the crossover sign are in fact artefactual.

**Can pre-operative hygiene reduce infection?**

In the early days of arthroplasty, surgical patients were supervised in taking a pre-operative bath by the ward sister to ensure that they were appropriately clean for theatre. In these days of high turnover, same-day admissions and accelerated recovery pathways, there has been some loss of focus in many units on the basics such as perioperative hygiene. In patients with MRSA, or a high MRSA risk, there is a focus on pre-operative skin preparation, and surgeons in Brooklyn, New York (USA) have asked the question: would a pre-admission chlorhexidine skin preparation reduce peri-operative infection? Their paper describes the outcomes of over 3500 patients, 998 who used chlorhexidine cloths pre-operatively and 2846 who did not.5 Subsequently a direct notes review was undertaken to establish which patients then went on to develop post-operative infections. There was a significantly higher infection rate in the ‘control’ group (1.6% vs 0.6%), however when the study team then went on to stratify the patients based on NHSN risk of infection, characteristics, there were no differences between groups. This is a promising intervention – although the stratified analysis did not find any differences, it is important to remember the event rate in the intervention group is only 0.6% (equating to six patients). When subclassifying this by three risk groups, it becomes unsurprising that there were no tangible differences in event rates between the cohorts.

**Femoral neck stress fracture X-ref**

Stress fractures of the femoral neck are a well-described entity and are relatively more common in endurance athletes and military recruits. Often diagnosed on MRI scan, the difficult call with these injuries is not making the diagnosis, but deciding on the management. When exactly are patients with a stress fracture of the femoral neck safe to return to sports? Sports doctors in Charlestown, Massachusetts (USA) report on a consecutive cohort of 24 patients presenting with 27 stress fractures of the femoral neck, diagnosed with MRI scan.6 The authors reviewed the scans to grade the stress fractures with the Arent score, and in addition information on patient demographics and return to sports time were collated from the patient records. An adjusted analysis was undertaken with the aim of eliminating the effects of age, bone mineral density and body mass index with the primary end point of return to running time – a fairly subjective end point. There was a roughly linear correlation between the Arent grade and return to running time (Grade 1 – 7.4 weeks; 2 – 13.8 weeks; 3 – 17.5 weeks and 4 – 17.5 weeks). Survival analysis suggested that fracture grade had a significant effect on return to running time, with a significant hazard ratio. For compression side fractures treated non-operatively, patients with low Arent scores returned to running earlier than those with higher scores, and multivariable analysis established that BMI was an independent factor, with low BMI delaying return. It is difficult however to be certain there isn’t a bit of chicken-and-egg going on here – we have no outcome data presented and essentially all that this paper proves is that higher-grade fractures, both clinician and patient were more cautious. Alas, though first described by Michael Devas in 1965, stress fractures are often missed7 and to make matters worse, very low BMI (anorexia) can confuse the MRI appearance, because the bone marrow contains very little fat.8
Ameliorating the systemic response to surgery? X-ref

- Any major surgery carries with it the risk of systemic inflammation and an unwanted stress response to the injury. Whilst a certain amount of immune modulation happens naturally, and additional corticosteroids are warranted in patients with adrenal dysfunction, there has been little research in recent years into the benefits or otherwise of systemic corticosteroids. Tried extensively in the 1980s and abandoned due to excess side effects, we were interested to see the results of this pilot study in total hip arthroplasty, undertaken in New York (USA).

- Reasoning that the interleukin 6 (IL-6) driven stress response may have the unwanted adverse effects of deep vein thrombosis and other medical complications, the authors devised a pilot study undertaken in 27 patients who were randomised to either 20 mg of oral prednisolone and then 2 IV doses of hydrocortisone or placebo. The stress response was measured with regular IL-6, prothrombin and fibrinolysis markers. In addition, visual analogue scale (VAS) pain scores, patient-controlled analgesia (PCA) use and progress with physiotherapy and stair climbing were also recorded. Patients all underwent a unilateral uncemented total hip arthroplasty. The steroid group had the effect of lowering IL-6 levels, although there were no differences in any of the coagulation markers measured. The pain scores were lower in the intervention group. This interesting pilot study does raise some interesting questions surrounding the effects of systemic steroids around THA. The inflammatory response was lower in the intervention arm and pain was also better controlled. What we want to know is what the side effect profile is, and specifically whether it increases infection and ulcer risk. A larger study is required, although care would clearly be needed to establish a safety profile, perhaps with an internal pilot phase.

Rationing based on national registry data? X-ref

- There is a complete lack of understanding in many corners about the use of hip and knee outcome scores. Which is puzzling as it is in the title ‘outcome score’. Despite this and a complete lack of data to support the use of clinical scores as a threshold for arthroplasty, it appears that managers, funders and now clinicians continue to do some. In a very alarming paper from Dunedin (New Zealand), the authors set out to compare the New Zealand Orthopaedic Association (NZOA) score with other clinical scores for the express purpose of establishing if it would be suitable as a tool for rationing. Here at 360 we feel the need to point out that this is a dangerous and damning thing to do. You cannot validate one score against another for a purpose for which the initial score has not been validated. It is simply not good enough to say our score is as good as this unvalidated score for making treatment decisions. The difficulties of course arise when journals publish these kinds of papers without heed for the potential political and health rationing consequences. For what it’s worth, this paper does attempt to establish the differences between those patients passed on for arthroplasty, listed as urgent and returned to the GP. However without any attempt to establish thresholds using a suitable method such as receiver operating characteristics (ROC), minimal clinically important differences (MCIDs) of the scores post-operatively based on pre-operative values or any attempt to establish responsiveness to change of the score, this is essentially a useless paper with a message that could be potentially very destructive.

Assessing outcomes in total hip arthroplasty

- Perhaps brought into sharper focus by the metal-on-metal difficulties - although this paper applies to all branches of arthroplasty - researchers in Oxford (UK) have undertaken a systematic review with the express intention of establishing what constitutes the surrogate markers of long-term outcomes in hip arthroplasty. With improvements in longevity and rising numbers of patients requiring intervention, failure itself may not be sensitive enough during the introduction of novel technologies to allow for the additional safety and monitoring that seems appropriate in the light of some high-profile failures. So, what is the gold standard of surrogate outcome measures in 2016 for monitoring changes to existing technologies or introduction of new arthroplasty technologies? The authors undertook an extensive review of the current literature and were able to identify 1082 studies, of which 115 were reviewed in full as fulfilling the inclusion criteria. The authors report on the findings of 17 papers, describing three approaches to surrogate outcome measures, and were able to conclude that there was enough evidence to describe both radiostereometric analysis (RSA) and Einzel-Bild-Röntgen-analyse (EBRA), both of which are able to measure both migration and wear as ‘validated’. The authors identified five RSA studies (one systematic review and four case series) and four EBRA studies (one RCT and three case series) supporting their use as surrogate outcome measures. However, the use of patient-reported outcome measures was not felt by the review authors to be suitable, as although potentially promising, they were not validated against longer-term outcome measures.

References


Hyaluronic acid equivalent to steroid injections in knee osteoarthritis X-ref

- There has been a great deal of controversial evidence regarding the efficacy of hyaluronic acid for treating early knee osteoarthritis. Whilst many patients and clinicians are convinced of the benefits, some studies have found no difference between hyaluronic acid and corticosteroid injections. However, other studies have concluded that hyaluronic acid provides greater pain relief. The cynical among us may not be surprised to realise that the positive studies are usually sponsored by the manufacturer. This prospective, randomised controlled trial comparing a specific viscosupplementation formulation and corticosteroid injections was undertaken by a trial team in Khlong Nueng (Thailand).

- The study team undertook a well conducted, double-blinded randomised controlled trial comparing a single-shot, intra-articular injection of either 6 ml of hylan G-F 20 or 6 ml of a solution comprising 1 ml of 40 mg triamcinolone acetonide and 5 ml of 1% lidocaine with epinephrine. Outcomes were assessed using clinical scores at six months with VAS pain scores and WOMAC knee scores. One hundred patients, all with a clinical diagnosis of osteoarthritis severe enough to experience pain on most days, were recruited into the study. The bottom line is that this study fails to demonstrate any differences between cohorts at six months of follow-up. In fact, there was earlier improvement in pain and function within the first two weeks after corticosteroid injection, but no differences at final follow-up. This is yet another well conducted study demonstrating equivalence between these two injections. However, there is significantly less cost associated with performing corticosteroid injections. Clinicians often confuse equivalence studies with negative results. Here there is a clear difference in health economic outcomes, although not in clinical outcomes. Accelerated discharge may be more successful in selected patients

- One of the difficulties with the two competing pressures applied by modern healthcare funders – shorter hospital stay and reduced unplanned readmissions – is that interventions to improve one are likely to adversely affect the other. An arthroplasty group in Stratford, New Jersey (USA) took a novel approach to risk stratification, to reduce length of hospital stay without resulting in higher unplanned emergency department attendances. The study focuses on the outcomes of 995 patients, all of them inpatients undergoing primary total knee arthroplasty. The group was arbitrarily divided into short (< 3 days) or longer stays. The cohort was then analysed according to comorbidities, length of stay, deep vein thrombosis history, discharge location and requirement for post-discharge emergency department visits. The authors established that the likelihood of return to hospital after discharge could be explained by risk stratification for patient comorbidities alone. When the authors went on to further evaluate the outcomes of the emergency department visits, just 50% resulted in an admission, suggesting that emergency room visits could be decreased by resolving problems in the outpatient setting. Cardiac Risk Index: a way of making arthroplasty safer X-ref

- Despite the relative frequency with which major joint arthroplasty is performed, there are some significant complications associated with what is a routine operation. One of the most devastating complications, for patients and clinicians alike, when a relatively independent and healthy patient undergoes a total hip or knee arthroplasty is a perioperative myocardial infarction. Despite the relative frequency of the surgery and the devastating effects of the complication, there are currently no validated scoring systems which are able to predict the likelihood of a major adverse cardiac event. A study team from Boston, Massachusetts (USA) set out to establish what the options were using the National Surgical Quality Improvement Program (NSQIP) dataset with regard to development of a consistent and reliable score for risk of major cardiovascular event following lower limb large joint arthroplasty. The authors undertook an analysis of the currently described risk factors, and defined these as age ≥ 80 years, history of hypertension, and a history of cardiac disease. The results from 85 129 patients who had data available on the NSQIP dataset allowed the investigators to establish how useful these factors were in predicting cardiovascular events. An equal weighting for all three identified risk factors has given equal discrimination to weighted models and around 75% of events could be explained by the risk model for intra-operative cardiac events. However, the model was not able to account for post-operative events in total knee arthroplasties. Whilst this study has supported other studies in the literature that demonstrate that older age, hypertension, and cardiac disease were all predictors of post-operative cardiac complications in total joint arthroplasty patients, it failed to support the use of the Revised Cardiac Risk Index in TKA patients. This means that there is still room to develop a useful index that can be used to predict outcomes after TJA, and it may include physical measurement factors in addition to patient comorbidities.
movement. The authors were able to conclude that there was no statistically significant difference in the majority of outcome scores except for the KSS(F) between metal-backed and all-polyethylene components. On the other hand, there were significant differences in terms of complications and revision rates, with fewer complications (1.92% metal-backed vs 2.22% all-polyethylene) and revisions (1.85% metal-backed vs 2.02% all-polyethylene) in the metal-backed group. The authors estimated that the additional cost of using metal-backed components compared with all-polyethylene comes to a total of $95 000 per 100 patients, however, this is just an indirect cost estimate and does not include the costs of higher revision and complication rates associated with the all-polyethylene components. Before dismissing all-polyethylene components entirely, the authors raise an interesting point. Since elderly patients (> 70 years) are less active, possibly all-polyethylene components could be considered in this age group. Alternatively, in the younger age group, metal-backed tibial components may convey advantages of a lower revision rate and therefore justify the increased cost. These are interesting theories and ones that are currently not examined in the medical literature but with an ageing population with an increasing demand for TKA, all-polyethylene tibial components may experience a renaissance in the not-too-distant future!

