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Beyond Tradition: "Figure of 8" Casting for Gartland Type 1 and Type 2A Pediatric Supracondylar Fractures of Humerus: Video Technique

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Learning Point of the Article:

The "Figure of 8" cast application technique, when applied to Type 1 and Type 2A SCHF in children, offers the dual benefits of maintaining fracture reduction in 100–110° flexion and reducing the risk of compartment syndrome. This technique provides an innovative solution for managing these common fractures in pediatric patients.

Abstract

Introduction: In the treatment of paediatric supracondylar humerus fractures (SCHFs), Gartland Type 1 fractures are traditionally managed with in situ above elbow casting, while Type 2A fractures are treated with closed reduction and above elbow casting.

Surgical Technique: This technical note introduces a novel "figure of 8" cast technique for Type I and 2A fractures. The technique aims to maintain fracture reduction while reducing the risk of compartment syndrome by avoiding placement of cast material in the anterior elbow crease. This innovative casting method has the potential to enhance the management of these fractures in children, providing a alternative to conventional approaches.

Conclusion: "Figure of 8" cast technique presents a unique, easy-to-implement, and effective approach for treating Type 1 and 2A SCHFs in children, maintaining fracture reduction in 100–110° elbow flexion and minimizing the risk of compartment syndrome.

Keywords: Compartment syndrome, figure of 8 cast, pediatric supracondylar humerus fracture.

Introduction

Supracondylar humerus fractures (SCHF) represent the most prevalent fractures in the pediatric population, accounting for 70–85% of all elbow fractures [1]. These fractures are classified using the modified Gartland classification [2], which includes Type 1 fractures (nondisplaced), Type 2A fractures (displaced with an intact posterior cortex and anterior cortex involvement but no rotation), Type 2B fractures (displacement with malrotation and an intact posterior cortex), Type 3 fractures (completely displaced with no cortical contact but an intact posterior periosteum), and Type 4 fractures (complete displacement with circumferential periosteal disruption and multidirectional instability).

Ideal treatment options for Type 1 fractures are managed with in situ above elbow casting, while Type 2A fractures are treated with closed reduction and above elbow casting. For type 2B fractures, treatment involves closed reduction, percutaneous pinning, and casting [3]. It is standard practice to apply an above-elbow posterior slab in the case of Type 1 and 2A fractures, mainly due to the risk of compartment syndrome and swelling around the elbow region [4]. However, utilizing only a posterior slab can potentially lead to fracture displacement during follow-up, resulting in malunion and cubitus varus deformity [5].

We manage the Type 1 SCHF in outpatient department with in situ above elbow cast and type 2A SCHF in operation theater with closed reduction and above elbow cast under general

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Author's Photo Gallery


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Figure 1: Picture depicts the "Figure of 8" direction of the cast.

Figure 2: Picture depicts the technique avoids the cast material in the elbow crease and fracture reduction is maintained at 100–110°.

Figure 3: After cast application.

anesthesia. To offer a definitive treatment method that maintains fracture reduction and minimizes the risk of compartment syndrome, we present a novel "figure of 8" cast technique for minimally displaced SCHF in children. This technique has been employed successfully at our institution for the past 10 years without any complications.

The Technique (Video 1)

Under general anesthesia and in a supine position, the patient is positioned at the edge of the operating table, with the affected shoulder in 90° abduction and the elbow extended away from the table. Fracture reduction is achieved by flexing the elbow to 110–120° and ensuring full supination. The reduction was confirmed in anterioposterior and lateral views on an image intensifier. The assistant holds the limb in the reduced position with thumb abduction, and the surgeon applies soft padding from the axillary folds to the metacarpals in a clockwise direction, keeping the elbow flexed in reduced position.

A soft cast is used for cast application. The first roll of the cast starts from the arm in a clockwise direction and then the cast is applied across the forearm in a "figure of 8" fashion (Fig. 1), proceeding in an anti-clockwise direction to keep the elbow crease free of the cast (Fig. 2). After three layers of cast in the "figure of 8" fashion, the second cast is applied from the arm to the metacarpo-phalangeal joints (Fig. 3). Adequate hand circulation is assessed, ensuring that the hand remains pink, warm, and has a capillary refill time of <2 s.

