there were very few clinical studies that reported the reliability of physical functioning tests in patients with low back pain. Overall, 20 eligible studies were found and 38 clinical tests were identified. Good test-retest reliability was concluded for the extensor endurance test, the flexor endurance test, the five-minute walking test, the 50-foot walking test, the shuttle walk test, the sit-to-stand test, and the loaded forward reach test. Only the Biering–Sørensen test demonstrated an overall good inter-rater reliability. None of the identified clinical tests could be considered to have good intrarater reliability. The authors call for future research that will investigate thoroughly the clinimetric properties of these clinical tests.

Low back pain and femoral geometry

■ The study from **Bari (Italy)** aims to assess the relationship between femoral anteversion, low back pain, and spinopelvic parameters in patients with severe primary unilateral hip osteoarthritis.[7] It is a relatively common presentation for patients to experience both low back pain and hip pain, both in the presence of degenerative disease. It is sometimes difficult to tease out which should be treated first, although there is almost universal agreement that the two conditions are linked. In a cohort of patients undergoing total hip reconstruction, this study seeks to identify the precise link between the two conditions, and brings us all one step closer to identifying the pathology behind the so-called 'hip-spine syndrome'. The study is based on the results of 91 patients, all with primary hip arthritis. All of the patients underwent a CT scan preoperatively and were divided into those with and without concomitant low back pain. The full gamut of radiological parameters was collected, as were clinical scores in the form of the visual analogue scale (VAS), Harris Hip Score (HHS), Oswestry Disability Index (ODI), Roland–Morris Disability Questionnaire (RM), and 36-Item Short-Form Health Survey (SF-36). The authors report that patients with severe primary unilateral hip osteoarthritis and low back pain exhibit a different femoral anteversion between the two hips, with a more anteverted femoral neck observed at the arthritic hip. This asymmetry was found to be strongly related to back pain, thus a new connection between hip and spine pathology has been discovered. This explains, in part, why patients with simultaneous hip osteoarthritis and back pain experience relief of both pathologies once a total hip arthroplasty is performed.

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Trauma

X-ref *For other Roundups in this issue that cross-reference with Trauma see: Children's orthopaedics Roundups 2, 6 & 7; Foot & Ankle Roundup 1; Research Roundup 2; Shoulder & Elbow Roundup 6; Wrist & Hand Roundups 1, 5 & 6.*

Suture button *versus* single syndesmotic screw for syndesmosis injury X-ref

■ There has been a resurgence of interest in the ankle syndesmosis, with recent papers looking at accuracy of reduction, functional restriction, and range of motion following syndesmosis injuries. This interest has paralleled the development of the TightRope syndesmosis device (Arthrex, Naples, Florida), which allows a 'flexible' fixation of the syndesmosis using an endobutton and a knot through traditional drill holes. Although there is much low-quality evidence making the argument that this is a reasonable approach, there is little in the way of high-quality evidence comparing TightRope and traditional screw treatment. These investigators from **Oslo (Norway)** undertook a randomized controlled trial to compare the clinical and radiographic results between patients, all of whom had a syndesmotic ankle injury, who underwent stabilization with a TightRope *versus* treatment with a single four-cortical syndesmotic screw.[1] The investigators enrolled 97 patients aged between 18 and 70 years old. Treatment allocation was via randomization; 48 patients received a TightRope device and 49 patients received treatment with a syndesmotic screw. The primary outcome measure was the score on the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale assessed to a final follow-up of two years. Secondary outcome measures were the Olerud–Molander Ankle (OMA) score, visual analogue scale (VAS), and EuroQol-5D (EQ-5D) Index. CT scans of both ankles were obtained at two weeks, and at one and two years postoperatively. The patients were followed at six weeks, six months, one year, and two years. Two years of follow-up were completed for 90% of the patients (46 in the TightRope group and 41 in the syndesmotic screw group). The median AOFAS score at two years was higher in the TightRope group than in the syndesmotic screw group (96 *vs* 86; $p = 0.001$), as was the median OMA score (100 *vs* 90; $p < 0.001$). The TightRope group reported less pain during walking at two years than the syndesmotic screw group. There was no difference between groups with regard to pain at night or during daily activities at the final two-year follow-up; however, the TightRope group had a higher median EQ-5D Index score at two years (1.0 *vs* 0.88). Around half of the patients in the syndesmotic screw group had a persistent radiographic malreduction of over 2 mm between the injured and uninjured ankles, which resulted in symptomatic recurrent syndesmotic diastasis in seven patients in the screw group. Although this is a relatively small randomized controlled trial, the investigators of this study conclude that patients treated with a TightRope do better over a two-year follow-up period, based on their AOFAS scores, OMA