**Tranexamic acid: better by both routes? X-ref**

- Intra-operative and post-operative bleeding remains an important issue and a cause of pain, swelling and anaemia following total knee arthroplasty (TKA). Other concerns associated with haematoma, wound complications and the potential for deep infection may have a long-term impact on the longevity and clinical outcomes achieved by the arthroplasty. There is little remaining debate in joint replacement circles as to the value of tranexamic acid in reducing these complications, and this excellent study from Copenhagen (Denmark) probably answers the final question: how best to administer the drug of the moment? This single-centre randomised, double-blinded, placebo-controlled study compared the outcomes of combined IV (1 g TXA) and intra-articular TXA (3 g diluted in 100 ml of saline solution) with IV TXA and placebo.1 In this study, 60 patients underwent a unilateral TKA without tourniquet under spinal anaesthesia. The mean 24-hour blood loss was significantly lower in the combined group (466 ml vs 743 ml). The difference between the two groups at the second day of 373 ml was also statistically significant.

There were no thromboembolic complications at 90 days, and there was one transfusion each in the TXA and placebo group. With more and more studies supporting the safety and efficacy of TXA intravenously, with no evidence that it increases the overall risk of thromboembolic complications when using doses of between 1 g and 3 g, and the added advantage of using intra-articular TXA which prolongs the TXA effect in further reducing blood loss, this intervention should be considered a key component of enhanced recovery programmes.

**Vascular calcification a poor pre-operative observation**

- It is hardly uncommon to notice the calcified popliteal artery prior to undertaking a knee arthroplasty; in some patients the appearance is almost like that of an angiogram. Here at 360 we have often wondered if this is associated with excess complications. It’s certainly a sign of vascular disease, however, does that equate to complications? This observational study from a study group in Ulm (Germany) was designed to establish if the presence of visible calcification on plain radiographs was associated with an increased complication rate.6 Their two-year study encompassed 825 patients, all undergoing total knee arthroplasty. The study team excluded patients with an absent pulse or occult vascular pathophysiology. There were signs of calcification in 268 patients, of which 54 were medial type and 214 intimal type. Whilst there were no differences in major vascular complications (just two across the whole cohort, one with and one without vascular complications), there was a higher rate of minor vascular complications (essentially wound healing problems) in patients with intimal calcification when compared with either of the other groups (6.1% vs 1.9% and 1.6%). This simple paper has quantified the excess risk associated with a commonly remarked upon radiographic sign. Quite clearly, although there is no evidence to support major complications associated with intimal calcification, the rate of minor complications is significantly higher. A simple sign with a relevant clinical message.

**Robotic surgery reaching its zenith?**

- Robotic and computer-assisted surgery in orthopaedics have really been a solution without a problem. The accuracy of bony cuts is not limited by the surgeon’s skill but by the limitation of the power tools, and in the absence of evidence to the contrary, robotic surgery has failed to gain traction in orthopaedics.

Surgeons in Glasgow (UK), presumably reasoning that achieving accurate positioning with a unicompartmental knee may well be an area in which a robot may be helpful (given the variable data on outcomes in the literature), designed a randomised prospective single-blinded study, reviewing the outcomes of 139 patients. The patients were randomly assigned to treatment with either a robotic-assisted surgical procedure using the Mako robot (Stryker, Kalamazoo, MI) or conventional surgery to implant the Zimmer Biomet (Warwick, IN) Oxford phase 3 unicompartmental knee.7 Final follow-up assessed 120 patients who were available, who underwent a CT scan at three months to confirm component positioning. Although the robot was far from perfect, it did improve the positioning accuracy, with 57% positioned within 2° of the target position as compared with 26% with traditional implantation. This study does demonstrate that implantation can be made more accurate using a robot. Nonetheless, we are slightly sceptical about the study design. The use of an arbitrary 2° of the target position as the surrogate outcome measure is slightly concerning in this study, which essentially demonstrates that the robot is slightly more accurate. If 3° or 4° had been used, would there have been any difference? And perhaps most important of all, the unanswered question is still: where should the knee be placed?

**Revising the stiff knee?**

- Surgeons in Toronto (Canada) offer insight into perhaps one of the trickiest of clinical decisions to make: when, how, to revise a stiff knee?8 9 Undoubtedly, patients whose post-operative result includes some significant stiffness are a bit of a mixed bag. Some will have had considerable pre-operative stiffness, some difficulties with physiotherapy, and some will have a degree of component malalignment. These authors describe the outcomes of 48 patients where they have taken the plunge and undertaken a revision arthroplasty for stiffness. The authors were able to report on a relatively large cohort of 48 patients,
all presenting with a stiff knee following total knee arthroplasty. The mean age at revision was 65.5 years and all surgeries were performed by a single surgeon with pre-operative arc of stiffness < 70° or flexion contracture of > 15°. Essentially, the authors describe an open revision and arthrolysis combined with a downsizing of the polyethylene liner by 4 mm, giving a ‘ sloppy’ revision. There are no long-term outcomes published for this approach (which may well open the door for catastrophic wear and macroscopic failure). However, within the constraints of the outcomes reported, this can be described as a successful approach. At a mean of 60 months’ follow-up, the authors report a mean improvement in composite flexion arc of nearly 45° – a remarkable achievement. It is easy to be either sceptical about the results presented here, or simply to write this off as a series of ‘overstuffed’ knees at initial surgery. However, it is an interesting technique and from a reputable unit it would be churlish to ignore such an honest account of treating complications.

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complications arising in this population is likely to be beneficial.

**Primary fusion and Lisfranc injuries**

The question whether to primarily fuse the second tarsometatarsal joint in the context of severe trauma is controversial, with two published level I studies apparently contradicting each other.4,5 The anxiety for the operating surgeon, especially in treating younger, higher demand patients, is whether a primary fusion by definition limits the functional capability of the foot in the future, due to either loss of the joint or the inherent shortening that always occurs. Hence there is general hesitance to fuse joints in the younger population and a tendency to try and preserve motion by joint reconstruction in the index surgery. This paper from the team at the Hospital for Special Surgery, New York (USA)4 has some significant value in that, although not a randomised trial, it does present the return to function data for a mixed group of purely ligamentous and mixed osseoligamentous injuries after primary fusion at index surgery. The study has a retrospective design and utilised patient-reported activity level questionnaires, and concludes participation in sports as equivalent to pre-injury in 64% and reduced in 25% of patients. This was a mixed group of partial fusions, including single column or all three. The activities referred to included impact sports, and relied on patient declaration to record the preinjury levels. Despite the sources of bias inherent in this study design, the strength is in the generalisability of the data. It is reasonable to advise patients contemplating a primary fusion that on average just over half of patients make a full return to sporting activity following this kind of surgery. Clearly there is still some way to go to narrow the evidence gap in Lisfranc injuries, and we are still waiting for the ‘definitive study’ to inform practice. However, for the time being these functional data do reassure all involved in their care that these patients may be successfully treated with a fusion, and that the long-term results are not as bad as one might think.

**Radiographic severity important in predicting outcomes in total ankle arthroplasty**

It is widely known and accepted that in total knee arthroplasty, the best predictor of post-operative outcome is pre-operative function. However, this is not a concept that has ported across to the world of ankle arthroplasty. Reasoning that patient selection for total ankle arthroplasty is key to achieving the best outcomes, researchers in Newcastle upon Tyne (UK) set out to investigate the impact that the pre-operative radiographic arthritis grade may have on post-operative functional results in total ankle arthroplasty (TAA).6 The research team focused on a large series of 178 ankle replacements in 170 patients. They undertook a retrospective review of their pre-operative radiographs and prospectively collected clinical outcome data (Foot and Ankle Outcome Score [FAOS; pain, function, and stiffness], MOS 36-item and Short-Form Health Survey [SF-36] scores). The patients were subdivided by the pre-operative Kellgren-Lawrence scores assessed on pre-operative weight-bearing films. There were few differences in patient demographic data; perhaps most interestingly, pre-operative FAOS scores were similar across all three groups with no statistically significant differences observed. However, the improvements in both domain-specific and general outcome scores differed dramatically between the groups. As perhaps might be expected, those patients with severe or end-stage arthritis had the greatest post-operative satisfaction rates (achieving > 90% at two years in severe arthritis), whereas in the mild to moderate group rates were as low as 50%. This paper informs decision making in an area where technologies continue to evolve and the relative indications for arthroplasty are not yet clear.

**Osteolysis around the ankle: a ballooning problem?**

There are definitely some differences in the osteolytic reaction between patients, but there are also some differences between joints and implants, suggesting that perhaps the final common pathway for bone loss is likely to be through a single, unified route. In common with the pattern of ballooning osteolysis seen on the tibial plafond following osteochondral defects, wear debris around ankle arthroplasties can result in a very similar pattern of osteolysis.

A research team in Magdeburg (Germany) have investigated the outcomes of 71 patients, all undergoing revision surgery for failed ankle replacements.7 Those with ballooning osteolytic cysts were compared with a primary group of ankle arthroplasties and some revisions without the characteristic balloon lysis. The research team undertook a fairly thorough basic science analysis of the explanted tissue including histomorphometric, immunohistochemical, and elemental analysis. Those patients with ballooning osteolysis showed characteristic changes including higher levels of lymphocytic expression and perivascular expression of CD3+, CD11c+, CD20+, and CD68+ cells. The study team also established that there were much higher odds of balloon osteolysis in those patients with a high calcium concentration in the periprosthetic tissue. Putting it all together, the study team propose that perhaps the pattern of tissue expression and very high calcium concentrations implicate the hydroxyapatite coating in the development of balloon osteolysis.

**Posterior fixation of the ankle?**

There has been a slow tectonic drift in ankle fracture surgery away from the ‘anterior-posterior’ screw towards an open approach to the posterior malleolus, either through a lateral incision with the patient supine or through a more formal posterior approach to the ankle. The rationale being that, given the low incidence of shear patterns of the fracture, reduction is best maintained with direct reduction and buttress plating. However, despite this change in practice, there is little in the literature (as so often happens) to support one approach over another. Patients treated in The Hague (The Netherlands) over a four-year period have been the subject of this recently published case series. The study team included 32 patients, all with significant posterior malleolar fractures presenting with an articular step. The authors undertook a direct reduction and fixation of the fragments, and achieved (they report) anatomical reduction in all fractures.9 The authors sadly do not include any functional data, although they are able to comment that there were no wound healing problems (bar a single superficial infection). Radiographic outcomes were satisfactory in all but one patient. This paper is a bit of a lost opportunity – it would be great to know the outcomes of open reduction and posterior plating of the distal tibia, and a comparative case series with functional scores is a much-needed study. Sadly this paper does not quite pass muster, and all that can be said is that this approach is possible.

