Joint Diseases and Related Surgery Case Reports

Jt Dis Relat Surg Case Rep
2022;1(3):95-98

OPEN ACCESS

Initial reduction of pediatric type II supracondylar humerus fractures does not guarantee a good outcome

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ABSTRACT

Pediatric supracondylar humerus fractures are important for orthopedic surgeons because of the high incidence, the accompanying neurovascular injuries, the lack of consensus on the choice of treatment in Gartland type 2 fractures where conservative and surgical treatment options are available, and catastrophic complications. We present the case of a two-year-old male, initially diagnosed as Gartland type 2 and received conservative treatment, which then went on to displacement, necessitating surgical treatment. In conclusion, although a good reduction is achieved with closed reduction and conservative treatment, it should be kept in mind that fracture reduction may be impaired in fractures above the olecranon fossa , and weekly X-ray follow-up should be performed. It should be noted that surgical treatment of these fractures after one or two weeks after the occurrence will be more difficult than treating at injury time.

Keywords: Closed reduction, loss of reduction, supracondylar humerus fracture, surgery.

Pediatric supracondylar humerus fractures are the most common elbow fracture in the pediatric population.[1] Supracondylar fractures can be mainly divided into extension and flexion types according to the displacement direction of the distal fragment. Extension-type fractures constitute approximately 97% of supracondylar humerus fractures.[2] In supracondylar humerus fractures, the Gartland classification is most commonly used for the evaluation of the fracture and planning of treatment.[3-5] There are nonoperative and operative treatment options for Gartland type II fractures. The condition of vascular and nerve structures should be evaluated with neurovascular examination since complications of these structures can be seen after these fractures.[5] This study aimed to demonstrate effectiveness of conservative treatment in type II supracondylar humerus fracture in a pediatric patient.

Received: December 10, 2021
Accepted: January 28, 2022
Published online: February 25, 2022

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Doi: 10.52312/jdrscr.2022.45

Citation: Özgür A, Bozoğlan M, Çankaya D, Turgut A. Initial reduction of pediatric type II supracondylar humerus fractures does not guarantee a good outcome. Jt Dis Relat Surg Case Rep 2022;1(3):95-98.

Herein, we present a case of initially diagnosed as Gartland type II and received conservative treatment, which then went on to displacement, necessitating surgical treatment.

CASE REPORT

A two-year-old boy applied to the emergency department with complaints of pain, swelling, and limitation of range of motion of the right elbow after falling while playing in a park. On physical examination, edema, ecchymosis, and crepitation were observed in the right elbow. Sensory and motor functions were normal in the neurological examination. Peripheral pulses were noted as normal. Radiologic examination revealed a Gartland type II supracondylar humerus fracture (Figure 1). A long arm splint was applied to the patient after closed reduction (Figure 2). The patient was weekly followed up with an X-ray due to the possible risk of loss of

reduction of the fracture. In the third week, surgical reduction and fixation with percutaneous Kirschner (K)-wires were decided due to loss of reduction in the fracture, especially for varus malreduction (Figure 3).

Under general anesthesia, the fracture was tried to be reduced by longitudinal traction and valgus manipulation at the elbow. Probably due to the soft callus formation, the reduction attempt was unsuccessful (Figure 4a, b). Afterward, the ulnar nerve was palpated and protected, and one 2 mm K-wire was applied transversely from medial to lateral direction with the aim of providing reduction with the joystick method (Figure 4c).[6] The varus deformity was corrected by the joystick method (Figure 4d), and two K-wires were applied from the lateral side to obtain both coronal and sagittal stability. Kirschner-wire, which was used for the joystick manipulation, was removed, and one K-wire was applied from the medial epicondyle retrogradely. After the reduction and fixation were confirmed by fluoroscopy, a long arm splint was applied to the extremity (Figure 5a, b). The fracture recovered in an acceptable position (Figure 6a, b). A written informed consent was obtained from the parents of the patient for the treatment of the patient and the publication of this article.

