

clinical applicability. This nomogram comes with advantages. Unlike prior nomograms, it incorporates nodal metastasis status as a prognostic factor in the predictive models, and can predict three endpoints: major progression events occurring during the clinical course. A word of caution by the authors: radiotherapy is used in Japan only for a small proportion of soft-tissue sarcoma patients who have a higher risk of local relapse. Only 22% of patients in this dataset underwent adjuvant radiotherapy, compared with a much larger proportion in Western countries. Hence, there will be a need to externally validate these nomograms using specific patient populations before they can be recommended for clinical use in other countries, where therapeutic strategies are different. The use of nomograms in this study highlights the strength of the technique. The majority of models we use in prognostication and scoring utilize linear methods, and require a computer for calculation. Nomograms are a great way of easily and rapidly estimating risks without the drawback of linear methods, and without requiring the use of a computer.

Giant cell tumours combined with secondary aneurysmal bone cysts are more likely to develop postoperative recurrence: a retrospective study of 256 cases

■ Giant cell tumours of bone (GCTBs) in isolation can be difficult to treat; however, when

combined with aneurysmal bone cysts (ABCs), surgeons are faced with an even harder challenge. Into the fray step a group from **Guangxi (China)**, who have conducted a retrospective analysis of 60 patients diagnosed with GCTBs combined with secondary ABCs, and 196 patients diagnosed with simple GCTBs.⁵ The cohort was treated with intralesional curettage or tumour resection. The study was undertaken in order to identify the impact of secondary ABCs, as well as other factors, on the postoperative recurrence of GCTB. Recurrence rate in the secondary ABCs group was significantly higher than that in the simple GCTBs group. Curettage showed a higher recurrence rate than tumour resection. Careful multivariate regression analysis identified that secondary ABCs and curettage were independent factors for recurrence of the GCTBs. Although the retrospective data suggests ABC as a poor prognostic factor, the reasons offered by the authors are unconvincing. An increased recurrence rate can be otherwise explained. First, secondary ABCs can easily cause haemorrhage because the blood does not clot, and the difficulty in controlling the intraoperative haemorrhage may result in contamination of surrounding tissues. Alternatively, the uncontrolled haemorrhage may blur the surgical field, which may cause incomplete tumour resection. Since 80% of recurrences occurred in areas where use of a tourniquet was feasible, it would be reasonable to suggest that uncontrolled

haemorrhage should not be an issue, although this is not made clear from the manuscript. Furthermore, to account for this difference, there is no clarification as to whether there was a preponderance of grade III lesions in the ABC sub-group or whether a larger number of non-ABC GCTBs underwent resection. This raises some scepticism surrounding the results of this otherwise interesting paper.

REFERENCES

1. **Fujiwara T, Medellin MR, Sambri A, et al.** Preoperative surgical risk stratification in osteosarcoma based on the proximity to the major vessels. *Bone Joint J.* 2019;101-B(8):1024-1031.
2. **Fujiwara T, Lex JR, Stevenson JD, et al.** Surgical treatment for pelvic Ewing sarcoma: what is a safe and functional acetabular reconstruction when combined with modern multidisciplinary treatments? *J Surg Oncol.* 2019;120(6):985-993. (Epub ahead of print) PMID: 31381161.
3. **Bosma SE, Lancia C, Rueten-Budde AJ, et al.** Easy-to-use clinical tool for survival estimation in Ewing sarcoma at diagnosis and after surgery. *Sci Rep.* 2019;9(1):11000.
4. **Sekimizu M, Ogura K, Yasunaga H, et al.** Development of nomograms for prognostication of patients with primary soft tissue sarcomas of the trunk and extremity: report from the Bone and Soft Tissue Tumor Registry in Japan. *BMC Cancer.* 2019;19(1):657.
5. **Tang H, Moro A, Feng W, et al.** Giant cell tumors combined with secondary aneurysmal bone cysts are more likely to develop postoperative recurrence: a retrospective study of 256 cases. *J Surg Oncol.* 2019;120(3):359-365.