scores, EQ-5D Index scores, and VAS scores for pain during walking and pain during rest.

Fracture-site mobility predicts nonunion in humeral shaft fractures X-ref

■ The best treatment for all humeral shaft fractures is widely regarded as a humeral brace, except for when the fracture doesn't heal. The difficulty, of course, is working out when these fractures are likely to heal. There are a number of factors that have been previously shown to be associated with nonunion or malunion in the conservative treatment of these fractures, including body habitus, open fractures, and energy of injury. However, despite the use of these widely accepted risk factors in most centres, there is still a proportion of patients who go on to need humeral nonunion surgery, which carries with it significantly more risks than primary fracture fixation. In an ideal world, we would have a reliable way of establishing which patients will eventually develop a nonunion, so they could have earlier intervention. In this interesting study from **New York, New York (USA)**, the authors postulate that fracture-site mobility at early follow-up may be a useful predictor of eventual nonunion.[2] The authors present this retrospective review with the aim of establishing whether nonunion can be predicted by clinical examination at the six-week interval. The authors recorded clinical examination for fracture stability, which they categorized as relative motion of any kind, in 84 consecutive patients with a primary treatment decision of nonoperative treatment of a diaphyseal humeral shaft. Within this series, there were 11 patients who went on to develop a humeral nonunion, which was defined for the purposes of this study as failure to heal after six months of nonoperative management. In terms of the primary study question, the investigators found that the presence of humeral shaft fracture-site motion at six weeks following injury identified future fracture nonunion with 82% sensitivity and 99% specificity (only one patient with motion at six weeks proceeded to fracture union). The authors concluded that examination of fracture motion in the clinic setting should be assessed in all nonoperative humeral shaft fracture patients at six weeks. Given the high negative predictive values reported in this study, there is the potential both to determine which patients should obtain closer follow-up for the risk of nonunion progression, and to intervene earlier in those patients who are most likely to go on to nonunion.

Is persistent pain a given in nonunion surgery? X-ref

■ Patients facing nonunion surgery have nearly always had many months of pain and disability following their fracture fixation, and some have had multiple previous operations, leading to scarring and often ongoing recalcitrant pain. In a fascinating and timely study from **New York, New York (USA)** the authors ask whether patients can really be cured of their persistent pain following treatment of their nonunion.[3] The authors report the outcomes of nearly 350 patients, all with fracture nonunions treated operatively. Although the authors report this as a prospective cohort study, in reality it is a prospective database study. Patient-reported outcomes (visual analogue scale (VAS) pain scores and short musculoskeletal functional assessment (SMFA)) and radiographic outcomes were recorded. The authors only included those who had a minimum of one-year follow-up and complete healing, giving them a cohort of 270 patients. They stratified patients into those with low initial pain scores (n = 233, 82.6%) and high initial pain scores, defined as greater than one standard deviation over the mean (n = 47, 17.4%). In terms of longer-term outcomes, the authors established that there was a difference in outcome between patients in the high and low groups (VAS 7.47 and 1.78, respectively), with up to half of patients in the high-pain group reporting an increase in their pain scores at long-term follow-up. On covariant analysis, the authors were able to establish that high baseline pain score, increased Charlson Comorbidity Index, lower income level, and current smoking status were more common in the high-pain cohort. This paper is noteworthy in that it characterizes expectations in this group of patients, many of whom go on to have long-term disability and pain. These authors have gone further, however, and identified a cohort of patients who smoke, have multiple comorbidities, and are suffering higher pain levels in the preoperative period. This is useful information, as patients can be consented appropriately, and surgeons can adjust both patient and medical team expectations in those patients who are not likely to do well.