**Resection versus fusion in the lesser toes**

This is a simple paper that does exactly what it says on the tin. The authors have designed a neat randomised controlled trial to evaluate the benefits or otherwise of proximal interphalangeal joint fusion (PIJ) over a simple resection of the joint in patients undergoing a hammertoe correction. The clinical trial based in Breda (The Netherlands) reports the outcomes of 55 patients randomised to either resection (26 patients, 39 toes) or fusion (29 patients, 50 toes),10 sadly leaving somewhat uneven groups. The PIJ procedure was combined as...
necessary with metatarsophalangeal releases to correct the toes’ attitude. Outcomes were assessed at one year following surgery using the American Orthopaedic Foot & Ankle Society scale, the Foot Function Index, and visual analogue scale pain outcome scores. In addition to clinical scores, the alignment of the toes was evaluated at final follow-up. Essentially there were no differences in functional outcomes between the two groups, however, the fusion group had a superior alignment in the sagittal plane at final follow-up. It is reasonable to presume that late recurrence will also be less common in the fusion group, although longer follow-up is clearly required to establish this. This study really does leave the choice of surgery to the patient and surgeon. However, although there are no differences in the clinical outcomes selected by the study design team, given that the aim of the surgery is to correct toe malalignment and there was a significant difference in favour of the fusion group with regard to sagittal malalignment, we can’t help thinking that perhaps the authors have not quite been definite enough with their conclusions. A fusion, we would conclude, is more reliable and has the same functional outcomes.

Minimally invasive ankle fusions? X-ref

Minimally invasive surgery (MIS) has a number of potential clinical, cosmetic (and even financial) advantages - on paper at least! The majority of readers will remember the fashion for mini-hipt, followed by ‘mini-knee’ and even ‘mini-bunion’, so given the lack of advantage these passing surgical fads have shown (and some have even been discredited due to higher complication rates), it is with some trepidation that we approach this paper from Taipei (Taiwan), a retrospective comparative series of mini- versus open reduction and internal fixation for unstable ankle fractures.” The authors make the not unreasonable comment that in the face of higher infection rates and compromised soft tissues, there is perhaps an argument for minimally invasive surgery. The surgical teams undertook a retrospective study of 71 patients, all with 44-B type fractures, 34 of whom underwent a standard ORIF and 37 of whom underwent MIS surgery of two different types. Although the authors set their paper out as a validation of their protocol, there is little evidence to support the algorithm itself, just the overall outcomes. The authors report essentially no differences in any of the outcome measures other than lower wound complication rates in the MIS group. This paper certainly supports the concept of MIS surgery in ankle fractures to reduce complication rates, however, in the face of other, better studies (such as the randomised controlled trials from Edinburgh reporting the fibular nail), a prospective randomised controlled trial would really be needed here to prove any kind of superiority.

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Wrist & Hand

X-ref For other Roundups in this issue that cross-reference with Wrist & Hand see: Research Roundups 1, 6, 8.

Is there any advantage in endoscopic carpal tunnel release? X-ref

Sometimes in surgery we just like to make things more interesting. Sometimes that results in better outcomes for patients; it however always seems to result in a more complicated operation. Endoscopic carpal tunnel release is one such intervention. Whilst there is no argument that it is more complicated than the open approach, there is still very much debate about the relative benefits of each approach. Endoscopic carpal tunnel release is not as easy to perform as open surgery - there is a learning curve, and special equipment is needed. That equipment is not cheap and some financially-strained systems might baulk at the cost, especially for an approach many perceive to be unproven. Added to this is the fact that a traditional open operation can be delegated to a more junior surgeon, thereby reducing the total health economic costs. So is there any advantage to the endoscopic approach? Separate review teams from Shanghai (China) and New York (USA) have systematically reviewed the evidence, and find that the outcomes in their reviews are essentially the same. The differences are that the endoscopic surgery takes significantly longer; however the patient recovery is significantly quicker. The two meta-analyses were structured slightly differently, with one reporting just five trials of 142 patients who had contralateral hands randomised to one of each treatment intervention, whilst the larger meta-analysis from New York reports the outcomes of 1859 hands randomised to one treatment or another. Both studies essentially reported the same outcomes with a reported higher risk of complications with endoscopic surgery as well. Given the essentially
equivalent results reported in these two studies, and given the higher costs of the procedure, we might wonder whether society or the patient recoups this from a quicker return to work?

**Does vascularised bone grafting work in scaphoid fractures?**

The scaphoid remains a notorious bone to manage. If it fails to heal—not an uncommon event—then bone grafting with fixation is the standard of care across the world. However, this is essentially where the consensus ends, with debate concerning vascularised or non-vascularised graft. Matters are further confounded by the definitions of failure; does it matter if there is ‘avascular necrosis’? Indeed, do we always know whether there is avascular necrosis? A group from Nottingham (UK) undertook a systematic review of the literature concerning bone grafting, particularly focussing on the value of vascularised bone grafting (VBG) versus non-vascularised grafting (NVBG). There were a large number of 2710 articles which met the screening criteria; however, just 144 of these studies reported the outcomes of 5464 scaphoid nonunions. The mean union rates when using VBG and NVBG were 84% and 80%, respectively. When considering the value of avascular necrosis of the scaphoid, the proximal pole was identified pre-operatively then the mean union rate was 74% with VBG, compared with 62% with NVBG. The results of this review highlight that perhaps in this setting there is a small advantage in a vascularised graft when there is AVN, but this is a difficult technique which should nowadays mean referral to a specialised centre.

**Do we need antibiotics for distal phalanx fractures?**

All orthopaedic surgeons must remember their duty as custodians of proper antibiotic use. There is a real threat within just a few years of infections for which there is no cure. Excessive use of antibiotics by doctors will carry much of the blame. So we should take note of this work from Coventry (UK) in which a meta-analysis of four randomised trials (353 fractures) found that antibiotics made no difference to the infection rate. So we are obliged to take note, to disseminate this work to our colleagues in general practice and emergency departments and to focus on proper washout and to avoid antibiotics.

**Nerve conduction studies for carpal tunnel syndrome?**

There is much variation in the diagnosis of carpal tunnel syndrome. Patients are usually managed using a standardised treatment pathway, however these pathways often vary from unit to unit, and specifically the routine use of electrodiagnostic studies is particularly controversial. In some units they are used as a gateway for referral, and in others are considered superfluous to requirements and patients can move through the entire pathway including release without any consideration of electrodiagnostic studies. Researchers in Ann Arbor, Michigan (USA) undertook a population-based analysis with the intention of establishing what role, if any, electrodiagnostic tests took in the US population undergoing carpal tunnel release between 2009 and 2013. Their analysis included three different multivariable analyses with the intention of establishing the relationships between timing of surgical interventions, the number of pre-operative physician visits and the total health economic costs. As is only possible with studies of this size, encompassing 62 894 patients, the authors were able to control for sociodemographic variables, comorbidities, health care insurance and treatment characteristics. Of the study population, 58% underwent pre-operative electrodiagnostic studies. Perhaps unsurprisingly, patients undergoing electromyography (EMG) waited longer for their decompression intervention and as perhaps might be expected, the total health economic costs were higher, with one additional visit and nearly $1000 additionally spent on healthcare provision for the group with the EMGs. The total cost analysis also identified that the use of occupational therapists and steroid injections introduced excess healthcare costs and delayed time to surgery. There is little data in this paper that supports anything other than access directly to carpal tunnel decompression; however it is important to remember that the outcome selected can result in additional costs and delays to treatment, so it isn’t surprising that less intervention hastens treatment and costs less.

**Sterilising the hand**

Sometimes some of the simplest papers are the most useful. We were interested when this paper from the Rothman Institute, Philadelphia (USA) crossed the desks at 360 HQ. The research team undertook a simple study to determine the effectiveness of skin coverage during surgical preparation of the hand. The team undertook a comparison of preparation using pre-stick applicators against 4 inch sterile gauze sponges. Their study was a comparison volunteer study, with thirty healthy volunteers having their hands prepped in matched pairs. Both groups were treated with the commercially available ChloraPrep compared to soaked gauzes applied using sterile gloved hands. Outcomes were reviewed using an image analysis technique to assess the number and location of un-prepped areas after both techniques. There were a greater number of unprepped areas in the ChloraPrep group (0.76% vs 0.15%). There is a clear message here with regards to the total coverage of the skin achieved with each method. However, there is little really to tie this to clinical relevance (either in the literature or in this paper). So although the message appears to be that a ChloraPrep device does not provide as good skin coverage as the traditional swab squares, it is not clear what the effects on the eventual infection rates might be. However, this paper does highlight for us that there are often unforeseen complications from introducing novel technologies.

**The biomechanical implications of wrist fusions**

The partial wrist fusion is a sometimes useful salvage operation in a range of wrist pathologies from scaphoid nonunion to wrist arthritis. Whilst clearly only suitable for end stages of disease as any fusion carries with it comorbidities, the partial fusion can maintain near-normal biomechanics in selected patients. The biomechanical implications of different fusions however are still not completely ironed out. A research team in Providence, Rhode Island (USA) undertook one of the few biomechanical studies into this phenomenon with a cadaveric study examining the biomechanics of 20 wrists when treated with either a 4-, 2- or 3-corner bone fusion. The study examined the motion effects across 24 pre-determined directions of wrist motion. The results were perhaps slightly surprising. Those patients with a 4-corner fusion lost pure flexion relative to the intact state and other fusions, whilst all fusions reduced extension. There were no restrictions on range of motion seen in radial deviation seen...
in the limited fusion groups. Whilst the composite range of motions (perhaps predictably) were within acceptable limits, there was a clear difference in the extremes of motion for flexion and radial deviation between the three fusions.

**Just how good is a wrist arthrodesis?**

- Wrist arthrodesis is one of those bailout options that exist in all sub-specialities of surgery – “if it all goes wrong we can always fuse it” is something that is perhaps more often thought than said, but is always at the back of the mind when evaluating the difficult-to-treat wrist. As the ‘salvage option’ when evaluating the difficult-to-treat it is something that is perhaps always at the back of the mind.

**Social support and upper limb functions?**

- It isn’t just an interesting observation that patients with psychological illness, or comorbidities have poorer outcomes, in these days of ‘surgeon-level reporting’ it is essential that patients who are likely to have poorer outcomes are identified so that this can both be taken into account in outcomes reporting and steps can be taken to ensure their function is optimised. Researchers in Boston (MA, USA) have undertaken a comprehensive analysis of the measurable effect of support (emotional, instrumental and psychosocial) on the patient’s perception of upper limb function.

**The research team administered the QuickDASH and the computer adaptive testing (CAT) PROMIS measurement system to establish the effects of pain interference and emotional support measures. The study concerned the responses of 193 patients all with upper limb pathology, and the study was designed to establish the contributory effect of the pain interference, depression, emotional support, psychosocial illness impact, and instrumental support on the QuickDASH score as a primary outcome measure. The results in themselves were somewhat surprising. Whilst there was a weak correlation between the emotional and instrumental support measures and QuickDASH in a multivariable analysis the social support measures were discarded and the pain interference CAT (perhaps not surprisingly) was able to explain 66% of variability in function. So it seems that social support has little bearing on initial presentation with upper limb illness. We would be intrigued to see what the outcomes of this study were if repeated to look at the effects on postoperative recovery – do patients who are isolated and not socially supported really vary in their outcomes as much as we think they do?**

**REFERENCES**


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**Shoulder & Elbow**

X-ref For other Roundups in this issue that cross-reference with Shoulder & Elbow see: Research Roundup 1, 3; Trauma Roundup 5.