Children's orthopaedics

X-ref For other Roundups in this issue that cross-reference with *Children's orthopaedics* see: *Sports Roundup 1; Spine Roundups 3, 5 & 6; Oncology Roundup 2; Research Roundups 5 & 6.*

Manifestations of pseudoachondroplasia

■ Considering that pseudoachondroplasia is the second most common form of skeletal dysplasia, it is surprising that descriptive studies of its manifestations have been less than thoroughly described in the orthopaedic literature. This is why we at 360 were pleased to come across this work from **Akron, Ohio (USA)**.¹ The authors of this simple but important study set out to review the medical records and radiographs of 141 patients presenting with pseudoachondroplasia. Their paper represents an excellent opportunity to define and clarify the presentation and orthopaedic sequelae of this common condition. As anyone studying for an

orthopaedic licensing exam will doubtlessly know, the condition is caused by a mutation in the collagen oligomeric matrix protein on chromosome 19. This leads to an accumulation of material in the rough endoplasmic reticulum of chondrocytes and, hence, impaired endochondral bone formation plus tendon abnormalities. Like most dysplasias, there are several individual mutations that can result in the same phenotypic condition. Mutations causing pseudoachondroplasia give rise to short limb and trunk stature with conventional craniofacial appearance. Individuals with the condition are of normal intelligence. Presentation is usually after walking age, with characteristic macroscopic findings such as a waddling gait. This study scrutinized positive clinical and radiological features and analyzed by body region. Features were defined as typical if they occurred in over 50% of individuals, common in 25% to 50%, or occasional in less than

25%. The precise and detailed analysis is listed in the paper, but many of the manifestations occur as a result of the spondyloepiphyseal dysplasia, with flattening or fragmentation of the epiphyses, and flaring or widening of the metaphysis regions of long bones. The femoral head and acetabulum were severely dysplastic in 100% of individuals studied. The knees showed either genu valgum (22%), genu varum (56%), or a windswept deformity (22%). Common manifestations in the spine at all levels included platyspondyly, anterior beaking, or an ovoid codfish deformity. In the cervical spine, these deformities were present in 89% of cases. This led to kyphosis (28%), scoliosis (58%), and lumbar lordosis (100%). The long-term sequelae are obviously complex and variable, but premature arthritis in the hips was particularly common in those individuals studied. Severe symptoms seen in the knees was frequent in the 20- to 30-year-old

age range. Overall, this is an interesting and instructive clinical review of a large cohort. We at 360 would recommend this study both to specialist paediatric surgeons and to those wishing to widen their knowledge of this common condition.

Motor nerve injuries in paediatric supracondylar humerus fractures X-ref

■ A degree of neurological dysfunction is not at all uncommon in extension-type supracondylar fractures. It occurs in approximately 11% of injuries, with median nerve or isolated anterior interosseous nerve injuries accounting for over 60%. The majority of presentations are neuropraxias, which will spontaneously recover with time. However, early surgery is beneficial for patients presenting with neurotmesis, since spontaneous recovery is not possible. Iatrogenic nerve injury from surgical intervention is very well described in the literature, and usually involves the ulnar nerve. Conversely, there is relatively little published evidence regarding the outcomes for nerve injuries that are a result of the injury itself. This paper from **Boston, Massachusetts (USA)** reviews their own series of cases presenting over a 16-year period.² The authors identified 244 patients, all presenting with a neurological deficit and an extension-type supracondylar fracture. The patients were treated by a fellowship-trained paediatric orthopaedic surgeon. Indications for open reduction and neurovascular exploration included an inability to obtain a closed reduction, an open fracture, and persistent vascular insufficiency after closed reduction and stabilization. Acute nerve decompression was reserved for open fractures, vascular injury, or when operative findings demonstrated nerve contusion or compression. Exploration was at the discretion of the treating surgeon. In terms of outcomes, recovery was determined to be at the time of full motor recovery, a time when full sensation had not necessarily returned. The majority of nerve injuries were median nerve palsies (62%), followed by radial nerve injuries (24%). Overall, 11% had more than one nerve injury, and these patients had the poorest outcomes. Perhaps surprisingly, 29% of the cohort also experienced a degree of concurrent vascular compromise. Isolated median nerve injuries had the best outcomes, with 70% recovering within three months and only 7% taking longer than six months to recover. Some (18%) of cases had acute nerve decompression at the time of fracture fixation and none of those required late nerve exploration. Median time to nerve recovery was 2.3 months. Multiple-nerve injuries took 5.4% longer to recover than single-nerve injuries. This is an interesting and large series that aids prognostication