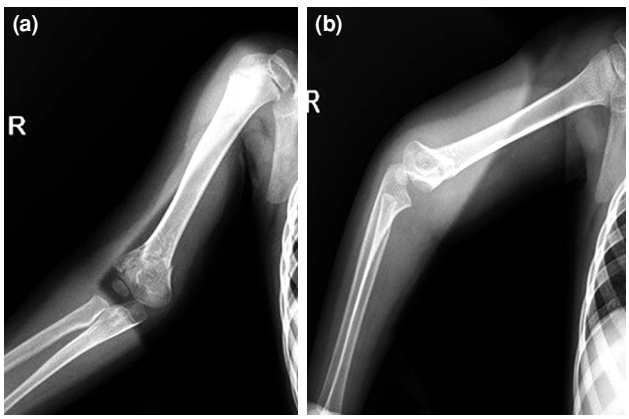

Figure 1. (a) Anteroposterior and **(b)** lateral radiographs of a Gartland type II supracondylar humerus fracture.

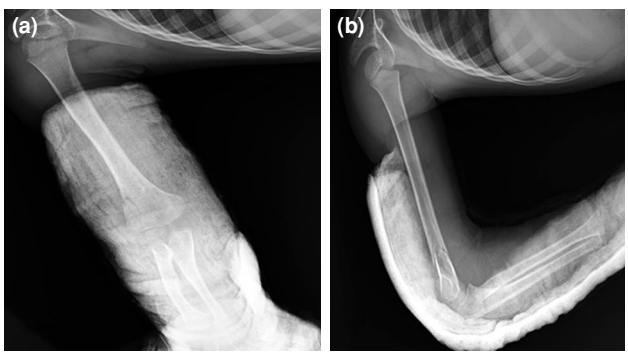

Figure 2. (a) Early anteroposterior and **(b)** lateral radiographic images of the case after closed reduction and long arm splitting.

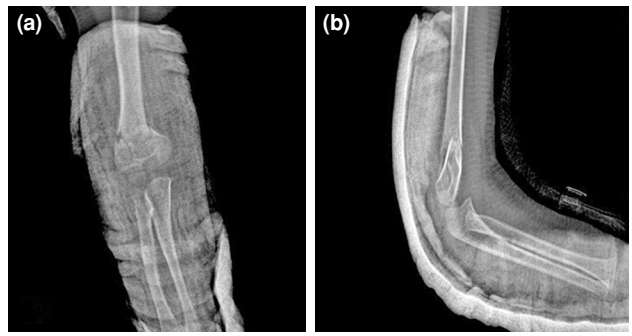

Figure 3. (a) Anteroposterior and **(b)** lateral radiographs showing loss of reduction in the third week.

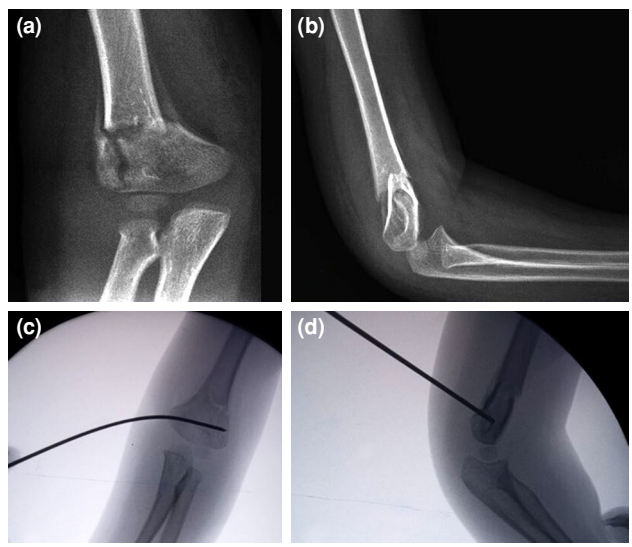

Figure 4. (a) Preoperative anteroposterior and **(b)** lateral radiographs showing early healing of the fracture. **(c)** Images demonstrating the transverse K-wire used as a joystick and **(d)** fracture reduction with the joystick method.

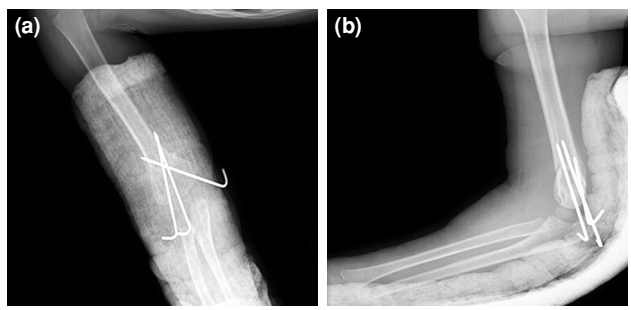

Figure 5. (a) Postoperative anteroposterior and **(b)** lateral radiographs.

