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REVIEW

Torus fractures – diagnosis and management

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Abstract

Torus fractures are a common paediatric injury involving the distal radius. Patients typically present following a fall onto the outstretched hand, with wrist pain as their primary complaint. The principal investigation of choice is a plain radiograph of the wrist joint. These fractures should be managed with a soft-bandage and immediate discharge approach and do not require specialist follow-up. Clinicians have historically had differing views regarding optimal management of torus fractures. It is therefore important for hospital clinicians to uniformly understand the most up-to-date management of this condition. This review provides an overview of the epidemiology, anatomy, diagnosis and management, with an aim to improve outcomes.

Key words: Buckle fracture; Distal radius; Paediatric fracture; Torus fracture; Wrist fracture

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Introduction

Injury of the distal radius is amongst the most common paediatric orthopaedic presentations (Davidson et al, 2001; Pretell Mazzini and Rodriguez Martin, 2009). The paediatric skeleton has unique characteristics that differentiate it from the normal adult anatomy. This is mainly the presence of soft, malleable bone, lined by a thicker protective periosteal layer. With this given plasticity of children's bones, injury to bones can occur with or without a break in the bone cortex, which is in contrast with adult fractures, where complete cortical separation is common (Solan et al, 2002). These injuries at the wrist can either present as plastic deformation of the bone, via multiple microfractures or as injury to only one cortex of the bone at the distal radius. The latter is described as a 'Torus fracture' or 'Buckle fracture' (Solan et al, 2002).

Historically, these fractures have been managed through immobilisation with a plaster cast (Perry et al, 2022). Given the stable nature of this injury, alternative and more optimum management has been evidenced in recent literature (Perry et al, 2022). This article describes the normal anatomy, epidemiology, clinical findings, recommended investigations and up-to-date management of torus fractures.

Anatomy

The normal anatomy of the distal radius and ulna in a child is characterised by specific features related to growth and development. The distal radius consists of two essential components: the epiphysis, which contributes to the formation of the articulating surface with the carpal bones, and the physis, commonly known as the growth plate. The epiphysis of the distal radius forms critical articulating surfaces with the scaphoid, lunate, and triquetrum bones, enabling smooth movement and stability within the wrist joint. The physis is crucial as it allows for longitudinal bone growth during childhood. However, its vulnerability to injury requires careful consideration during paediatric orthopaedic evaluations. In parallel, the distal ulna also contains an epiphysis and a growth plate responsible for longitudinal bone growth. As the child matures, the growth plate in the distal ulna gradually fuses, contributing to the overall development of the forearm and the stability of the wrist joint. The fusion of the growth plates in the distal radius and ulna typically occurs between the ages of 17 and 19 years (Brausch et al, 2022). This milestone serves as an essential indicator of skeletal maturity in the forearm and provides valuable insights for diagnosing and managing paediatric orthopaedic conditions effectively.

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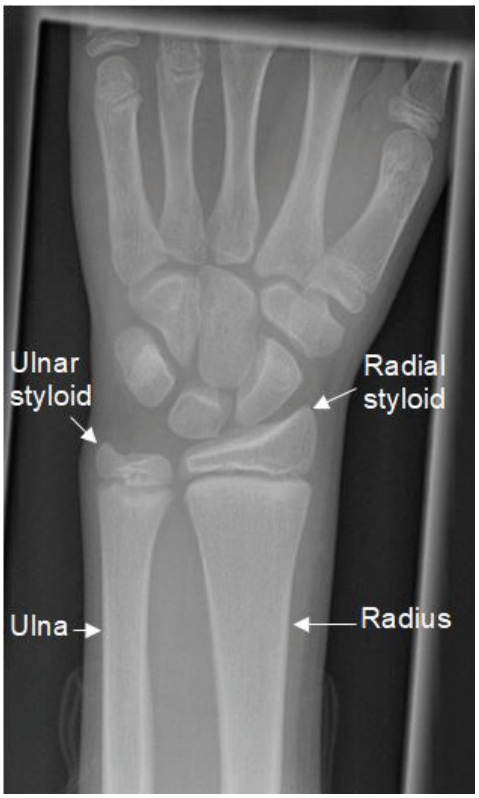

Figure 1. Poster-Anterior view of the left wrist (normal). The figure is provided courtesy of Ian Bickle, https://radiopaedia.org/, rID: 37947.

Figure 2. Lateral view of the left wrist (normal). The figure is provided courtesy of Ian Bickle, https://radiopaedia.org/, rID: 37947.

Epidemiology

Of all hospital attendances by children, a quarter are due to fractured bones, with the distal radius being the most commonly injured bone in the paediatric population (Asokan and Kheir, 2022). Up to half of these fractures are torus fractures, which constitutes 27.2% of paediatric fracture presentations (Baig, 2017; Asokan and Kheir, 2022). These are most common between the ages of 7 and 12, however, can occur at any point throughout childhood. The mean reported age presentation of torus fractures is between 9.61 and 9.69 (Perry et al, 2022).

