X-ref ***For other Roundups in this issue that cross-reference with Trauma see:*** *Knee Roundup 1; Foot & Ankle Roundups 1, 2, 4, 6; Hand & Wrist Roundups 4, 5, 6; Shoulder & Elbow Roundups 1, 3, 8; Spine Roundup 1; Children's Orthopaedics Roundup 2.*

Can vascular injury be appropriately assessed with physical examination after knee dislocation? X-ref

Though rare, knee dislocations are devastating for a patient and are often part of a polytrauma scenario. The alert orthopaedic surgeon will be conscious of the risk of an arterial injury, which can be significant enough to put the limb at risk. However, to conclusively exclude an arterial injury can be difficult, particularly to predict which patients are more at risk than others. Traditionally, arterial injuries were excluded by performing a physical examination to detect the distal pulses and an ankle-brachial index (ABPI). However, with advances in technology there is an opportunity to request a vast array of imaging modalities to detect an arterial injury. But which one is the most pertinent? This study from **Cleveland, Ohio (USA)** attempted to examine the risk factors and treatment algorithms for knee dislocation.[1] The study identified 110 patients with a knee dislocation. Factors established as risk factors for vascular injury included increased BMI (7.7% increase in odds of sustaining a vascular injury) and open injuries. An ABPI of less than 0.9 had the highest positive likelihood for predicting a vascular injury and it also had the highest specificity (99%). The presence of a palpable dorsalis pedis pulse had the lowest likelihood ratio and also had the highest sensitivity for ruling out a vascular injury (98%). The combination of physical examination had a sensitivity of 100%, specificity of 98%, a positive predictive value of 100% and an overall diagnostic accuracy of 98%. The authors did not use a 'gold standard' of CT angiography to detect a vascular injury for all patients; instead they used a reference standard of clinical follow-up at six months from the time of injury. Previous treatment algorithms relied on the assessment of the dorsalis pedis pulse, the posterior tibial pulse, the presence of Doppler-detecteable pulses and the assessment of the ABPI. However this study showed that the dorsalis pedis pulse was the most sensitive finding for excluding a vascular injury in the dislocated knee. In addition, an ABPI <0.9 was the most specific physical examination finding for detecting a vascular injury. However neither test had 100% sensitivity or diagnostic accuracy. Clearly any assessment that is not fully sensitive is inadequate when considering vascular injuries following a knee dislocation. The authors concluded that although the individual physical findings were not 100% sensitive, when used in conjunction with one another they were then able to complete the clinical picture. No patients in this study with a vascular injury had an entirely normal physical examination. There were two false positives, which the authors deemed acceptable when seeking to identify a vascular injury. This study is immensely useful for those surgeons involved in managing patients with these kinds of injuries, and provides clear guidance when a CT angiogram is indicated on how to properly assess these patients.

Making sense of talofibular ligament injuries based on ultrasonography findings X-ref

In Japan ultrasound has been becoming a very common tool for the diagnosis of soft-tissue pathology. The difficulties associated with diagnosis of a ligament injury following an acute ankle sprain can be overcome easily with the use of a handheld ultrasound in clinic. The difficulty of course being that when there is a change of practice, clinicians do not always have a framework around which to make decisions with the information they have. Clinicians from **Tokyo (Japan)** set out to establish a framework to evaluate the anterior talofibular ligament within the clinic setting based on easy-to-measure ultrasound parameters.[2] Their study focussed on the evaluation of a total of 140 lateral ligament complex sprains in 132 patients. The ligament injuries were subdivided into five subtypes based on the apparent pathology, and clinical outcomes and treatments were then established to explore the prognostic value of their proposed classification. The ultrasound findings differed by injury classification and were predictive of the treatment type offered with 133 of 140 injuries achieving a good or excellent result at the final follow-up. Although not the most earth shattering of papers, from an interest point of view this paper does highlight not only the changes in clinical evaluation for soft-tissue injury in clinic but also the value of re-evaluating diagnostic methods. Orthopaedic surgery often focusses on treatment rather than diagnosis.