**Glenoid fracture still an issue in shoulder arthroplasty**

X-ref

- The longevity of total shoulder arthroplasty is usually considered to be limited by the glenoid component. The large forces placed across a small surface area (in traditional arthroplasty) and large lever arm (in reverse arthroplasty), both resisted by the relatively slight bone seen in the glenoid, are more often than not the cause of wear, loosening and failure. The advent of more modern materials, in particular polyethylene bearings which can form carbon-carbon cross-links between polyethylene molecules during irradiation, changes to glenoid designs and different joint kinematics have potentially improved the longevity of these components and their functional outcomes. There is, however, a wide array of component designs, and material scientists in Berkeley (USA) have set out to establish which of these design variations are associated with mechanical failure and fracture. This interesting and insightful study is based on the retrieval of 16 glenoid components, all presenting with fracture. The implants consisted of a range of materials, including gamma-sterilised Hylamer and ultra-high-molecular-weight polyethylene (UHMWPE), and gas plasma-sterilised, remelted, highly cross-linked (HXL) UHMWPE, and a range of conformities between a 0 mm and 10 mm radial mismatch. The explanted components were subjected to highly detailed analysis including scanning electron microscopy (SEM) and oxidative analysis. There was a common pattern of failure with fracture at the rim of the component for all 16 explanted components, and significant oxidative change was seen in the components subjected to gamma sterilisation. However, this was not seen in the HXL glenoid component. Fracture at the rim of the glenoid component in traditional total shoulder arthroplasty is still clearly a problem, despite evolution in component design. Whilst this paper cannot
quantify the problem, it is interesting and important to note that the failure mechanisms remain the same, with the exception that heat annealing does appear to reduce the rates of oxidative degradation in the glenoid component.

Glenoid retroversion and pathology

Little is known about posterior instability, other than the associations with fits and electrocution. The reasons why some patients suffer from unidirectional posterior instability are far from clear. Given that there is a natural range of glenoid versions, it would be reasonable to expect that if the glenoid version varies, this is likely to impact on shoulder stability. Researchers in Boston (USA) have investigated the impact of glenoid version relative to the scapula body and the effect that this has on stability of the shoulder. The authors report three groups of patients: those with anterior pathology (33 patients), those with posterior instability or glenoid labral tears (34 patients) and a number of normal controls (30 patients). Version was established with plain films using a variety of methods. Despite the potential for inaccuracy in this methodology, there was a 5° greater posterior version (−9° vs −4°) in the control group. This patient group is essentially a retrospective cohort study that establishes an association between posterior version and unidirectional instability. Although there is no clear take home message from a clinical standpoint, the observation of association alone is enough to raise some extremely interesting questions.

How long is long enough? Stemmed shoulder arthroplasties X-ref

The effects on bone loading of implant design have become the province of computer scientists and engineers. Gone are the days of following plain films for years to establish what the long-term effects are. Despite the significant advances in computer modelling, this has rarely translated into generic design feature evaluations – the technology is more often used to design or prove the design benefits of a particular implant. We were delighted to see this paper from London, Ontario (Canada) which was devised to evaluate the benefits or otherwise of longer-stemmed humeral components. The authors used digital imaging and communications in medicine (DICOM) standard CT images to construct finite element analysis models of five patients with short, standard and stemless humeral components, and then simulated loading in various degrees of shoulder abduction. The aim was to establish the level of stress transfer to the humerus. Results were reported as average with bone stresses at eight transverse slices as a percentage of intact values. As perhaps would be expected, the shorter stems matched the normal humeral loading better than the longer stems. This paper very capably and succinctly summarises the effects on biomechanical loading although it doesn’t tell us anything about other design constraints such as fixation. However, it has brought the issue back into orthopaedic discussion. This kind of comparative generic biomechanical computer-modelled study provides an insight into specific design features that would not be investigated with industry-run studies.

Steroids apparently not great in bursitis

Some of the most common conditions in orthopaedics are those with the poorest evidence for treatment and the most debated best treatment choice. We were delighted to see this randomised controlled trial from Goyang-si (South Korea) which asks the question, do steroid injections have any benefit over compression bandaging in the non-operative management of olecranon bursitis? The authors recruited 90 patients from two centres, all of whom had confirmed non-infected olecranon bursitis and were allocated to receive one or other treatment on a 1:1 basis for the three interventions tested: compression bandage and NSAIDs, aspiration alone, or aspiration with steroid injection. There was some attrition with seven patients lost to follow-up, making some of the groups rather small. Outcomes were assessed using the VAS pain scale and signs of symptom resolution. Broadly speaking, the authors didn’t see any difference with either group in their study. However, three-way studies are always notoriously difficult to power adequately, and the authors here appear to have performed a retrospective power calculation, concluding that they were only adequately powered to detect a 30% difference in the primary outcome measure, suggesting that this study is hugely underpowered. Although we would commend the authors for selecting an interesting and relevant topic for their study, it is somewhat surprising that they have then sadly chosen not to adequately power the study.

When surgery of the olecranon fails X-ref

The olecranon is a fracture that is not very tolerant of failure. The fracture itself can be difficult to stabilise, and with large eccentric forces crossing the joint, the metalwork failure rate is not insignificant. To top it all, the thin and mobile soft-tissue envelope is prone to irritation and infection and, as such, the re-intervention rate is also quite high. Surgeons in Boston, Massachusetts (USA) utilised their large in-hospital registry to identify 392 patients, all with operative treatment of an isolated olecranon fracture, with the intention of identifying factors that are associated with both implant removal and re-operation. The patients had a combination of plate fixation (n = 138; 35%) and tension band wiring (n = 254; 65%). Outcomes were assessed at a minimum of four months, and in that time one quarter of patients had required further intervention. The predictors of the need for further surgery were well explored by the authors, and re-operation was more common in women than men (64% vs 36%) and younger patients, and the same was true for patients requesting metalwork removal.

Designing the best total elbow arthroplasty

Total elbow arthroplasty (TEA) can sometimes be a poisoned chalice. Done well, it can provide reliable and satisfactory performance for a range of diagnoses including degenerate and traumatic indications. However, the excellent pain control and range of motion achievable in modern devices belies the short lifespan and restrictions in upper limb weight-bearing imposed by most surgeons to improve outcomes. The survival of TEAs is inextricably linked to the inherent design of most modern arthroplasties, with large torsional and tension forces dissipated across a small bearing surface. In what is an excellent review article from the Hospital for Special Surgery, New York (USA), the authors walk through current implant designs and review the limitations, expanding indications and challenges faced by surgeons, patients and device manufacturers in the coming years. This is an excellent read from a world-leading centre and we would thoroughly commend the article to the 360 readership.

Can septic arthritis of the shoulder be treated with closed suction drainage?

Septic arthritis of the shoulder can be a challenging diagnosis, particularly when the infection includes the other spaces around the shoulder such as the subacromial space. Effective debridement and lavage can
be difficult to achieve, leaving the patient at risk of recurrence. These surgeons in Seoul (South Korea) report their experience of treating septic arthritis using a predominantly closed suction drainage method. The surgical team performed a fairly aggressive debridement on 68 patients, combined with arthroscopy and irrigation. A suction drain was placed in the glenohumeral joint and left in place for an average of 24 days at a constant negative pressure of 15 cm H2O. This strategy appeared to be rather successful with a reported cure rate (in combination with around five weeks of antibiotics) of 98%. The authors conclude that their approach provides reliable eradication of the infected joint with little in the way of recurrence. Nonetheless, we would inject a note of caution; nearly four weeks of closed suction drainage isn’t without its morbidity, and the presence of a drain in the joint for that period may well accelerate any future arthritic change. Slightly less enthusiastically than the authors, we would perhaps recommend this as a reasonable option for patients in whom traditional methods have failed as it certainly does appear to have an excellent outcome here in terms of clearance of the primary septic arthritis.

**Depression hinders outcomes in total shoulder arthroplasty**

There doesn’t seem to be much in the way of positive news for the depressed with regard to their health outcomes. Surgeons at NYU Hospital for Joint Diseases, New York (USA) conducted a study to explore the link between depression and outcomes in total shoulder arthroplasty (TSA). The study team used the US National Inpatient Sample to identify 224,060 patients undergoing elective TSA. There was a pre-existing incidence of depression of 12.4% in those patients, which was associated with significant independent risks for post-operative complications, including delirium (OR 2.29), anaemia (OR 1.65), infection (OR 2.09) and discharge to an alternate location (OR 1.65). Due to the large sample size, all of these observations were of course highly significant. It is interesting that this incidence of pre-operative depression is associated with poorer post-operative results in the selected outcome measures that were used in this study. Whilst the study of course only establishes an associative link, rather than a causation, there is a clear message here: patients with depression are at higher risk of complications, and perhaps this should be taken into consideration when making treatment decisions.

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still remain unclear. This study left vertebral cages in place, and so we don’t know if the size of cage or its indication for insertion might impact the outcomes of posterior instrumentation removal. In light of this study, we can say with reasonable certainty that flexibility is improved and pain is reduced, though whether this outweighs the risks of the procedure is debatable.

The discogram – not a benign procedure?
- Lumbar discography, which involves the injection of fluid under pressure into an intervertebral disc, is performed as a provocative test to diagnose discogenic pain. It is a controversial procedure, and the results are somewhat subjective to interpret. Previous studies have demonstrated a lack of validity, poor sensitivity and specificity, with the American Pain Society recommending against its use. Despite this, many clinicians continue to use it, and those who do so regularly argue that the ability to distinguish a painful disc and other potential pain sources provides valuable information that cannot be gleaned in any other way. There have been some somewhat concerning reports of accelerated disc degeneration on MRI following discography, in subjects without low back pain, when compared to controls. This latest study from the same group in New York (USA) assesses these same cohorts ten years later. The study reports the outcomes of 75 patients without lower back pain who underwent discography injections, and a matched group of similar patients also without low back pain who did not undergo the discogram either. The cohorts were followed up to ten years following the discogram and outcomes assessed included imaging outcomes and intervention rates in the lumbar spine. As is always expected with studies of this type, there was significant attrition throughout the timecourse of the study and 57 discogram patients and 51 controls completed the ten-year follow-up visit. There was a marked difference in intervention rates in the discogram group when compared to the controls. The discogram patients underwent 16 lumbar surgical interventions, compared to four in the control group. In addition, the incidence of CT and MRI evaluations, doctors’ visits for lumbar spine pain and reported work loss and episodes of lumbar spine pain were all higher in the discogram group. Although proponents of discography will doubtless point out the obvious flaws in this study, there are some clearly important take home messages here, and discography should not be considered a benign procedure.

Bone marrow oedema does predict pain in degenerative scoliosis
- Just like every other branch of musculoskeletal surgery, spinal surgeons are facing increasing challenges from the ageing population. Increased life expectancy, coupled with higher quality of life expectations is somewhat of a clinical challenge when faced with the increasing prevalence of degenerative scoliosis. However, despite the increasing frequency and clear health and social care burden associated with adult degenerative scoliosis, the cause of back pain is unclear. Bone marrow oedema has been associated with pain in joint disease (and is commonly associated with pain following trauma), such as that seen with a “bone bruise”), and so not unreasonably authors from Hiroshima (Japan) set out to evaluate if the appearance of endplate oedema on MRI scanning is associated with pain in adult degenerative scoliosis. One hundred and twenty patients all with lumbar degenerative scoliosis were reported in the study. Patients underwent MRI imaging and clinical palpation to determine any point tenderness and were divided into two groups – those with low back pain and those without. Importantly, patients who had had symptom alleviation with facet joint anaesthetic injections were excluded. The results were clear: bone marrow oedema was present in 96.9% of patients with low back pain, compared to 37.5% of patients without pain. The authors were also able to establish that the oedema was seen on the concave side more than the convex side of the curve - where loading is greater. Perhaps even more convincingly, the signal intensity of the oedema was strongly correlated with the severity of back pain and the location of point tenderness. For the clinician faced with a severe and generally degenerate spine, identifying a focal pain source in a spine with widespread degenerative changes offers the possibility of localised intervention. This leads on nicely to this group’s next study – targeted therapy for degenerative scoliosis.