Predicting distal radius fracture instability

■ In a straightforward but important paper, researchers from **Amsterdam (The Netherlands)** set out to externally validate the Edinburgh Wrist Calculator (EWC) in a population of patients with distal radius fractures.[4] The EWC is a result of several decades of research into distal radius fractures in Edinburgh, and was built as a multivariate model with the intention of calculating the risks of secondary loss of fracture position based on radiographic parameters. The authors used a retrospective cohort design and included a cohort of 99 consecutive adult patients with distal radius fractures. The authors collated the initial radiographic parameters and only included patients with initial dorsal angulation $>10°$ and/or an ulnar variance of >3 mm who were treated with closed reduction and cast immobilization. The authors used both the original Mackenney thresholds and the Dutch Consensus Statement thresholds to validate the EWC as a predictor of secondary loss of alignment. There was a dramatic difference in the risk of redisplacement when assessed with the two different definitions. Redisplacement within two weeks when using Mackenney's criteria occurred in 62% (n = 61/99), while only 18% of fractures went on to redisplacement using the Dutch criteria (n = 18/99). The EWC itself predicted a $>70\%$ chance of redisplacement for only three fractures. The EWC was – whichever thresholds were used – a disappointing predictor of redisplacement in this validation series. The area under the receiver operating characteristic curve was poor for Mackenney's threshold (AUC = 0.47) and adequate for the Dutch thresholds (AUC = 0.71). Given the independent validation here, it is difficult to recommend the EWC for prediction of secondary displacement in wrist fracture.

Does hip arthroplasty always follow acetabular fracture? X-ref

■ While the jury is still out on a number of matters surrounding the treatment of acetabular fractures, what we have seen here at *360* is a propensity towards a more aggressive approach with these fractures, with surgeons the world over starting to lower the threshold for operative management of the acetabulum. This is probably due to the increase in availability of cross-sectional imaging, combined with the improvement in implants and operative techniques. There are still, however, many unknowns, and one of the most topical areas for research

is that of conservative management *versus* fixation *versus* fixation and arthroplasty in the older patient with an acetabular fracture. Although there are strides being taken in this area, with the start of the Acetabular Fractures in Older Patients Intervention Trial (AceFIT, a pilot study into these three options), there are a number of things that are not yet entirely clear with regard to fixation of these fractures. In particular, the incidence of degenerative change is not clear following surgical fixation, rendering the decision-making process somewhat tricky in borderline cases. This population series from **Toronto (Canada)** sets out to establish if patients with an acetabular fracture fixation were at a higher risk of developing arthritis.[5] Unusually, this team chose to utilize a population-wide approach. The authors identified patients from the population of Ontario (approximately 13 million) who were undergoing fixation of their acetabular fractures over a 14-year period, then undertook a prognostication study. They matched the populations by age, sex, and socioeconomic and demographic factors, with a 4:1 matching: 1725 eligible patients, with 6900 patients in the control group. The authors then estimated the incidence of arthritis in the population at two-, five-, and ten-year timepoints. A Cox proportional hazards model was then used to estimate the influence of patient, provider, and surgical factors on the risk of eventual total hip arthroplasty. Overall, there was a 13.9% incidence of hip arthroplasty during the six year follow-up period, compared with 0.6% among matched controls. The authors were also able to establish that the relative risks of undergoing a total hip arthroplasty reduced over the course of follow-up until there was no difference in risk between the group who had previously undergone open reduction internal fixation of the acetabulum and the control group. There were some identified covarieties that increased the risk of eventual hip arthroplasty, including older age (hazard ratio 1.035) and female sex (hazard ratio 1.65). There was also a marked volume effect from a surgical perspective, with higher surgeon volume resulting in a 2.6% decreased risk of arthroplasty for each acetabular fixation undertaken over ten per year. Although just a simple prognostication study, this series contains some valuable information. It supports the need for high-volume acetabular surgical practice to improve eventual outcomes, gives a figure for follow-up – after ten years, there is no increased risk of arthrosis – and identifies the overall risk of arthritis development at a surprisingly low 14%.