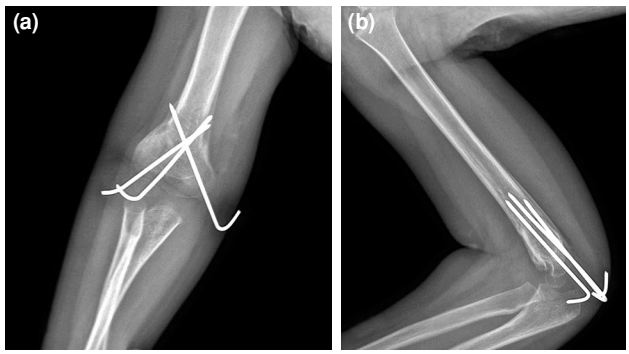

Figure 6. (a) Anteroposterior and **(b)** lateral radiographs of the recovered fracture.

DISCUSSION

In pediatric supracondylar humerus fractures, conservative or surgical treatment options are available after a meticulous neurovascular examination and evaluation of radiographs. Anatomical structures play a key role in determining the treatment. In extension-type injury, the posterior periosteum usually remains intact despite tearing of the anterior periosteum, thereby somewhat stabilizing the fracture by creating a hinge effect.[7] This intact posterior periosteum also plays a significant role in the reduction maneuver.

Between the posterior of the olecranon fossa and the anterior of the coronoid fossa, the medial and lateral columns of the distal humerus are connected by a thin bone segment, so this area is highly susceptible to fractures.[7] In Gartland type I supracondylar humerus fractures, since the fracture can be stabilized with the hyperflexion maneuver, the patient can be managed conservatively. It is difficult to achieve an adequate result with conservative treatment using plaster, particularly in fractures with a small contact surface above the level of the olecranon fossa, even if acceptable closed reduction is achieved.[8] It should be noted that fracture reduction may be impaired. Therefore, it is necessary to evaluate the fracture with weekly direct radiography due to the possibility of a loss of reduction in this kind of injury in the first three weeks.

In children, the periosteum is thicker than in adults and envelops the fracture hematoma, stimulating new bone formation more vigorously.[7] The more vascular structure and osteoblastic activity of the pediatric bones provide a faster and stronger inflammatory response in fracture healing.[7] Thus, the new bone formation is completed in a shorter time than in adults. Therefore, if the fracture reduction is impaired in the future, the correction of malreduction of the fracture may be difficult due to the potential for rapid recovery.

The axis of motion of the elbow joint is in the sagittal plane, and the distal humeral physis contributes to 20% of the longitudinal growth.[8] Consequently, varus and valgus remodeling is not expected in coronal plane angulations in fractures of this region.[9] In the absence of additional injury in humeral supracondylar humerus fractures, closed reduction is the first choice when performing surgery.[10] The joystick method is exceedingly effective in obtaining closed reduction in patients who develop reduction loss in the late phase of fracture healing.[3]

The main limitation of this study is that the initial lateral radiograph was not sufficient for a decision by an orthopedic surgeon on the type of fracture. We could classify the fracture in the post-reduction radiograph (Figure 2). If initial radiographs do not allow the classification of the fracture, a Gartland type III fracture that needs to be surgically treated can be considered as a Gartland type II, and conservative treatment may be preferred, which can yield a suboptimal outcome.

In conclusion, although conservative treatment with a sufficient reduction can be chosen in Gartland type I pediatric supracondylar humerus fractures, it should be kept in mind that fracture reduction may be impaired during follow-up in more proximal fractures, particularly in cases where the contact surface is low, such as in fractures above the olecranon fossa level. Type 2 fractures are inherently unstable, although they can initially be reduce, reduction loss should be observed in most of them. Surgical reduction is required to provide optimal functional and cosmetic results in cases of reduction loss, mainly in coronal plane deformities. The joystick method can be convenient in reduction of delayed fractures.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

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