to a degree. As is well established, the majority of nerve injuries recover within six months without acute nerve decompression, and the presence of either an isolated radial nerve injury or multiple-nerve injuries is associated with a prolonged motor recovery.



Lengthening with monolateral external fixation versus magnetically motorized intramedullary nail in congenital femoral deficiency

■ Femoral lengthening is required in several scenarios for both adults and children. It can be achieved through different techniques, such as sole use of an external fixator, lengthening over an intramedullary nail, or use of a lengthening nail. Frames are generally unpopular with patients, as their bulky nature makes sitting, mobilizing, and dressing challenging. Pin site infections, joint contractures, and soft-tissue complications with femur lengthening are also concerns generated by this method. As technology has advanced, magnetically motorized intramedullary nails have been utilized, which obviates some of these issues. However, their clinical efficacy is much less well established in the literature. We at 360 were therefore interested to see this paper from **Baltimore, Maryland (USA)**, which compares the clinical outcomes in patients with congenital femoral deficiency (with or without fibular hemimelia) when undergoing femoral lengthening using monolateral external fixation versus a magnetically

motorized intramedullary nail.³ This retrospective review included 32 patients treated with external fixation and 30 patients treated with internal lengthening nail. The groups had heterogeneous age ranges, with means of 9.4 years and 15.4 years for the external fixation and nail patients, respectively. There was a suitably long follow-up for the former (4.4 years); however, follow-up was unhelpfully shorter (1.8 years) for the latter. This is partially explained by the fact that the smaller diameter motorized nails have only recently become available. They also require a trochanteric entry point, limiting their use in younger patients. Patients treated over a nine-year period (up until 2015) were included and retrospectively reviewed. Demographics, follow-up period, range of motion, and complications were noted, as well as radiological consolidation visible on plain film radiographs. A distraction index, defined as the length of regenerative millimetres divided by the duration of distraction in days, was also recorded. In the external fixation group, the lengthening goal was achieved in 88% of patients, with two having slow healing and two having premature consolidation. In the nailing group, the goal was achieved in 87% of patients; two patients had a knee or hip subluxation and two experienced delayed union. Mean lengthening achieved was greater in the external fixation group (5.6 cm vs 4.8 cm), most likely because lengthening could be extended across the knee to mitigate the risk of subluxation. Although the mean arc of motion before surgery and at final follow-up were similar between the groups, the external fixation cohort had significantly lower average range of motion at the end of distraction and at consolidation than the intramedullary nail group. The distraction index and consolidation index were similar between groups; however, complication rate was significantly lower in the nail lengthening patients, mainly due to the absence of pin site infections. This work suggests that the internal motorized nail is a good alternative to the external fixator for older patients, although care must be taken in those with knee instability. Here at 360, we do wonder about the relative cost profiles of the two procedures. We would be very interested in an analysis of this, especially given the huge financial costs of the motorized nails for the initial implant: is this offset against lower care costs later on down the line?

Minimum five-year follow-up of Mehta casting to treat idiopathic early-onset scoliosis X-ref

■ Casting of paediatric early-onset scoliosis patients using the Mehta technique has yielded