Targeted therapy for low back pain in elderly degenerative lumbar scoliosis
- With major deformities and often widespread disease present in patients who are not suitable for extensive surgical intervention, the prospect of targeted therapy is a very attractive one. The treatment options for degenerative scoliosis are therefore significantly problematic. Non-operative measures offer poor pain relief and little change in function; anaesthetic injections provide only temporary or partial symptom relief and patients are often significantly limited in their everyday activities, sometimes to the extent that independent living can become a challenge. Whilst instrumented arthrodesis with decompression can achieve good outcomes, the risk of complications from such extensive surgery in a fragile patient population is high. With this in mind, Fujimoto’s group in Hiroshima (Japan) has developed a novel, targeted therapy termed intervertebral-vacuum polymethyl methacrylate (PMMA) cement injection (PIPI). This approach involves injecting discs directly with PMMA cement in patients with back pain, adjacent bone marrow oedema on MRI and concordant physical findings, in a similar manner to vertebroplasty or kyphoplasty but into the disc space itself. The authors report the outcomes of over 150 patients, 109 who underwent targeted PMMA injection and 53 who were managed with non-operative treatment. The results of the selective therapy are impressive, with significant improvements in VAS pain scores (55 point improvement vs two point improvement). The intervention group also reported significantly greater improvements in the ODI scores, both at one month and two years post-procedure. So given the remarkable improvements seen, how did the authors explain this from a simple intervention? Their proposed mechanisms include a thermoablative effect, the cement acting as a shock absorber and the suppression of inflammatory cytokines. Before we all start injecting intervertebral discs with cement, clearly more work is needed. This is a novel procedure with short follow-up from a single centre, and further studies are warranted; however this represents a new approach to an old problem, and both papers appear to contain honest and frank reporting.

To inject or not to inject: the facet joints
- All practicing spinal surgeons will use injections to steer diagnoses, offer therapy, and sometimes see a patient over the most painful part of a spontaneously improving natural history. Facet joint injections are something we at 360 have seen used, and used ourselves many times, however just how good are they? If we accept that every injection is placed accurately, then the systematic review from Warwick (UK) makes interesting reading. The authors have conducted an extensive systematic review with a narrative analysis looking at six RCTs comparing corticosteroid facet joint injections with either sham injections or conservative treatments for the management of low back pain. The paper confidently describes
a thorough search strategy, and uncovers six relevant papers to be included in its analysis. The included studies are however of dubious quality, and certainly leave something to be desired. The authors note that only one study finds a benefit to injections at six months when compared to a treatment that is known to worsen symptoms in low back pain, negating its validity. The remainder show that our well-meaning injections, whilst not doing any harm, are also not actually doing any good. This review shows that the evidence supporting therapeutic facet joint injections is still not there. Whether this is a problem with diagnosing the pain generator, or a misunderstanding of the pathology, remains to be seen but if this treatment is to continue to feature in our armamentarium, a good RCT will need to emerge. For the time being, the search should continue to employ other treatments in managing facet joint degeneration.

Is fusion essential in laminectomy?

It is not quite clear where the benefits in lumbar spine decompression and fusion lie in degenerative spondylolisthesis. Whilst it is clearly an effective treatment, is this the result of the decompression alone or is the fusion an essential part of the procedure. There are some significant potential benefits to undertaking decompression alone as it would maintain the flexibility of an already degenerate and stiff lumbar spine, however the fusion element may maintain the decompression more effectively. A research team from the Alan L. and Jacqueline B. Stuart Spine Research Center, Burlington, Massachusetts (USA) have investigated the two approaches using a randomised controlled trial methodology. Their study published in the *New England Journal of Medicine* concerns the efficacy of treatment for grade I lumbar spondylolisthesis. The investigators were able to recruit a total of 66 patients randomised to either decompression and instrumented fusion or decompression alone. Clinical results were assessed using the SF-36 score at two years of follow-up, in addition to secondary outcome measures of the Oswestry Disability Index and measures of hospital stay, intra-operative complications and length of stay. A total of 66 patients (mean age, 67 years; 80% women) underwent randomisation. The rate of follow-up was 89% at one year, 86% at two years, and 68% at four years. The fusion group had a greater increase in SF-36 physical component summary scores at two years after surgery than the decompression-alone group did (15.2 vs 9.5). The increases in the SF-36 physical component summary scores, with the fusion group remaining greater than those in the decompression-alone group at three and four years. With respect to reductions in disability related to back pain, the changes in the Oswestry Disability Index scores at two years after surgery did not differ significantly between the study groups (-17.9 in the decompression-alone group and -26.3 in the fusion group). More blood loss and longer hospital stays occurred in the fusion group than in the decompression-alone group. The cumulative rate of reoperation was 14% in the fusion group and 34% in the decompression-alone group. This study revealed that the clinical outcome of the addition of lumbar spinal fusion to laminectomy for patients with grade I spondylolisthesis was superior to decompression alone on the SF-36 physical component score at two, three and four years post-surgery. However, there was no benefit in the Oswestry Disability Index. There were significantly lower rates of reintervention in the fusion group (14% vs 34%). Although the spinal fusion adds to the total health economic costs, the improved and sustained improvements in combination with a reduced re-intervention rate offset the additional costs.

**Predicting revision risk following adult spinal deformity surgery**

Predicting complications following surgical procedures is only really of interest if the risk factors identifiable are either modifiable, or suggest that specific groups of patients could be managed in a different way in order to reduce the complications. We were interested in this paper from New York (USA) which attempts to establish what factors drive the need for revision procedures when treating adult spinal deformity. The study team reports the outcomes of 243 patients, all of whom had undergone deformity surgery for adult acquired spinal deformity. Of these, 16.5% went on to have a subsequent revision procedure. The authors cast their net wide for potential predictors of revision surgery with total body mass and pre-operative deformity increasing the risk of revision. The use of greater diameter rods and BMP-2 reduced the risk of revision surgery. There are however some caveats, of course, to these findings. It does seem that the common thread is that more is more – BMP-2 improves fusion mass (although this can bring with it its own problems), heavier patients with greater deformities apply more mechanical load to the construct. So the take home message appears to be that mechanical instability is associated with revision surgery.

**REFERENCES**

Predicting death in femoral shaft fractures X-ref

The interest in venous lactate as a predictor of morbidity and mortality is continuing to produce more and more useful research. Investigators in Baltimore (USA) have revisited the question of early mortality in femoral shaft fractures. Their study aimed to evaluate the predictive value of venous lactate as a risk factor for pulmonary complications following early nailing of the femur. In their retrospective study, the authors included 414 patients with multiple injuries treated in three academic tertiary referral centres. The authors included all adult patients with multiple injuries (ISS >16) with an elevated lactate on admission. All patients underwent a reamed intramedullary nail of the femur. The authors attempted to correlate elevated pre-operative lactate to post-operative pulmonary complications and to relate the pre-operative score to the outcome (measured as duration of mechanical ventilation and recorded pulmonary complications). The lactate was of use in distinguishing those patients who were likely to have pulmonary complications. Patients with an admission lactate of 3.7 mmol/L were likely to undergo mechanical ventilation for >5 days. Patients who did not have an extended period of post-operative ventilation presented with a median pre-operative lactate of 2.8 mmol/L. This study reinforces the value of serum venous lactate as a marker of peri-operative morbidity and mortality.

Psychiatric illness affects outcomes in polytrauma X-ref

Researchers in Cleveland, Ohio (USA), have investigated the outcomes of 332 skeletally mature patients, all of whom were surgically treated for multiple orthopaedic injuries. The patients were identified from a local trauma registry and a thorough notes review was undertaken, relating to both admission and other pre-existing psychological diagnoses. Their study demonstrates that almost 40% of patients sustaining orthopaedic polytrauma have depression and a further 17% misuse substances. Depression was associated with a threefold increased risk of complications. Orthopaedic surgeons were poor at managing inpatient medication and arranging for post-discharge care. We should remain conscious of these problems in our patients. The authors were also able to establish that post-operative complications were independently predicted by depression, perhaps due to poor compliance – or, equally likely, that the failure to improve following surgery due to complications leads to depression.

Radial head arthroplasty OK? X-ref

Unreconstructable radial head fractures may defy definition, as the degree of reconstructability is clearly open to a range of opinion, and perhaps not everything that can be fixed should be fixed. There are various theories as to what to do with complex radial head fractures. Proponents of fixation argue that particularly where there is an associated ligament injury, the radial head is required to protect any medial ligament injuries. Others argue that the associated stiffness compromises any advantage the native head may have, and advocate either resection or arthroplasty. We would never advocate resection, here at 360, or excision of the radial head as it can lead to radial shortening, distal radioulnar joint (DRUJ) pain, and medial overload. There is, however, the option of radial head arthroplasty, although results for fracture are few and far between and long-term follow-up is sadly lacking. Marsh and colleagues in London, Ontario (Canada) report their own series at a minimum of five years post-radial head arthroplasty using a modular metal arthroplasty system. Their series consisted of 55 patients treated with arthroplasty for an unreconstructable radial head fracture. In common with many series like this, the patients were a mixture of isolated injuries, complex dislocations and combination injuries. The range of motion was, on average, acceptable in the elbow group with a range of flexion from 11° to 137°. The radiograph appearances could only really be described as poor, with 45% of patients having radiolucencies around the stem, and it may be that further longer-term follow-up will show a deterioration. The main message of this paper is that the authors have shown that early good function following radial head arthroplasty in trauma is sustained beyond five years of follow-up (mean eight years). We would perhaps inject a note of caution in that there was significant reduction in range of movement and strength compared with the uninjured side, but with only two of 55 patients requiring further surgery.

Lisfranc and associated fractures may recover better than commonly thought X-ref

An injury much focused on with respect to its diagnosis, principally due to the poor outcome associated with missed treatment, fracture dislocations of the tarsometatarsal joints of the midfoot are renowned for their complexity. However, surgeons in Geneva (Switzerland) studied 61 patients, all with a diagnosis of tarsometatarsal joint injuries and all treated with operative fixation. The paper reports outcomes followed up to 24 years after fixation. Much like long-term studies of the distal radius and ankle, radiographic osteoarthritis (OA) was prevalent and present in 72% of cases, but the occurrence of symptomatic OA was lower at 54%. Despite this, all 41 patients on whom employment data were available had returned to their previous employment at a mean of five months, and only three required modified shoes. Although the ‘hard’ endpoints of appearances of osteoarthritis of the foot appear to reflect the commonly held belief that these injuries are associated with poor outcomes, when moving to a patient-reported outcome measure such as the the visual analogue scale (VAS) and American Orthopaedic Foot & Ankle Society (AOFAS) score, the outcomes look very much better. In light of this fresh look at very long-term follow-up, it seems that outcomes may not be so bleak for patients with a complex midfoot fracture after all.

Complications with clavicle fixation X-ref

Fixation of the clavicle has become somewhat routine following a number of widely publicised randomised controlled trials over the past few years. Whilst for many patients this improves outcomes, there are still some complications. In a topic study that focuses on the bad rather than the good associated with clavicle fixation, authors from Melbourne (Australia) set out to review 138 patients, reporting on their complication rate and profile.
associated with surgical fixation of acute midshaft clavicle fracture. A not insignificant incidence of complications was seen with operative fixation, and around 15% of patients suffered a complication of one kind or another. The series was a mix of plate (n = 110) and intramedullary (n = 28) fixation, and complication rates were significantly higher in the intramedullary fixation subgroup (10% vs 32%). The most common complications were due to inadequate surgical technique (35%), symptomatic metalwork (23%), nonunion (6%) and just 3.6% infection rate. This is an honest paper that frankly reports the notable risk of complications associated with plate fixation of the clavicle. It is important to remember that the only way to avoid complications is to avoid operating, and the rates reported here are acceptable. Nonetheless, the authors make the reasonable point that complications are not infrequent and should be taken into account.

