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Don't Forget the Bubbles

Sticks and stones may break some bones

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Don't Forget the Bubbles (www.DontForgetTheBubbles.com) is a paediatric educational website providing free online content aimed at healthcare professionals.

Introduction

Up to a quarter of the paediatric population of the United Kingdom present to an emergency department annually¹ with a large number being due to falls.² High risk activities such as scooter riding, climbing on monkey bars and backyard trampolines are partially to blame though the implementation of safety netting for trampolines has led to a reduction in injuries.³

In this article we seek to explore how a child with a simple forearm fracture is treated. We focus on how we look after their pain, how we make the diagnosis and how we might manage their fracture once it has been diagnosed.

Providing pre-emptive analgesia

A recent study found that only 76% of children with significant upper limb fractures received any analgesia within their first hour in hospital.⁴ Appropriate analgesia can begin in the prehospital phase.⁵ Both intravenous opiates and inhalational analgesia such as methoxyflurane have been trialled without serious adverse effects.⁶

Assessment of pain can be challenging in children so it is often under-recognised. The Wong-Baker faces pain scale⁷ may be used in children over three year old, but use of this scale is unreliable in pre-verbal children, in whom the Faces, Legs, Activity, Cry, Consolability (FLACC) score may be more helpful.⁸ Subjective measures such as changes in physiological parameters

(pulse, respiratory rate or blood pressure) can add to nurse or physician gestalt. Despite these tools, children are routinely under-treated.⁹

The WHO analgesia ladder is an appropriate starting point¹⁰ with rapid escalation as required. Whilst it suggests the addition of mild opioids for moderate to severe pain, the use of codeine as an adjunctive agent has been linked with fatalities in patients subsequently found to be rapid or ultra-rapid metabolizers.¹¹ Given that it is also ineffective in 10% of the population its use should be de-emphasised. Children with moderate to severe pain may be more effectively treated with an alternative agent such as intranasal fentanyl.

Intranasal medication obviates the need for potentially distressing intravenous access. A Cochrane Collaborative analysis suggested that there was little evidence to suggest that intranasal fentanyl was any better, or worse, than intravenous morphine, and it was well tolerated by patients.¹² Use of a specific intranasal fentanyl pathway could speed up the delivery of analgesia.¹³

Other agents such as sub-dissociative doses of ketamine have also been trialled as an opioid sparing measure.¹⁴ The PICHFORK trial compared intranasal fentanyl at doses of 1.5mcg/kg with intranasal ketamine at 1mg/kg in children aged 3-13 years with isolated limb injury and found similar reduction in pain scores 30 minutes post treatment.¹⁵ With children increasing in size, one should be aware that a number of agents such as paracetamol and morphine should be dosed according to ideal rather than actual body weight. Generally if the ideal weight is more

than 40kg then an adult dosing regime can be used. The exception to this is paracetamol (acetaminophen), with which 15mg/kg should be used up to 65kg to avoid toxicity.¹⁶

Non-pharmacological options

Weight-based doses of analgesia are the mainstay of treatment but a number of non-pharmacological approaches may also be used to reduce both pain and anxiety. If the limb has not been immobilised in a splint it may help to do so prior to imaging.

We know that distraction therapy such as bubbles, music and television screens can also allay some anxiety.¹⁷ It is easy to put an iPad with an episode of a popular children's television program in front of a crying child in an attempt to distract them but these passive distraction techniques are less effective than using more interactive games.¹⁸

Making the diagnosis

If the limb is obviously deformed then making the diagnosis is easy. When there is enough clinical suspicion to suspect a fracture, the majority of clinicians instinctively reach for the x-ray request form. In children we use the ALARA approach to imaging - using As Low As Reasonably Achievable a dose of radiation to reduce radiation exposure.¹⁹ Ultrasound has been successfully used to detect a number of fractures such as undisplaced greenstick fractures and torus fractures²⁰ and may be more sensitive than x-ray in detecting toddler's fractures. Rather than sending the child home for delayed imaging, point of care ultrasound by trained emergency physicians has been shown to have a sensitivity of 91 to 100% and a specificity of 69% to 100% for detecting such fractures.²¹ It can also be used to compare sides without additional radiation.

Ultrasonographic evidence of fracture may be visible up to three weeks earlier than radiographic evidence.²²

There are a number of challenges to the effective use of ultrasound, however, including credentialing of practitioners in non-traditional use of the technology, remuneration for services that are normally the remit of the diagnostic imaging department as well as acceptance by orthopaedic colleagues.

Treating the injury

Once the child has had adequate pain relief and the fracture visualised one must decide how best to manage it. There is some controversy how simple buckle fractures should be managed. One option is to place all such fractures in a cast. A number of small studies have suggested that a removable splint is a viable alternative²³ with improved patient satisfaction and no increase in pain with the added merit that the patient will not have to deal with the potential complications of cast application. Inhalational agents such as methoxyflurane or nitrous oxide reduce the pain of applying a well molded cast if it is needed.

More displaced distal forearm fractures can be safely reduced in the emergency department under procedural sedation. Ketamine has been shown to be a safe and effective agent for this.²⁴ In a resource limited setting, ultrasound facilitated fracture reduction may obviate the need for traditional radiography and reduce the need for further manipulation as compared to a 'blind' technique.²⁵ Local practice varies around the decision to reduce a fracture in theatre. The Royal

Children's Hospital, Melbourne produce a fracture guideline which is freely available online and provides a robust basis for decision making in this area.²⁶

Follow-up

Do all undisplaced minor buckle fractures need to be seen in a specialist orthopaedic fracture clinic? Paediatric distal metaphyseal fractures invariably remodel with minimal functional sequelae. There is no change in outcome for these patients followed up in the community and it is likely to be significantly more convenient for the patient. All other fractures should be routinely reviewed in orthopaedic outpatients/fracture clinic. Parents should be warned of the potential early complications of plaster application and provided with written information about plaster care prior to discharge.

Conclusion

By taking the patient's journey, from point of impact, through the emergency department and beyond, we can see many ways that we can optimise the patient experience. Weight-based analgesia should be offered in the pre-hospital phase as well as on arrival in the department and will likely involve both opiates and non-pharmacological adjuncts such as splints and interactive distraction techniques. The use of ultrasound technology has the potential to help the emergency practitioner to diagnose minor fractures and may be used to facilitate manipulation of certain fractures under procedural sedation.

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