Clinical features

Torus fractures occur exclusively in the paediatric population, following a fall onto an outstretched hand, resulting in axial loading of the bone (Williams et al, 2018). The main presenting complaint of patients is typically wrist pain, however mild associated swelling may also be seen (Asokan and Kheir, 2022). The extent of this usually depends on the magnitude of the injury.

Suspected torus fractures should be examined using usual clinical examination principles. Clinicians should inspect for any signs of swelling, asymmetry or bruising which may be present and act as an indicator. Signs of deformity and any evidence of open fracture should also be assessed in all patients (Asokan and Kheir, 2022). Clinicians should feel for bony tenderness and patients will typically experience this on palpation of the distal radius at the point of insult. Movements are usually painful in the context of fracture however distal neurovascular status should still be assessed (Zelle and Nomides, 2023).

In the context of a distal radius fracture, the median, radial, and ulnar nerves are susceptible to individual or simultaneous involvement, making it imperative to evaluate the function of all three nerves (Zelle and Nomides, 2023). To assess the motor function of the recurrent motor branch of the median nerve, the clinician should observe the abductor pollicis brevis muscle's function through palmar abduction of the thumb. For evaluating the motor functions of the ulnar nerve, finger abduction against resistance and finger crossing tests are recommended (Sheth, 2021). The adductor pollicis muscle, innervated by the deep branch of the ulnar nerve, can also be assessed by assessing thumb adduction toward the little finger. The primary assessment of the radial nerve involves evaluating the sensation in the first dorsal webspace (Augusto Bertelli et al, 2017). Furthermore, the sensory function of the median and ulnar nerves should be assessed in their respective sensory territories.

Several signs indicating limb perfusion should be taken into consideration, including the presence of a radial pulse, a capillary refill time of less than three seconds, and distal warmth (Zhu et al, 2020). It is imperative to examine the joints both above and below the site of injury.

As with any trauma case, patients must be assessed to ensure no concomitant injuries have been sustained and that a distracting injury to a more serious matter has been excluded. In addition to this, clinicians should always be alerted to the possibility of non-accidental injury when assessing paediatric trauma. Factors such as the mechanism of injury, time to presentation and consistency in the history should all be taken into consideration, while maintaining a high index of suspicion.

Investigations

The principal investigation used to diagnose torus fractures is a plain radiograph of the wrist joint. Poster-Anterior and lateral views are both required to visualise any cortical changes of the radius (**Figures 1–4**). It can sometimes be difficult to discern torus fractures using plain radiographs, as distinct fracture lines are not seen, and angulation may be the only hint in some cases (Weerakody et al, 2010). However, in other cases subtle deformity may be evident and act as a clue. Observing associated bones for deformities can also act as aid to diagnosis – for example, there may be a degree of plastic deformity of the ulna in a case of a distal radius fracture. In such cases, it may be prudent to obtain contralateral radiographs to determine the patient's normal anatomy for comparison.

Figure 3. Poster-Anterior view of a torus fracture of the left distal radius (arrow). The figure is provided courtesy of Mohammed A. ElBeialy from https://radiopaedia.org/, rID: 39780.

Figure 4. Lateral view of a torus fracture of the left distal radius (arrow). The figure is provided courtesy of Mohammed A. ElBeialy from https://radiopaedia.org/, rID: 39780.

While torus fractures are stable injuries, it is important to rule out concurrent injury of associated structures. Radiographs of the hand and elbow may be of some value, if concurrent injury is suspected. Computed tomography may be useful to enhance images if there is any doubt, although is less commonly used, and magnetic resonance imaging can be used to provide preferable views of soft tissues.

Management

Management of torus fractures has been disputed in the literature, with clinicians historically opting to use rigid cast immobilisation techniques with follow-up after four to six weeks using a below elbow plaster of Paris back slab (Rowlands et al, 2012). Following a recent multicentre randomised control trial by Perry et al (2022) an optimal management strategy has been evidenced (Figure 5).