Timing of surgery and hip-fracture mortality X-ref

■ Most orthopaedic surgeons argue that delay to surgery following hip fracture is likely to result in a higher postoperative mortality. The rationale is that mortality is mostly driven by medical complications, and bed rest is innately bad for the older population. While this seems to make sense, there has been some difficulty in proving it. However, even the most sceptical of surgeons are usually convinced of the benefit of early surgery from a humanitarian perspective. We were interested to see this cohort study from **Cleveland (Ohio)** with the headline that early surgery reduces mortality in hip-fracture patients.[6] This is a ten-year study from a very low-volume unit (720 patients over a ten-year period). The study was undertaken through the now familiar International Classification of Diseases (ICD) diagnosis coding, chart review for demographics, and linkage to the state and Social Security Death Indices. The relationship between delay to surgery and one-year mortality was assessed using a multivariable logistic regression, adjusting for baseline clinical status and surgical factors. Of the 720 patients, 159 (22%) died within one year. The authors established that there was a significant association between surgical delay and excess mortality (odds ratio 1.05 for each ten-hour delay). While we agree with the sentiment of the study in principle here at *360*, we do wonder what inferences can really be made from a study with just 72 patients per year. There are multiple potential reasons for delays to surgery, and it is important in this sort of study to ensure that there is not a confounder, with the sickest patients waiting for medical interventions. The authors clearly provide food for thought, but, without proper account being made for frailty or comorbidity, we are less convinced that these results can lead to the firm conclusions stated in their paper.

Reliably classifying open fractures X-ref

■ One of the difficulties with any research into traumatic diagnoses is that of classification, and this is certainly the case with open fractures. Given the broad range of outcomes and the severe consequences of complications for patients, it is surprising that the most commonly used classification system (that of Gustilo and Anderson (GA)) has such a poor interobserver reliability. There are other systems, however, and researchers from **New Lambton Heights (Australia)** have set out to evaluate the interobserver reliability of the Orthopaedic Trauma Association's Open Fracture Classification System (OTA-OFC).[7] The authors used a panel of eight orthopaedic surgeons who were presented with radiographs, wound photographs, and a short clinical description, then asked to independently assess the injury using both the GA and OTA-OFC classifications. The overall interobserver agreement was 'moderate' for the GA ($\kappa = 0.44$) and not much better for the OTA-OFC ($\kappa = 0.49$). The OTA-OFC has subdomains and there was differential agreement in the five categories of OTA-OFC for skin ($\kappa = 0.55$; moderate), muscle ($\kappa = 0.44$; moderate), arterial injury ($\kappa = 0.74$; substantial), contamination ($\kappa = 0.35$; fair), and bone loss ($\kappa = 0.41$; moderate). Although the OTA-OFC has not managed to improve upon the GA classification from the perspective of reliability, by describing the concordance between observers for each subdomain, the authors report useful information on where the variability in classifications lies.

Missing data and hip fractures X-ref

■ The problem of missing data has never been so acute as now. While missing data is relatively uncommon in clinical trials, and efforts can be made to complete the data set, we are increasingly relying on large registry studies and on data sets designed for healthcare billing and other activities. The authors of this study from **New Haven, Connecticut (USA)** ask how much missing data can be sustained before the results of a study are affected.[8] The authors used the National Surgical Quality Improvement Program (NSQIP) database from the United States and aimed to determine how the missing data affected the outcomes reported using this data set. The authors queried the NSQIP database for patients receiving treatment for a hip fracture between 2005 and 2013. The authors then went on to establish what percentage of missing data was for variables in demographics, comorbidities, and investigations results. There were different rates of missing data, with up to 78% of data missing in some fields. The authors undertook an analysis for association with 'adverse events' using a multivariate model. The analysis was undertaken using common methods for handling of missing data. Overall, there were 26 066 patients in the study and 35 risk factors were identified that may be associated with adverse postoperative events. However, only seven of these were seen in all three methods

of analysis. In order to make sense of large data sets, reliable methods for handling missing data are important to institute, as in many cases the exclusion of incomplete records is inappropriate, as it risks introducing inherent biases.