The feasibility of two screw anterior fixation in an Arab population

Management of unstable odontoid peg fractures has moved a little towards operative intervention. Many patients are now treated with anterior screw fixation, a tricky procedure at the best of times. Concerns have been raised in many quarters about the potential safe corridor for placement of the ideal biomechanical construct of two screws. In a very useful cross-sectional study aiming purely to assess the feasibility of the placement of screws in the C2 peg in the Arab population, investigators in Kuwait City (Kuwait) present a retrospective review of 156 CT scans of the cervical spine using just adults. The minimum external and minimum internal transverse diameter, and the minimum external and minimum internal anteroposterior diameter of the odontoid process were measured to evaluate the feasibility of two screw anterior fixation. The male population did have (unsurprisingly) a larger diameter of the canal, however, there was less than 8 mm for screw position in more than 98% of the adult male population, suggesting that two 3.5 mm will not fit, and that the risks of breaching the canal are high in this population. Clearly, screw fixation has some significant advantages over other options, but in certain populations it may not be feasible.

Early weight-bearing and ROM in ankle fractures

Ankle fractures are almost exclusively intra-articular fractures. However, they are often (and indeed, perhaps, usually) treated with open reduction and internal fixation followed by immobilisation in a plaster cast. The rationale for this (as opposed to other intra-articular fractures that are fixed to allow early mobilisation) is due to the concept that the poor soft-tissue envelope may result in higher infection rates if early mobilisation is used – as, in fact, was seen in the early randomised trials on the topic. The study team in Toronto (Canada) has published their own randomised controlled trial investigating the potential benefit of delayed weight-bearing and early mobilisation. Their study involved 110 patients, all of whom underwent fixation for an unstable ankle fracture and were recruited to either early weight-bearing and range of motion at two weeks, or late weight-bearing and immobilisation for six weeks. The outcomes were assessed using return to work as a primary outcome measure, and then secondary outcome measures of the Molander score, SF-36 and complication rates. The authors were able to report that there were some differences (as one might expect) in the earlier weight-bearing group, with a return to function earlier and no increase in wound complications or infections. The authors advise that, based on their study, patients may do better with early weight-bearing and motion without increasing the risk of complications.

Improving core surgical training in a major trauma centre

These authors from Nottingham (UK) studied the trauma and orthopaedic (T&O) core surgical training in major trauma centres (MTCs) to determine whether it meets Joint Committee on Surgical Training (JCST) quality indicators. After an audit cycle assessing the outcomes following their interventions.

REFERENCES

Distinguishing low-grade chondrosarcoma from enchondroma

- Distinguishing low-grade chondrosarcoma from enchondroma remains a dilemma in orthopaedic oncology. What is an enchondroma and what is a low-grade chondrosarcoma? Researchers in Madrid (Spain) have shed some light on what might be useful clinical and radiological criteria to guide treatment. These orthopaedic oncologists report their experience of 133 patients with cartilaginous tumours that could theoretically fall into either category, presenting in the appendicular skeleton. All patients were followed prospectively. Features including clinical history, and radiological and nuclear imaging, along with biopsy results, were collected, and the authors also categorised patients on an aggressiveness scale. Patients were followed clinically and radiologically, and their characteristics compared with the eventual outcomes. The authors were able to identify that pain on palpation, cortical erosion on cross-sectional imaging and Tc99 bone scan uptake above that at the iliac crest were all statistically significantly associated with the likelihood of malignant tumours. Interestingly, the clinical judgement showed a sensitivity of 73.5% and specificity of 94.1%. This paper goes some way towards identifying helpful criteria for diagnosis, and certainly outlines some important factors that can be used to arouse suspicion.

PET-CT in chondroma and chondrosarcoma

- On the same theme, an oncology team in São Paulo (Brazil) evaluated the potential for use of positron emission tomography–computed tomography (PET-CT) in differentiating between chondroma and chondrosarcoma. PET-CT is a maturing technology that is starting to find its feet, and, although clearly not suitable for all applications, is finding its niche in a number of diagnostic situations. The study team reports their experience of PET-CT as a diagnostic modality in 36 patients with suspected chondrosarcoma over a period of six years. The authors identified a threshold of SUVmax of 2.0 as the threshold for exploring the potential for malignancy. Patients above the threshold underwent surgery; those below, observation. Their study population included 17 below-threshold patients diagnosed as chondromas and 19 diagnosed as likely chondrosarcomas with SUVmax values over the threshold. Although the authors do examine nicely the potential benefits of SUVmax and undertake some ROC analysis, not all patients underwent biopsy, and follow-up is rather limited. While this paper adds extra sophistication, it is potentially less clinically useful than the previous report!

Denosumab: great until you stop taking it

- Denosumab has become a bit of a wonder drug in orthopaedic oncology, with widely reported trials demonstrating it to be as effective as almost any other treatment in the management of giant cell tumours of bone (GCT). Denosumab works through direct inhibition of the bone resorption pathways mediated by the RANK receptor and its ligand. In a small prospective series from Toronto (Canada), the research team investigated the outcomes of 20 patients managed with denosumab to downgrade tumours prior to resection. The patients in this study received at least six months of neo-adjuvant denosumab and then joint-preserving surgery. Denosumab was effective in all patients in resolving pain, and intrasional resection was possible in 18 of 20 cases. The patients were followed up to 30 months, with local recurrence occurring in three patients within this relatively short time period. This is a small series, confirming other work showing that denosumab works brilliantly to downstage GCT and allows for conservator surgery; however, rates of local recurrence when denosumab is stopped are worrying.

Is cement augmentation helpful in intramedullary nailing for mets? X-ref

- The management of metastatic disease of the long bones is often a quality-of-life issue, with surgery performed to maintain mobility and reduce the pain associated with mechanical instability. In difficult-to-treat metastatic disease associated with fracture or impending fracture, intramedullary nailing is usually the preferred choice; in difficult-to-treat conditions, this can be augmented with the use of polymethylmethacrylate cement. There is little evidence, however, to support the use of cement augmentation. Researchers in Gyegongi-do (South Korea) have reported their experience of 43 patients, all achieved with cement augmentation, and compared their outcomes with those of 23 ‘controls’ without the augmentation. Outcomes were essentially assessed using VAS pain scores, with patients followed up at one week and six weeks. In addition, PET-CT was undertaken to evaluate tumour spread. Those patients who underwent the cement augmentation had significantly lower immediate mean post-operative pain scores (3.8 vs 6.0) and in addition, the further spread of metastatic disease was only seen in 50% of patients compared with 92% in the control group, suggesting that the thermal setting of the cement had a therapeutic effect. This is an informative study which clearly demonstrates that cement augmentation along with IM nailing improves stabilisation, relief of symptoms and tumour control. This technique should be much more widely used in palliative nailing of long bone metastases.

Nailing sufficient for pathological fractures X-ref

- With a slightly different slant to the previous paper investigating the benefit of cement augmentation, researchers in Victoria (Australia) set out to establish what the outcomes were of plain intramedullary (IM) nailing for those metastatic deposits in the femur with an associated fracture. The authors undertook a retrospective review of 80 consecutive cases in 75 patients, all treated with femoral nailing. The majority of fractures were seen in the subtrochanteric region (46/80) and, perhaps unsurprisingly, the post-operative rate of survival was low at 14.2% and 8.4% at two and three years from surgery, respectively. In contrast, implant survival was good, with a 94% survival at both two and three years post-surgery. The authors concluded that the performance of the simple intramedullary nail was satisfactory. To some extent, this goes against the grain of recently published research. The thrust in recent years has very much been towards the use of the proximal femoral replacement as a potentially curative option, with reported excellent outcomes. This series and the previous nail: cement reinforcement paper do underline the advantages of simple interventions, particularly in cohorts like this one with poor longer-term survival where clearly a smaller operation with quicker recovery time has some intrinsic advantages for the patient.
The patella in distal femoral arthroplasty? X-ref

- Resurfacing of the patella is a controversial procedure, whatever the indication for the arthroplasty. There are some potential significant advantages (potential for improved tracking, the possibility of increasing quadriceps function or reducing anterior knee pain) and some disadvantages (patellar fracture, increased wear). While this issue is yet to be resolved in total knee arthroplasty, it has certainly caused some significant levels of interest with much debate and research. This has not been mirrored in the world of massive endoprostheses.

- Whilst this is understandable from a volume perspective when distal femoral arthroplasties don’t offer the same anatomical landmarks to help with rotation and length, there is an argument that patellar resurfacing may be more advantageous in this situation. In one of the only research papers to address femoral arthroplasty, resurfacing the patella doesn’t make a difference one way or the other!

Does size reliably predict malignancy in soft tissue tumours?

- In a retrospective study from Innsbruck (Austria), the authors set out to examine whether size is a predictive marker of tumour malignancy in soft tissue masses (STM), and furthermore if the ratio of width and length of a STM reflects tumour biology more accurately. The research team performed measurements of maximal lesion size and perpendicular diameter on MRI and ultrasonography studies of 212 patients, all with a histologically verified diagnosis. Size alone was a weak predictor of malignancy in STMs (sensitivity 68.8%, specificity 50.3%), whereas the ratio showed better discriminatory power, with greater separation between benign and malignant entities (sensitivity 83.6%, specificity 93.8%).

Surgical staging of osteosarcoma under the spotlight

- Although widely used throughout orthopaedics, classifications can sometimes be simply an end unto themselves with no clinical or surgical relevance. We are always slightly hesitant when a ‘new classification’ paper crosses our desks at 360. The journals are full of self-serving classifications with little visible benefit over previous efforts at classification. In orthopaedic oncology, however, classifications are hugely important, and understanding the prognosis of specific lesions is key to the patient and medical team in order to have an idea as to the likely success of any treatment. So any new classification should add utility to the decision making.

UK guidelines for the management of bone sarcomas

- And finally we would draw the attention of 360 readers to the British Sarcoma Group (London, UK) guidelines, which are newly updated this month from their previous 2010 incarnation. The new guidelines incorporate recent recommendations from European and UK bodies and essentially boil down to the recommendation that all patients with bone pain or a palpable mass should be appraised thoroughly with appropriate clinical review and imaging. A valuable read for anybody with a general orthopaedic practice who is likely to come into contact with bone sarcomas.

REFERENCES

Children’s orthopaedics

X-ref For other Roundups in this issue that cross-reference with Children’s orthopaedics see: Trauma Roundup 1, 6, 7; Foot & Ankle Roundup 2; Knee Roundup 3, 5.

Current practice in the management of slipped capital femoral epiphysis X-ref

- Treatment of the slipped capital femoral epiphysis (SCFE) has been a controversial topic for many years and continues to stimulate much debate amongst paediatric orthopaedic surgeons. The authors of this survey-based study from New York (USA) report the results of their survey which was sent to all members of the Pediatric Orthopaedic Society of North America, inquiring about preferences in the treatment of SCFE patients. The survey was designed to establish a consensus as to what could be considered current standards of care amongst a broad range of settings including private, public, specialist and generalist practice. As with the majority of survey-based studies, the response rate was respectable, with around 30% of the eligible 990 surgeons replying. The study highlighted the ongoing controversies among the membership, however, it was also able to highlight some areas of broad agreement. Aspects such as initial radiographic evaluation using the anteroposterior and frog-leg lateral views, and use of MRI or bone scanning in patients with significant clinical suspicion but with a normal radiograph, or for hips with questionable head viability, all met with sweeping approval. Members who responded to the survey also tended to agree that cannulated stainless steel screws are used more often than titanium screws and one screw is used more frequently for stable slips, as is in situ fixation method without manipulation. The authors were able to shed some light on the disagreements as well, noting that the current treatment of SCFE varies significantly depending on the surgeon’s type of practice, years in practice, and volume of practice. With so much disagreement and so many recent publications on the topic, surely the management of SCFE is one of those topics where a prospective, multicentre study (randomised or comparative) would be invaluable in resolving some of these controversies and establishing evidence-based guidelines for the management of SCFE.