Local vancomycin in contaminated wounds

In a contaminated traumatic animal model, the authors from **San Antonio, Texas (USA)** propose that the addition of vancomycin powder may be beneficial in the prevention of infection in contaminated wounds.[3] To test the hypothesis the authors used a segmental defect rat femur model with a contamination of *Staphylococcus aureus*, with treatment at either six or 24 hours post-inoculation. Rat models are usually surprisingly resistant to infection, hence the authors used surrogate outcome measures of detectable bacteria and serum vancomycin levels following treatment of either debridement or irrigation alone (control group) or in combination with either vancomycin powder or vancomycin-impregnated polymethyl-methacrylate beads. The topical vancomycin powder and impregnated beads both significantly reduced bacterial load at six hours. However, delaying treatment to 24 hours reduced the efficacy of vancomycin in both groups. Vancomycin was only detectable in all animals treated at 24 hours; however absorption was negligible from beads. It appears that the introduction of topical vancomycin is likely to be effective in contaminated wounds if introduced early in the evolution of the wound. There are few downsides to bead administration, as lack of systemic absorption would suggest a very safe route of delivery.

Infected nonunions

The monolateral fixator is perhaps the 'poor man's' ring fixator, often brought into play for its ease of application and the simplified surgical technique. However these fixators are not as intrinsically stable or flexible as the older Ilizarov frames. Both find widespread use in infected nonunions with a fracture gap, and we were delighted to see this randomised controlled trial from **Haryana (India)** comparing the radiological and functional outcomes of ring and rail fixators in patients with an infected gap (> 3 cm) nonunion of the tibia.[4] The authors were able to recruit 70 patients, all of whom presented with an infected nonunion with bone defect to either of the treatment modalities. Outcomes were assessed radiographically and using the Association for the Study and Application of the Method of Ilizarov (ASAMI) score in addition to the short musculoskeletal

functional assessment (SMFA) score. Both fixator systems had comparable rates of union and functional outcomes. Deep pin site infection was more common in the rail fixator group. The authors conclude by recommending the use of a ring fixator in patients with a bone gap of more than 6 cm. Patients with a bone gap of up to 6 cm can be managed with either a ring or rail fixator. Although possibly a bit of a moot point, this underlines the difficulty of these cases for us here at *360*, and the complexity of these injuries is highlighted for us by the lack of success seen with the simpler surgical options.

Hypovitaminosis in hip fractures in Egypt X-ref

■ This cross-sectional study included hip fracture patients admitted to a level 1 trauma centre in **Assiut (Egypt)**, in a single calendar year.[5] These authors set out to establish the prevalence of hypovitaminosis D in their patient population. A random sampling technique and serum vitamin D levels in conjunction with DEXA bone mineral density scans were used to select 133 patients. This simple paper identified (as would be expected) high rates of osteoporosis (femoral neck, 72.2%) but perhaps more surprisingly, there were similarly high rates of vitamin D deficiency (60.9%). The authors found vitamin D deficiency to be associated with low bone mineral density and a high BMI. Increasing awareness regarding the prevention and treatment of vitamin D deficiency is clearly needed, and this paper serves to highlight the regional variations in incidence of micronutrients.

Warfarin and hip fractures X-ref

■ The difficulties surrounding medical care for patients with fractures to the neck of the femur are well-known. Warfarinisation continues to spark debate, with many physicians now not recommending or prescribing warfarin over a particular age for patients in the low-risk category. However, there are many patients in the community who have been taking warfarin for many years who come into hospital with a fractured hip, often with poorly controlled warfarinisation. There are few studies investigating the impact that warfarin has on the provision of care for this fragile patient population. A research team in **Cambridge (UK)** reviewed the outcomes of 2036 patients managed at their centre over a 15-year period.[6] There are currently few studies that report the outcomes of patients admitted with a neck of femur fracture and who are warfarinised. Within their cohort, 8% of patients were taking warfarin pre-operatively and even after adjusting for age, sex, American Society of Anesthesiologists score, Abbreviated Mental Test Score, fracture type, operation type, and premorbid Work Ability Index score, there was still an independent effect of warfarinisation a number of outcome measures. Patients who were admitted on warfarin are less likely to have surgery within 36 hours (OR 0.20) and likely to stay longer than their counterparts (15 *vs* 13 days) which is likely an effect of the delay to theatre. The authors also established that there was a higher likelihood of death, with survival at 12 months just 66% compared with 76% for 'normal' patients. This paper is interesting in that it highlights the difficulties associated with warfarin administration, and certainly in this group it appears to produce a delay to theatre, which can then result in an increased length of stay. It is of course difficult to state conclusively that the difference in mortality is due to the warfarin *per se*; the authors have not conducted the most sophisticated of survival analyses and adjustment for comorbidities is notoriously difficult in this group of patients.