good results. However, published follow-ups are generally of short duration and the technique requires high patient tolerance. This paper from **Salt Lake City, Utah (USA)** assesses the results of a series of patients treated with serial casting at a minimum five-year follow-up and also, interestingly, aims to identify predictive factors for sustained resolution.⁴ Follow-up of this duration has only previously been recorded in the originating centre. Children with idiopathic early-onset scoliosis treated with serial casting between 2001 and 2013, and with a minimum five-year follow-up, were included. Those children at final follow-up with a Cobb angle of $\leq 15^\circ$, and with a decrease in the Cobb angle of $> 20^\circ$, were then analyzed separately to establish the factors associated with a good result. During the study period, 54 children were treated and 38 had the requisite follow-up duration and data available. Age at the time of first cast, initial rib vertebral angle difference, flexibility, and body mass index were not significantly different between the groups. Mean age at treatment initiation was 24 months, with a mean Cobb angle of 56.2° . At the time of the most recent follow-up, 49% of patients had a scoliosis of $\leq 15^\circ$, and 73% of children were improved by at least 20° . Those who achieved $\leq 15^\circ$ of scoliosis, as compared with those who did not, had significantly lower initial Cobb angles at presentation (48.2° vs 63.7°). Furthermore, their supine traction Cobb angle was also significantly lower (22.5° vs 33.2°), as was their first in-cast rib-vertebral angle difference (12.8° vs 26.2°). Three children who had achieved a correction to $\leq 15^\circ$ subsequently relapsed after the casting treatment was complete. These results are impressive; however, they are poorer than the previously published 69.1% for complete correction at mid-term follow-up. In the same study, the initial Cobb angles were significantly lower than those in the present study. This is a valuable paper that adds to the literature supporting the use of Mehta casting in idiopathic early-onset scoliosis. It perhaps gives a realistic insight as to what can be expected in terms of results at a non-originating centre.

Autism and toe walking: are they related? X-ref

■ Tiptoe walking is a common presentation in the paediatric orthopaedic clinic, but is rarely persistent beyond two years of age. In those children who do continue to tiptoe after two years of age, a diagnosis of persistent toe walking is made. Previous studies have indicated that 2.1% of the paediatric population have a diagnosis of idiopathic toe walking. Those patients with neurodevelopmental

and autism spectrum disorders (ASDs) have a much higher rate of toe walking, quoted as up to 41%. This paper from **Stanford, California (USA)** provides a helpful insight into both the treatments currently employed in, and the outcomes for, these patients in orthopaedic practice.⁵ This study is based around analysis of 'big data', procured from a private payer medical database of over two million patients. This study is the largest current study looking at ASD and tiptoe walking practices. The authors were able to include 5,739 patients with a diagnosis of ASD. Of these, 484 (8.4%) also had a diagnosis of persistent toe walking, compared with 0.47% of children in the non-ASD, normally developing population. When compared with the non-ASD population, children on the autism spectrum had a significantly higher incidence of surgical corrections (3.3% vs 1.2%). This trend of requirements for increased intervention rates was also true for physiotherapy (59.3% vs 38.1%) and serial casting (7.4% vs 3.6%). Surgical intervention was invariably unsuccessful in the ASD population, with 75% continuing to toe walk at two years. That being said, the picture was far from rosy in the idiopathic group, with around half continuing to tiptoe walk after casting and physiotherapy, and 67% toe walking postoperatively. When no intervention took place, 63.6% of ASD patients continued to toe walk ten years after the diagnosis, compared with 19.3% of otherwise normally developing children. This study suffers from two main criticisms. First, there is the potential for coding and billing inaccuracies, as well as the persistence of reductant codes, associated with the use of big data. The second limitation is the nature of the population used; it consisted only of private payers, excluding Medicaid. However, this study is the largest to date examining the incidence of, and treatments for, tiptoe walking. Thus, it is helpful in counselling patients and parents in what to expect with treatment for this condition.

Delaying surgery in type III supracondylar humerus fractures

■ With the modern resistance to performing surgery out of hours, there has been an increasing movement in the trauma and orthopaedic community to leave cases until the next available daytime operating list. Coupled with the centralization of specialist services in many healthcare economies (including paediatric trauma services), this means that there are several reasons why an operation may be bumped to the next day. The clear positive facets to this policy include the reduction of fatigue-related errors and the slashing of staffing and theatre costs. When introducing daylight