Calcaneal apophysitis: equally effective conservative options X-ref

- Conservative management of self-limiting conditions is a bit of an art form, and given the general lack of funding for conservative management studies it is unusual to see well-conducted research in this area. We were delighted to report a different story from Dutch authors in Amsterdam (The Netherlands) who designed a randomised controlled trial to evaluate the effectiveness of three different conservative treatment options in children with calcaneal apophysitis (Sever’s disease). The authors designed their three-arm randomised controlled trial to evaluate the effectiveness of observation, a heel raise and physiotherapy on pain at three months following enrolment in the study. The authors recruited 101 patients into the three groups, and each intervention was initiated for a ten-week period with a final follow-up at 12 weeks. Ultimately, each group showed statistically significant improvements in all measured outcomes when compared with baseline during follow-up. There were, however, no significant differences between the intervention groups at final follow-up. The authors concluded that the results of this study demonstrate the effectiveness of each of these conservative options for children with calcaneal apophysitis, or they could, of course, just represent the natural history of the disease; after all, “wait and see” is not really an intervention.

ACL reconstruction in the paediatric population? X-ref

- We are not really fans here at 360 of the data mining exercise that many national datasets and registries have become. It seems to us to be the antithesis of good study design to have some data and then think of a question. However, this paper from Charlottesville (USA) is definitely worth bringing to readers’ attention. Although a retrospective cohort study, the authors have taken care to answer their study question and used data from a national dataset to identify temporal patterns in ACL injury and treatment in the paediatric population. The ICD-9 codes from a national dataset covering treatment episodes between 2007 and 2011 were used to identify both ACL tear and arthroscopic reconstruction in a variety of paediatric and adolescent age groups. For each age group, ACL reconstruction, partial meniscectomy, meniscus repair, microfracture, osteochondral autograft or allograft transfer, and shaving chondroplasty were also identified as secondary procedures. Across the dataset an ACL tear was identified in 44,815 paediatric or adolescent patients, and 19,053 underwent arthroscopic ACL reconstruction. Compared with the adult control group from the same coding database, there was an 18.6% increase in the diagnosis of ACL tear and a 27.6% increase in ACL reconstruction in the ten- to 14-year-old age group. There was also a 17.7% and 15.7% increase, respectively, in the 15- to 19-year-old group. Rates in the youngest group were equivalent to those seen in adults. It seems likely that this trend is multifactorial; a combination of an increase in competitive athletic activity, increased single-sport concentration and year-round participation are implicated by the authors. In addition to this, there are some other potential explanations: increased awareness, more aggressive diagnosis and a lower threshold for evaluation with MRI may also be responsible. The estimated rate of injury is rising at a rate significantly higher in the paediatric population than in adults, and ACL reconstruction in this group was commonly associated with meniscal and cartilage injury requiring surgical procedures. This paper raises some interesting questions: if the rate of ACL injury really is rising, then why is it not, then is the increased rate of surgery due to over-investigation or higher expectations?

Severe open tibial fractures in the child

- Limb salvage is the initial goal for the majority of children with Type IIIB and IIIC open tibial fractures. Soft-tissue reconstruction and management of bone loss are challenging in any case, and children add their own particular subtleties to this difficult problem. Surgeons from Dallas (USA) have reported their own (small) experience with this injury. Their retrospective 20-year series includes just eight patients with this injury, indicating its rarity. All of the cases reported were Type IIIB and IIIC open tibial fractures, all managed with circular external fixation and soft-tissue coverage between 1990 and 2010. These injuries were at the more severe end of the spectrum, with free or rotational soft-tissue flaps required to achieve soft-tissue closure and with a mean...
bone segment loss of 5.4 cm (0 to 12 cm). The authors used circular external fixation for initial static stabilisation to allow for soft-tissue coverage and fracture healing, acute shortening with subsequent limb lengthening, and stabilisation of the extremity for soft-tissue coverage and bone transport. Complications are dealt with candidly in their manuscript. These included infection, partial or total flap necrosis, delayed union, infected nonunion leading to amputation, ipsilateral growth disturbance due to physseal injury, angular deformity, leg-length discrepancy, ipsilateral fracture proximal to the frame, neurogenic pain, equinus contracture, premature consolidation of distraction regenerate, inability to proceed with treatment plan due to psychosocial concerns, progressive contralateral deformity due to incomplete epiphysiodysis, and foot drop due to initial injury. All were present in at least one of the just eight patients reported with this injury. Seven of eight limbs were salvaged and all patients were followed to skeletal maturity, at which point all were walking without assistance. Four patients suffered from foot drop due to anterior compartment soft-tissue loss, three had a clinically significant leg-length discrepancy (> 2 cm) and four required secondary or contralateral procedures. The fact that this study considers a 20-year experience from a US paediatric level I trauma hospital indicates the rarity of these injuries. The authors describe a general algorithm to inform management and demonstrate that limb salvage with good function is possible for these severe injuries. Despite the clearly specialist nature of the care provided to these children, the outcomes were average at best.

Tibial spine fractures: what to do best? X-ref

Tibial spine avulsions are a common occurrence in the paediatric population, and setting aside for a moment the controversies that exist surrounding the indications for fixation, there are also two differing schools of thought regarding the approach (open or closed) for fixation and appropriate peri-operative care. Paediatric orthopaedic surgeons in Rochester, Minnesota (USA) have reported their study designed to establish which of the modifiable risk factors affect outcomes in tibial spine fixation. Although ambitious in its aims, this paper makes its conclusions based on 31 patients (13 open and 18 arthroscopic) on whom the authors evaluated the effects of surgical approach and modifiable peri-operative factors on arthrofibrosis incidence. The series included patients treated over a 26-year period, and follow-up continued until both radiographic union and clinical recovery. Arthrofibrosis was seen in eight patients (one open and seven arthroscopic). Actually having an arthroscopy was not found to be the independent risk factor that it appears, however, it is confounded by operative length - which was an independent risk factor for arthrofibrosis. Specifically, a surgical delay of over a week and prolonged operative times (> 120 min) were significant risk factors for arthrofibrosis. Despite possibly overinterpreting what is a limited series of patients, the authors do make very sensible conclusions. They conclude that prioritising those patients needing surgery and then using whichever approach the surgeon is most familiar with seems a very sensible option.

Flexible nailing in the paediatric tibia X-ref

The tibia is not the femur. This is a lesson that adult trauma surgeons seem to relearn on a regular basis. The soft-tissue envelope is different, the cortical bone is much thicker and the biomechanics are also different. The use of titanium elastic nails has revolutionised the treatment of many fractures. Nonetheless, they are not as stable as interlocking nails, with only frictional rotational stability and no length stability unless endcaps are used, and even when endcaps are used there is a risk of failure due to excessive loading. Surgeons at the Children’s Hospital of Philadelphia, Philadelphia (USA) undertook a research project to evaluate the benefits or otherwise of flexible tibial nailing in children of different sizes. This retrospective review reports the outcomes of a cohort of 95 patients, all of whom underwent stabilisation of a tibial shaft fracture with titanium elastic nails. Patients were stratified according to arbitrary weight (+/- 50 kg) and age (+/- 14 yr) thresholds. Analysis was undertaken for adverse outcomes (delayed and malunion at fracture union and/or nail removal) at a mean time of 243.6 days. There were similar malunion rates between the two weight groups, with the lighter patients faring better (13.3% vs 10%), and similarly the malunion rate in > 14-year group was not significantly higher than in the younger patients (7.6% vs 8.2%), although clearly there is the potential for a significant difference with larger group sizes. Conventional wisdom recommends a cut off of 50 kg for the management of lower limb, long bone fractures with flexible intramedullary nails. This study contradicts this and certainly raises the prospect of extending these indications. We clearly have some concerns about a malunion rate of nearly 18% and would want to see a larger study before changing our routine practice here at 360.

Paediatric tibial osteomyelitis X-ref

Paediatric tibial osteomyelitis often requires sophisticated investigation and prolonged management, typically in a multidisciplinary manner. Treatment with antibiotics and surgical debridement as appropriate can lead to a good clinical outcome, but complications are common. The paediatric team in Auckland (New Zealand) set out to establish the outcomes of their own series of patients with follow-up to just shy of eight years. This retrospective study reports on an impressive 191 patients. On average, patients presented with symptoms for around five and a half days and the majority (60%) were atraumatic. Inflammatory markers were the most sensitive, with 78% presenting with an elevated ESR, 78% an elevated CRP, and 40% presenting with pyrexia. In common with many other types of osteomyelitis, only 75% were tissue-culture positive, with Staphylococcus being the most identified organism. Almost half of patients required a surgical debridement, and antibiotic treatment was required for an average of 20 days (intravenous) and 23 days (oral). Six post-surgical complications were identified and 25 patients required re-admission for one or more relapses. This paper restates what is already known about the serious nature of tibial osteomyelitis, even in the paediatric population. However, it presents contemporaneous information on a condition that has a changing epidemiology. The paper highlights the variable clinical and radiological features seen and the improved diagnostic accuracy of MRI and nuclear imaging.

On supracondylar fractures

This is a peer-reviewed, level V (expert opinion) paper from Nottingham and Bristol (UK) that examines the controversies associated with this common fracture. The authors’ view is that preservation of neurological function, the prevention of further neurological injury and the avoidance of ischaemic muscular damage are of fundamental importance in management. They argue that the majority of perfused but pulseless hands can be managed expectantly, provided there is no evidence of evolving muscular ischaemia. The majority of peripheral nerve injuries, which are caused at the time of injury and present at the time of first assessment, can also be managed expectantly, provided there is no evidence of neuropathic pain, or deterioration over a period of eight to 12 hours. The current dogma of reduction and transcunetaneous pinning of all displaced supracondylar humeral fractures in children should
be approached in a more analytical fashion, and there are alternative management strategies for under-resourced healthcare systems. Good function is to be expected in the majority of cases and the current paradigm of prevention of cosmetic deformity at all costs is not only illogical, but also potentially harmful. This is an interesting read by two ‘senior’ opinions, but like all opinions, should be taken as such!

**References**


## Research

**X-ref** For other Roundups in this issue that cross-reference with Research see: Hip Roundup 1, 3, 5, 6; Knee Roundup 1, 3, 5, 6; Trauma Roundup 5; Foot & Ankle Roundup 5.

**Body fat should be the focus X-ref**

- Much has been made of the potential issues associated with obesity and outcomes. However, the current body of research could at best be described as ‘conflicting’ and, perhaps more accurately, as ‘murky’.
- The majority of studies are consecutive case series, where, at worst, patients are arbitrarily divided into their WHO groups, and incidence of complications and such is reported in a comparative manner, usually with some rudimentary statistical analysis. Researchers in Durham, North Carolina (USA) have taken a slightly more scientific approach, and started by asking, how should obesity be defined? There are plenty of potential measures, and body composition is becoming ‘in vogue’ in many academic disciplines. The research team reports a small study of 215 patients undergoing lower limb arthroplasty, and examines the value of body fat percentage as a marker of complications and outcomes. The study team collected patient demographic data, BMI and body fat percentage as pre-operative variables, and the UCLA activity and appropriate clinical outcome scores. Perhaps not surprisingly, the body fat percentage was a better predictor of medical or surgical complication (odds ratio 1.58) than BMI. The measure also predicted UCLA activity and pain scores more accurately than BMI, which was not predictive in this small study. Patients may be denied surgery secondary to a high body mass index, however, this study demonstrates that manual measurement of body fat percentage is a better metric for evaluating clinical outcomes and complications.
- Future use of this index may be beneficial for patient risk stratification, if properly measured, and certainly should form the basis for further study rather than the much more crude (but easier to obtain) BMI data.