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Oncology

Reconstruction of the hip after resection of periacetabular oncological lesions X-ref

■ Periacetabular lesions are relatively common, either as metastasis or as a primary tumour. Unlike other areas of the musculoskeletal system, there are myriad options for reconstruction and even more opinions as to which are the best and which are most appropriate, either in general or specific cases. The range of reconstructive options include allograft, prosthesis, reimplantation of sterilized autograft, porous tantalum, and custom megaprosthesis. These authors from **Rochester, Minnesota (USA)** set out to establish exactly where we are with the evidence for reconstruction and outcomes.[1] The authors undertook a fairly extensive literature review and were able to identify 57 studies reporting the outcomes of 1700 patients, all with oncological lesions of the acetabulum. Among the 1700 patients, there were more metastatic lesions (41%) than any other type of lesion. The other lesions included chondrosarcoma (29%), osteosarcoma (10%), Ewing's sarcoma (7%), and multiple myeloma (2%). The authors sensibly divided the reconstructive options into the following groups: Harrington reconstruction; saddle prosthesis; an allograft and allograft prosthesis composite; sterilized autograft; porous tantalum implant; a custom-made prosthesis; and a modular hemipelvic reconstruction. Overall, there was an unsurprisingly high complication rate of 50%, with infection (14%) and instability (8%) being the most common. Similarly high were the rates of mortality, with 50% having died of disease progression; 23% were alive with disease, and 27% were alive with no evidence of disease at the final follow-up of, on average, 3.5 years.

Amputation for limb sarcoma: contemporary indications and outcomes

■ Another ongoing debate is that of amputation *versus* limb salvage for patients presenting with peripheral musculoskeletal sarcomas. Our interest was piqued by this paper from **Boston, Massachusetts (USA)** that sheds some interesting light on the role of amputation in contemporary sarcoma practice in today's era of limb salvage.[2] The authors report their own retrospective analysis of a series of 54 patients, all with limb sarcomas requiring amputations. The authors reviewed ten years of patient records to identify the 54 patients, all of whom had primary non-metastatic limb sarcomas and had also undergone amputation. There were three clear subgroups here of patients who underwent primary amputation (n = 18), secondary amputation after previous limb salvage (n = 22), and those with hand or foot sarcomas (n = 14). The authors cited a number of causes for limb amputation. In the primary group, the common causes were loss of function, bone involvement, multiple compartment involvement, and large tumour size. For those having secondary amputation, the common causes were proximal location, joint involvement, neurovascular compromise, multiple compartment involvement, multifocal or fungating tumour, loss of function, and large tumour size. With the hand and foot tumours, the causes for amputation were essentially joint involvement and prior unplanned surgery. The authors go on to identify differences based on amputation timing, and evaluate outcomes. They conclude that amputations chosen judiciously are associated with excellent disease control and survival. There is, in orthopaedics, as the pendulum swings, sometimes the risk of throwing out the baby with the bathwater. With the move towards limb reconstruction in all sarcomas, this paper is important in that it does note the role of amputation in suitable cases.

Clavicula pro humero technique after resection of the proximal humerus in children?

■ Among the many options for reconstruction of proximal humeral resections after wide resection for malignant tumours in children, the clavicula pro humero technique is a biological option that has a few small series documenting the results of the procedure. This technique uses the ipsilateral clavicle to reconstruct the proximal humerus. The clavicle is cut into its medial third and returned through a lateral pivot point corresponding to the acromioclavicular joint, allowing verticalization of the clavicular segment. Osteosynthesis of the distal humerus is then performed directly or through an interposed graft if a bone defect persists after clavicle rotation. This technique allows for maintenance of upper limb length, with growth potential of the lateral growth plate of the clavicle, stability of the 'new shoulder', and its mobility. This series from **France** looks at the results of eight children aged between eight and 18, all operated over an eight-year period in four university hospitals, who received a clavicula pro humero reconstruction.[3] Proximal and distal bone unions were achieved before ten months without an additional surgical procedure in two and six of