Predicting nonunion in the tibia

■ The burden of orthopaedic reconstruction continues to grow with increasing numbers of patients presenting needing nonunion and infection surgery, and the newer biologic treatments have yet to show any efficacy even in the most optimistic interpretation of the study results. Given the severity of the problem, being able to predict which patients are likely to go on to nonunion is incredibly helpful. The team at Shock Trauma, **Baltimore, Maryland (USA)**, have (as they often do) stepped in with a sensible approach, presenting their nonunion risk determination (NURD) score.[7] The authors collected 35 factors they hypothesised might be associated with nonunion, and using the collated data on all of those factors they report the results of seven years of tibial fractures treated at their centre. Of their cohort of 382 patients, 56 went on to nonunion and 326 healed. Using a fairly straightforward stepwise modelling approach the authors constructed a score to include all factors with a moderate effect size of two or more. The authors established that the factors contributed to the likelihood of nonunion flaps (5 points), compartment syndrome (4), chronic conditions (3), open fractures (2), male sex (1) and ASA grade (1). Although the authors did not perform a ROC analysis, the NURD score did strongly predict the likelihood of nonunion, with a NURD score of 12 points suggestive of a 61% risk of nonunion. This is an excellent start to nonunion prediction; an independent validation in perhaps this and other fracture types would be an excellent place to start.

Compartment syndrome and tissue oxygenation X-ref

■ In what is a really important study, authors from **San Francisco, California (USA)** test the hypothesis that direct measurement of tissue oxygenation may be an excellent marker of compartment syndrome.[8] They used a dog model of compartment syndrome alongside a tourniquet ischaemia model. The use of a polarographic oxygen probe in the muscle of both hind limbs was tested for sensitivity. The animals had a single hind limb with compartment syndrome and the other with a tourniquet ischemia model. Fasciotomy was then performed. The investigators were able to measure a drop in compartment perfusion with the increase in pressure associated with the compartment syndrome model; this was relieved with fasciotomy. Clearly there are some significant drawbacks with the current diagnostic methods for compartment syndrome, essentially being based around some arbitrary pressure thresholds or the less objective clinical examination findings. The facility to measure real-time tissue perfusion would be a game changer in the early diagnosis of compartment syndrome.

REFERENCES

1. **Weinberg DS, Scarcella NR, Napora JK, Vallier HA.** Can vascular injury be appropriately assessed with physical examination after knee dislocation? *Clin Orthop Relat Res* 2016;474:1453-1458.
2. **Kemmochi M, Sasaki S, Fujisaki K, et al.** A new classification of anterior talofibular ligament injuries based on ultrasonography findings. *J Orthop Sci* 2016. (Epub ahead of print) PMID: 27444555
3. **Tennent DJ, Shiels SM, Sanchez CJ Jr, et al.** Time-dependent effectiveness of locally applied vancomycin powder in a contaminated traumatic orthopaedic wound Model. *J Orthop Trauma* 2016;30:531-537.
4. **Rohilla R, Wadhwani J, Devgan A, Singh R, Khanna M.** Prospective randomised comparison of ring versus rail fixator in infected gap nonunion of tibia treated with distraction osteogenesis. *Bone Joint J* 2016;98-B:1399–1405.

5. Farouk O, Mahran DG, Said HG, et al. Hypovitaminosis D among patients admitted with hip fracture to a level-1 trauma center in the sunny Upper Egypt: prevalence and associated correlates. *Geriatr Orthop Surg Rehabil* 2016;7:148-152.

6. Lawrence JE, Fountain DM, Cundall-Curry DJ, Carrothers AD. Do patients taking warfarin experience delays to theatre, longer hospital stay, and poorer survival after hip fracture? *Clin Orthop Relat Res* 2016. [Epub ahead of print] PMID: 27586655

7. O'Halloran K, Coale M, Costales T, et al. Will my tibial fracture heal? predicting nonunion at the time of definitive fixation based on commonly available variables. *Clin Orthop Relat Res* 2016;474:1385-1395.

8. Weick JW, Kang H, Lee L, et al. Direct measurement of tissue oxygenation as a method of diagnosis of acute compartment syndrome. *J Orthop Trauma* 2016; 30:585-591.