surgery policies, it is of paramount importance that there is no detriment to surgical outcomes. This study from **Dallas, Texas (USA)** aimed to determine whether a delay to surgical treatment would affect operative times and the rates of open reduction in patients with a modified Gartland type III supracondylar humerus fracture.⁶ In this series, the results of 309 patients that presented between 2011 and 2013 with grade III injuries were included. The cut-off between an early versus delayed treatment was selected as 15 hours. Fractures were deemed to be high-energy if there was an associated neurovascular injury. Patients with an open injury or requiring vascular repair were excluded from the series and analysis. Surgical time was recorded and fluoroscopy time was used as a surrogate for reduction difficulty. All patients were treated by a fellowship-trained paediatric attending doctor. In this series, 54% of patients were treated before 15 hours, and 46% after 15 hours, with higher-energy injuries being treated sooner than low-energy injuries (12.9 hours vs 15.3 hours). Surgical time was longer in the high-energy injuries (37 minutes vs 31 minutes), as was the fluoroscopy time (54 seconds vs 48 seconds). When the high-energy injuries were excluded, no significant difference was detected in the surgical time or fluoroscopy time between the early and delayed treatment groups. Delayed treatment in patients without evidence of soft-tissue or neurovascular injury did not result in a longer surgical or fluoroscopy time in this study. Permitting that these outcomes can be considered surrogates for the difficulty of reduction, this data does support the hypothesis that there are no increased difficulties in reduction, or higher rates of conversion to open reduction. The authors are careful to point out that this paper does not suggest that all Gartland type III fractures can be safely delayed, but rather that, in appropriate clinical circumstances, a delay is not detrimental to operative difficulty and may be considered appropriate.

Risk factors for the development of avascular necrosis after femoral neck fractures in children: a review of 239 cases X-ref

■ Fortunately, femoral neck fractures are relatively rare in the paediatric population and are usually associated with high-energy trauma. As in the adult population, they represent a surgical challenge due to the potential for displacement with instability and their high complication rate, the most common of which in the paediatric population is avascular necrosis (AVN). This is a devastating complication at any age, but it is especially detrimental for the younger patient, where a joint arthroplasty is

neither a viable, nor desirable, option. This group from **Fuzhou (China)** aimed to clarify, in one of the only series big enough to do so, the predictive features for development of avascular necrosis in paediatric patients with a fracture of the femoral neck.⁷ The authors retrospectively reviewed 239 children undergoing surgical treatment for a femoral neck fracture. In this prospective series, the children had a mean age of ten years, and the development of AVN was assessed on plain film radiographs. Risk factors, including age, sex, mechanism of injury, initial displacement, time type of fracture, time to reduction, and the method and quality of reduction were recorded. Logistic regression analysis was used to evaluate independent risk factors. None of this study's findings are particularly surprising, with the degree of initial displacement of the fracture, as well as age, being significant, independent risk factors for AVN. With a receiver operating characteristic analysis, the authors established a cut-off age of 12 years as the critical point for increasing the incidence of AVN. If the subject was over

the age of 12 years, severe initial displacement of the fracture and poor quality of reduction significantly increased the rate of AVN. However, for those under the age of 12 years, these factors were not significantly predictive, with only initial displacement reaching statistical significance. Interestingly, in those patients treated with open reduction, the authors reported a significantly reduced secondary AVN rate when a plate and screw fixation was used, compared to cannulated screw or Kirschner wire fixation. In patients treated with closed reduction, a poor quality of reduction significantly increased the rate of AVN. While we should be relatively unsurprised by some of these results, the finding that plate and screws is superior in open reduction is an interesting one. This warrants further investigation, as this is certainly a more invasive procedure.

REFERENCES

1. **Weiner DS, Guirguis J, Makowski M, Testa S, Shauver L, Morgan D.** Orthopaedic manifestations of pseudoachondroplasia. *J Child Orthop.* 2019;13(4):409-416.

2. **Shore BJ, Gillespie BT, Miller PE, Bae DS, Waters PM.** Recovery of motor nerve injuries associated with displaced, extension-type pediatric supracondylar humerus fractures. *J Pediatr Orthop.* 2019;39(9):e652-e656.

3. **Szymczuk VL, Hammouda AI, Gesheff MG, Standard SC, Herzenberg JE.** Lengthening with monolateral external fixation versus magnetically motorized intramedullary nail in congenital femoral deficiency. *J Pediatr Orthop.* 2019;39(9):458-465.