**How best to learn orthopaedic surgery?**

- There is a potential problem raising its head in the future - that of a lack of a skilled workforce. Healthcare systems throughout the world are struggling with raised expectations, difficulties of surgeon-reported outcome measures (which can be a bar to training) and imposition of time-restrictive and service-driven contracts. All of this may potentially lead to a significant skills shortage. Propponents of modern training argue that simulation (now a compulsory part of the UK core teaching curriculum) may be able to compensate for this and that surgeons ought not to be worried. However, with more and more specialties and centres the world over also moving towards an ‘on call’-based system of care provision, there is the worry that the traditional model of ‘surgical apprentice’ may not suffice to allow appropriate training in procedural skills such as arthroplasty. The financial and human cost of a poor arthroplasty is high, and researchers from London (UK) have undertaken a nice assessment of the learning curves and assessment tools, making the point that the move to a competency-based training framework really does require the use of appropriate and validated assessment tools.
- In a 2013 report in the same journal, researchers in Christchurch (New Zealand) evaluated the outcomes of 33,415 patients and concluded that, in their system at least, there were no differences in outcomes between those who underwent consultant-led surgery, and those who underwent trainee-led surgery. We may do well to re-evaluate this question as surgical training moves forward into the future.

**All prep is good prep X-ref**

- The prevention of infection is a laudable goal, and sometimes it is the more simple steps - theatre hygiene, skin preparation and attention to detail in maintaining a surgical site clean of contaminants - that are perhaps of greater importance than the more expensive approaches to infection control, such as laminar flow and antimicrobial-resistant implants. We were delighted to see this simple study from Philadelphia, Pennsylvania (USA) evaluating the use of particular skin prep methods. Six hundred patients were enrolled in a prospective randomised controlled trial, comparing standard of care (alcohol and povidone-iodine prep before draping) with a double prep group where a second application of iodine poviroyls and isopropyl alcohol was undertaken before application of the final adhesive drape. The final analysis included the outcomes of 577 patients. The incidence of superficial surgical site infection was significantly higher in the control group (6.5% vs 1.8%), although there were no differences in deep infection risk between the two groups. It certainly seems that the results of this study support the double prep approach as a simple low-cost intervention to reduce the risk of superficial infections.

- The ‘weekend effect’ does not exist!

- Much has been made in the world’s press about the potential difficulties associated with the new

7. Bohl DD, Shen MR, Kayupov e, cvetanovich GL, Della Valle cJ. Single vs repeat surgical skin preparations for total joint arthroplasty? a study of 4517 patients from Birmingham (UK), a simple analysis of pager activity in a central London teaching hospital[a] shed light on the use of pagers — it seems that doctors are far from the most popular recipients of the ‘bleep’.

REFERENCES


Clinical guidelines: must we follow them?

Controversy about clinical guidelines is not new. Hurwitz (1999) described how, in the fourth century BC, Plato explored the difference between skills grounded in practical expertise and those based solely on following instructions or obeying rules. Plato was of the opinion that flexible responsiveness and ‘improvisatory ability’ were endangered by the use of guidelines. Plato’s view was that the ritual following of guidelines debased medical practice because guidelines presuppose an average patient rather than the particular patient that the doctor is treating. He also believed that the knowledge/analysis that goes into the development of guidelines is not with the treating clinician, but with guideline developers distant from the clinical situation.

The legal profession seem to like guidelines and protocols; it gives them something to judge us by. The question we need to ask in clinical practice is, how do we stand legally if we don’t follow NICE guidelines or hospital/departmental protocols? Is it a mandatory requirement that we do so? If not, why have they been drafted in the first place? Gupta and Warner helpfully summarise the rubric of the NICE guidelines, pointing out that NICE concede that they are not a replacement for clinical knowledge and judgement, and do not take the place of the individual responsibility of healthcare professionals to make appropriate decisions.

NICE itself indicates that clinical guidelines recommend the ways in which healthcare professionals should care for people with specific conditions and encourage best practice. However, Tingle describes how, in 1996, the Department of Health indicated that the guidelines should be constructed in such a way that permits deviation and initiative, which has the potential to result in improvements. The point is also made by Tingle that clinical guidelines are not a cookery book and clinical judgement is not suspended when they are used.

In our day-to-day clinical practice we are generally judged on the basis of the Bolam principle or test, after the case of Bolam v Friern Hospital Management Committee (1957). Judge McNair opined in this case, “A doctor is not guilty of negligence if he has acted in accordance with the practice accepted as proper by a responsible body of medical men skilled in that particular art. Putting it another way round, a doctor is not negligent if he is acting in accordance with such a practice, merely because there is a body of opinion that takes a contrary view.”

Since that time, our professional practice has been judged on the basis of clinicians performing to a reasonable and competent standard that would be supported by their peers. While doctors should clearly strive to achieve ‘best practice’ the Bolam principle is based on reasonable and competent practice rather than Olympian or gold standard practice. The Bolam test was modified to a degree by the Bolitho judgement in 1996 which held that the position taken by the treating doctor had to be logically defensible, even if Bolam-compliant.

Following the recent Montgomery ruling, the Bolam principle has of course been further attacked and overturned as far as it applies to informed consent. James Badenoch, senior counsel in the presentation of the Montgomery appeal to the Supreme Court, argues that in all areas of medical litigation, “the writing is on the wall” for Bolam and, “the law should go further and remove Bolam from its pedestal altogether.”

In orthopaedics-related medical negligence practice, the author has recently been asked to advise on cases where failure to adhere to the NICE guidelines on DVT thromboprophylaxis in joint arthroplasty surgery, and failure to follow pre-operative rehabilitation protocols prior to surgical management of low back pain, have been raised as an important issue by claimants solicitors in support of their clients’ claim for substandard treatment. Samanta et al described the use of guidelines in a group of litigation cases in the USA. They found that they were only used in 7% of the cases, more usually by the defence team (the shield) but also on occasions by the claimants legal team (the shield.)

The theme was further developed in the UK by Samanta et al in 2006, in a detailed review of the awareness and use of guidelines by solicitors and barristers in their medical negligence practice in England and Wales. They contacted 372 lawyers (220 solicitors and 152 barristers) of which only 110 (71 solicitors and 39 barristers) responded. Despite the poor response rate (30%), the results are of interest. Eighty-nine per cent of the respondents reported that they or someone in their team had used clinical guidelines in clinical negligence cases in which they had been involved in the previous three years. They found that guidelines were brought into the case more often by expert witnesses, rather than having been introduced by the legal teams. There was a significant majority view amongst the legal responders (85%) that the remit of NICE would increase the use of clinical guidelines in future negligence cases. It appears that at the time the survey was carried out, the use of guidelines was more prevalent in negligence litigation in England and Wales than in the United States, although the study cited by Samanta et al in 2003 is not strictly comparable with that reported in England and Wales in 2006.

Samanta et al proposed a four stage conceptual model for the use and utilisation of guidelines in negligence litigation:
• Is the decision made by the treating clinician, as far as it applies to the use (or avoidance of use) of the guideline, Bolam defensible?
• Is the decision by the treating clinician, as far as it applies to the use (or avoidance of use) of the guideline, Bolitho justifiable?
• Is there scientific validity behind the quoted guideline or protocol?
• How does the guideline apply to the particular circumstances of the matter under consideration, i.e. the case-specific application?

Clearly in any negligence case if the position taken by the treating doctor in relation to the use of the guideline in question is not Bolam defensible, then the court would conclude that no reasonable practitioner would have behaved in that manner and the duty of care owed to the patient has been breached.

If the position is Bolam defensible, is it Bolitho justifiable? In the Bolitho case Lord Browne-Wilkinson opined, “The court has to be satisfied that the exponents of the body of opinion relied upon can demonstrate that such opinion has a logical basis. In particular, in cases involving, as they often do, the weighing of risks against benefits, the judge, before accepting a body of opinion as being responsible, reasonable or respectable, will need to be satisfied that in forming their views, the experts have directed their minds to the question of comparative risks and benefits and have reached a defensible conclusion on the matter.” Therefore the individual doctor or Trust needs to be able to demonstrate to the court’s satisfaction that their adherence to or avoidance of the guideline in question has a logical and scientifically justifiable basis.

The third stage would be to decide whether or not the particular guideline was admissible as evidence. Guidelines arise from a variety of sources ranging from NICE, the Royal Colleges, other professional bodies and private insurance companies. There may be differing recommendations between guidelines. Consideration may have to be given by the court to the principles and methodology used in formulation of the guidelines together with their reliability and relevance. Guidelines developed using rigorous, evidence-based methodology are unlikely to be regarded as unreliable.

Indeed, the emphasis between the NICE guidelines on venous thromboembolism (VTE) prophylaxis following total joint arthroplasty and the ‘living document’ on the BOA website is one area where guideline recommendations are not strictly in alignment. The BOA document praises the efforts of NICE in formulating their guidance, but also presents compelling evidence from Barrack,12 the American College of Chest Physicians (ACCP) and the American Academy of Orthopaedic Surgeons (AAOS) for the use of aspirin as equally effective to other forms of chemoprophylaxis against VTE. There is reference to the 2013 report of the National Joint Registry (NJR) which shows, for example, that 8% of patients undergoing total hip or knee arthroplasty in 2012 were given aspirin as VTE prophylaxis. This amounted to 12 692 patients treated outside NICE VTE guidelines. Does the position taken by the treating surgeons amount to reasonable and competent practice in light of the ACCP and AAOS evidence? Is it logically justifiable from a judicial perspective? I believe so, but until it is tested in the legal arena we will not know for certain.

The final stage suggested is application of the guidelines to the specific facts of the case under consideration. This would usually involve consideration of a narrow range of issues including whether the guidelines had been followed (a matter of fact), and whether the conduct of the practitioner in these circumstances fell below what would be expected of a reasonable doctor in that situation. The latter would still require expert witness opinion.

They suggest that their proposed approach is a halfway house between the traditional Bolam test and the position where guidelines define the standard of care. They believe that the model blends a scientific evidence-based approach with clinical autonomy which is an inherent component of medical practice which would provide a structured approach to judicial decision-making.

I believe that the suggestions made by Samanta et al are sensible and logical in relation to the position of guidelines in medical negligence cases. In reality, very few negligence cases get to court. Guidelines are introduced sporadically and are often used as shields or swords in the early skirmishes, and (subject to the veracity of the expert evidence on each side) no doubt are one piece of the jigsaw that the legal teams use in deciding whether to settle or proceed with the claim.

Therefore what are we to make of all this in our day-to-day management of patients? If we take a decision not to follow a guideline or protocol, we need to have a reasoned argument for taking that decision. This applies whether the decision is taken on an individual patient basis or if we have a fundamental issue with the recommendations made within the guideline or the reasoning behind it. After all, guidelines are just guidelines, not mandates, aren’t they? However, in light of Montgomery it would be important to explain to the patient the rationale behind the departure from a NICE guideline or standard hospital protocol.

As long as Bolam continues to be recognised by the law, we may (I think) rely on Foster’s argument:13 “Clinicians are worried about protocols because they think that failure to follow them will necessarily connote negligence. This is nonsense. The Bolam test does not cease to apply simply because a protocol has been drafted.” However, given the evolving state of medical negligence litigation in 2016 and the Montgomery assault on Bolam, we would also need to ensure that our position was Bolitho logically and scientifically supportable from a judicial perspective.

REFERENCES
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