Oncology

X-ref ***For other Roundups in this issue that cross-reference with Oncology see:*** *Children's Orthopaedics Roundup 7.*

100% required for 'good response' to chemotherapy

A paper questioning the traditional 'cut -off' between poor and good responders in patients of Ewing's sarcoma from **Birmingham (UK)**[1] has caught the beady eyes of the editorial board here at 360. The study team reviewed all of their patients treated for Ewing's sarcoma between 1980 and 2012. They grouped patients according to percentage of necrosis after chemotherapy with < 50%, 50% to 99% and a total 100% response. In terms of survival there were, as would be expected, some significant differences between the groups. The authors established event-free survivals of 45%, 59% and 89% for all of their groups respectively, and overall survivals of 49%, 72% and 94%. One might perhaps expect the results to be better for the 50% to 99% response rate, and the authors concluded that only patients with 100% necrosis after chemotherapy should really be classified as having had a 'good response' to chemotherapy, with significantly poorer survivals in those patients with any viable tumour in the surgical specimen. This may have implications for the addition of adjuvant therapy in the post-operative period, both in the need to add local radiotherapy and to intensify subsequent chemotherapy in the 'poor' responders.

Local controls and survival

Sticking with the theme of survival and tumour eradication, this study from **Villejuif (France)** set out to evaluate the relationship between local control and overall survivals in patients with extremity soft-tissue sarcomas.[2] The authors were able to report on the outcomes of over 500 consecutive patients, all treated for a primary soft-tissue sarcoma at a single centre. Outcomes were reported to a median follow-up of seven years and the investigators report the local recurrence and overall survivals. Their results were all in all good with an 8% local recurrence rate and 80% five-year overall survivals. The predictors of poorer overall survival were, perhaps unsurprisingly, higher grades of tumour, leiomyosarcoma, male sex and age. Perhaps more surprisingly, however, tumour size, margin status, and local recurrence were not. The authors went on to develop their own multivariate analysis to examine the specific tumour subtypes and surgical factors associated with local recurrence. Their analysis suggested that a diagnosis of epithelioid sarcoma or myxofibrosarcoma and margin size < 1 mm correlated with local recurrence. However, grade of tumour and the tissue constituting the surgical margins did not. The authors concluded that specific subtypes and surgical margin size < 1 mm correlated with a higher local recurrence while neither the margin status nor local recurrence affected the overall survivals. Perhaps an important take away message is that tumours demonstrating a higher local recurrence rate could require wider local margins.

Surveillance of sarcomas?

One of the perennially difficult problems to solve in any field of cancer surgery is how, and for how long, patients should be followed up after their orthopaedic diagnoses. Surgeons in **St Louis, Missouri (USA)** have tried to reach a consensus as to what is a reasonable follow-up for soft-tissue sarcomas.[3] The authors undertook a survey of the Musculoskeletal Tumor Society (MSTS) membership to establish what the current practice was as to follow-up strategies. The authors were able to achieve a 20% return rate, but although a relatively small percentage, all were 'experts' by a commonsense definition. The main message from this survey is that surveillance strategies utilised by MSTS members are arbitrary; rather than being evidence-based, they are based on training continuation and inherent caution. This interesting, but simple, study really does raise the question of excessive radiation exposure during imaging for surveillance of sarcoma.

Patterns of disease relapse in primary extremity soft-tissue sarcoma

The previous article highlighted the non-standardised and variable surveillance strategies that are commonplace amongst sarcoma specialists. This paper provides something of an evidence base to suggest that the patterns of post-operative surveillance could be tailored to sarcoma diagnoses. The 'unwanted outcome' relapse following soft-tissue sarcoma excision is surprisingly poorly examined, with few studies investigating the outcomes of recurrent sarcomatous disease. A research group in **London (UK)** aimed to characterise the patterns of disease relapse in patients undergoing resection of primary extremity soft-tissue sarcoma.[4] Of the 556 patients who underwent resection at the Royal Marsden Hospital between January 2004 and January 2014, the local recurrence-free survival (LRFS) did not differ significantly between histological subtypes. Distant metastasis-free survival (DMFS) and disease-specific survival (DSS) were found to differ significantly between sarcoma subtypes, and the worst outcomes were seen in patients with pleomorphic undifferentiated sarcoma (PUS). However, when the authors undertook a more comprehensive multivariable analysis, histological subtype was not found to be independently prognostic for LRFS, DMFS or DSS. Metastatic disease developed in 149 patients, with the lungs being the most common site of first metastasis. This series suggests that the patterns of distant metastatic disease in extremity sarcoma are not uniform, and histological subtype should be considered alongside other patient and tumour factors, such as tumour grade and size, and patient age, in order to facilitate tailored follow-up regimens.

Conservative management of desmoid tumours is safe and effective

The desmoid tumour remains something of an enigma. Historically, surgical excision has been the mainstay of treatment, however, the current trend has been a move towards