Once a torus fracture is seen on a plain radiograph and any concurrent injury has been excluded, the treatment should focus on managing the fracture. The main goals of treatment are comfort for the patient as well as reassurance for their parents (Perry et al, 2022). Given

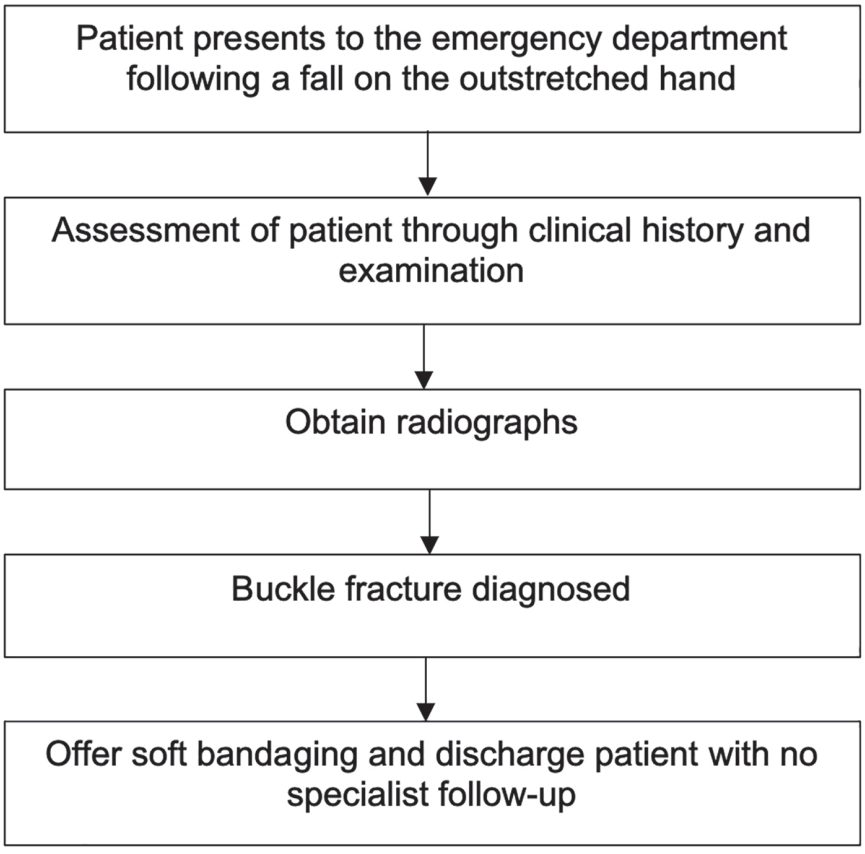

Figure 5. Treatment algorithm for torus fractures of the distal radius.

Table 1. Recommendations derived from National Institute for Health and Care Excellence (NICE) guidelines on managing torus fractures of the distal radius (NICE, 2016)

Management of torus fractures of the distal radius
1. Rigid casting should not be used for torus fractures of the distal radius.
2. Children who have been diagnosed with a distal radius torus fracture should be discharged after the first assessment.
3. Parents and carers should be advised that further review is usually not needed.

the stable nature of these injuries, the management option of choice is preferably a soft bandage, which should remain in place for a maximum of two to three weeks and patients may need simple analgesia in the initial few days following injury (Achten et al, 2020). This can then be removed by the patient's family at home after this period, negating the need for further follow-up appointments (Table 1) (NICE, 2016). There is no reported difference in pain or deformity when managed this way, compared with rigid immobilisation (Perry et al, 2022). Additionally, soft-bandaging has been shown to be more favourable among patients and their parents – allowing for greater comfort, continued ability to conduct daily activities as well as allowing for better functional use of their arm (Perry et al, 2022). Soft-casting remains an alternative option if the patient's parents want more wrist support, as this can be peeled off at home (Pretorius et al, 2023).

With appropriate safety netting advice, these patients can therefore be discharged immediately from the emergency department without the need for onward specialist referral. Patients and their parents should be advised to keep the affected limb elevated for the first 48 to 72 hours, while also ensuring they rest and ice the wrist to minimise swelling (Auley, 2001). They should refrain from any contact sports for at least four weeks post injury, after which there is no restriction provided symptoms have resolved (Bhanushali et al, 2023).

Conclusions

Paediatric patients can present with torus fractures of the distal radius, due to the plasticity within their bones. These injuries should be clinically suspected following any fall on the outstretched hand with associated wrist pain and should be confirmed using a plain radiograph. Management should focus on optimising pain management and deformity, through the application of a soft bandage, with immediate discharge. These patients do not require any specialist input and specialist follow-up is not required for patients with isolated buckle fractures.

Key points

Torus fractures are a common injury of the distal radius in the paediatric population, owing to the increased plasticity in children's bones.

- The management of torus fractures has differed among previous clinicians, given the uncertainty around outcomes related to specific management strategies.
- Accurate diagnosis is essential to ensure optimal management, which should involve thorough clinical assessment and plain radiographs.
- Torus fractures should be managed with a soft-bandage and immediate discharge approach, with no specialist follow-up required, provided concurrent injury has been ruled out.

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Availability of data and materials

All data included in this study are available upon request by contact with the corresponding author.

Author contributions

All authors designed the structure of the review article. AT and ON performed the literature search and drafted the article. All authors were involved in critical revisions of the article. HK and MJI provided supervision and advice on article content. All authors contributed to the editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics approval and consent to participate

Not applicable.

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Conflicts of interest

The authors declare no conflict of interest.

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