4. **Fedorak GT, D'Astous JL, Nielson AN, MacWilliams BA, Heflin JA.** Minimum 5-year follow-up of Mehta casting to treat idiopathic early-onset scoliosis. *J Bone Joint Surg Am.* 2019;101(17):1530-1538.

5. **Leyden J, Fung L, Frick S.** Trends and treatment patterns between 2005 and 2016. Autism and toe-walking: are they related? *J Child Orthop.* 2019;13:340-345.

6. **Prabhakar P, Ho CA.** Delaying Surgery in Type III Supracondylar Humerus Fractures Does Not Lead to Longer Surgical Times or More Difficult Reduction. *J Orthop Trauma.* 2019;33(8):e285-e290.

7. **Wang WT, Li YQ, Guo YM, et al.** Risk factors for the development of avascular necrosis after femoral neck fractures in children: a review of 239 cases. *Bone Joint J.* 2019;101-B:1160-1167.

Research

X-ref For other Roundups in this issue that cross-reference with Research see: *Sports Roundup 3; Foot & Ankle Roundup 5; Wrist & Hand Roundup 4; Spine Roundup 1.*

Long-term impacts of brace treatment for adolescent idiopathic scoliosis on body composition, paraspinal muscle morphology, and bone mineral density

X-ref

■ In the past, some studies have claimed that brace treatment affects the mobility of the spine in later life, as well as negatively influencing bone mineral content and muscle strength. It is known that immobility, bed rest, and even surgery itself has a profound effect on body composition including dry muscle mass, myosteatosis, and sarcopenia. The mechanisms behind this are not entirely known; however, there is some evidence that this affects outcomes and wellbeing. There is, however, very little evidence as to the effects of functional bracing, such as that used in scoliosis, when used for a period of time. In this interesting study from **Niigata (Japan)**, a team has investigated the effects of brace treatment on body composition in patients with adolescent idiopathic scoliosis (AIS) in an effort to evaluate any changes in bones or muscles.¹ In this study, the authors used

bioelectrical impedance analysis to estimate body composition and MRI to measure cross-sectional area and fatty degeneration of paraspinal muscles in patients treated nonoperatively for AIS. Bone mineral density was also measured at the lumbar spine and left hip. The authors had a population of 319 patients treated nonoperatively for their AIS. Among the 80 patients who enrolled in the study, 44 comprised the full-time brace group (more than 13 hours per day), and 36 made up the non-full-time brace group (observation, dropouts from brace wear, or part-time brace users). No significant differences were found in any of the body composition parameters between groups. Further analysis showed that full-time brace wearers were significantly more active. The conclusions drawn from this study can be included in the information given to patients and parents, in order to alleviate their concerns about some of the negative effects of bracing for scoliosis. This study has some wider implications for researchers and clinicians interested in body composition. The implication that functional bracing does not have profound effects on body composition is important and supports other work suggesting that exercise and activity, even in shorter timeframes (such as high-intensity interval training), can offset any losses from immobility.

Single vendor arthroplasty: is there a benefit?

■ The purchase of orthopaedic implants constitutes a significant proportion of the costs associated with arthroplasty. The choice of implants is influenced by many factors, including surgeon choice and the purchaser's relationship with vendors. In the past, manufacturers would set the price of the implants and hospitals would pay for them. As these relationships have developed, many hospitals moved to setting prices and ensuring that vendors provide their implants under that price. The newest iteration of cost savings is to move large systems into a single vendor (or a 'preferred vendor'), with the potential to dramatically reduce implant prices by guaranteeing large volume. In this study from **New York, New York (USA)** a team has compared the overall implant costs and readmissions, length of stay, and surgical site infections (SSIs) before and after the introduction of a preferred vendor programme.² Nearly 8,000 cases were included in the study, evenly split between the year before and the year after the programme was introduced. The team found that the use of implants supplied by the preferred vendor rose from 50% to 69%, with low-volume surgeons showing the largest increase. The mean cost per case was