A 6-year-old child suffered an injury to the left elbow after a fall on outstretched hand while playing. There was no other injury and distal neurovascular status was intact. Radiographs of the left elbow showed a Type IIA SCHF (Fig. 4). The child was treated with closed reduction under anesthesia and cast was applied using "figure of 8" technique. Post-operative radiographs show a reduced SCHF with anterior humeral line crossing the capitellum in lateral view (Fig. 5). The fracture healed well and the child recovered with full range of motion of the elbow at 3 months. Radiographs at the latest follow-up show a normal healed distal humerus (Fig. 6) with full range of motion (Fig. 7).

Postoperative Care

The child is instructed to perform active finger movements, and plaster care instructions are explained to the parents before discharge from the hospital. A pulse oximeter is employed to

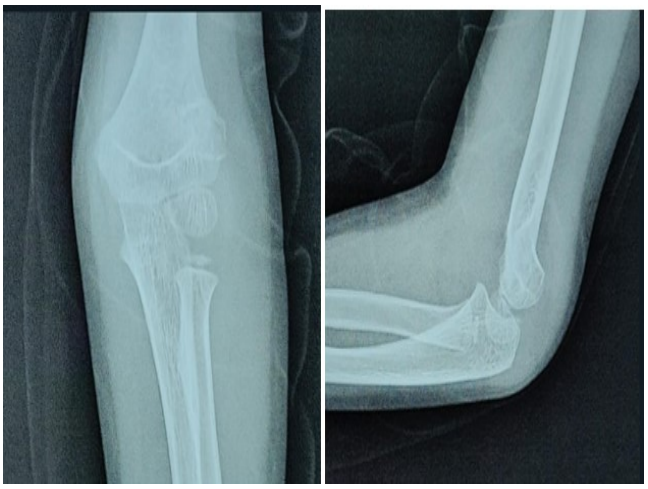

Figure 4: Pre-operative radiograph shows Type IIA left supracondylar humerus fracture in a 6-year-old child.

Figure 5: Post-operative radiograph shows well reduced fracture with "Figure of 8" cast application.

assess satisfactory perfusion, and clinical checks are performed to confirm active finger movements in the injured limb. Patients are advised to perform active finger movements, and plaster care instructions are explained to the parents before discharge from the hospital. A follow-up clinic visit is scheduled after 1 week to evaluate finger swelling, cast condition, and neurovascular status. After 3 weeks, the cast is removed in the clinic, and active elbow range of motion exercises is initiated. Subsequent monthly follow-up appointments are conducted to monitor clinical and radiological improvements in fracture healing.

Discussion

The treatment of minimally displaced SCHFs in children has seen various immobilization techniques employed, including the cuff and collar technique [6], posterior humerus splint [6], above elbow cast in 90° flexion at the elbow [7], and Blount's immobilization technique [8]. Ballal et al. conducted a comparative study of Type 1 SCHF treated with the cuff and collar technique or a posterior splint in 90° elbow flexion. They found that children treated with the posterior splint experienced less pain and required fewer analgesics than those treated with the cuff and collar. In addition, the cuff and collar group reported more sleep disturbances. However, there were no significant differences in radiological outcomes [6]. Silva et al. conducted a randomized control study in 2018 to compare the traditional fiberglass cast and a soft fiberglass cast in SCHF. They reported no significant differences in fracture displacement, pain scores, and range of motion. Nevertheless, the use of a soft fiberglass cast was associated with advantages such as ease of cast removal at home, fewer hospital visits, reduced healthcare costs, and higher parent/patient satisfaction [7]. Kinkpé et al. employed Blount's immobilization for all types of SCHF, involving closed fracture reduction and immobilization with a cuff and collar using 2 cm thick foam, with the elbow positioned at 100–120° flexion based on swelling and muscle mass. They reported excellent results in 80.6% of children, with a range of motion of 0–120° at union. However, the use of Blount immobilization remained controversial due to potential complications, such as compartment syndrome and Volkmann's ischemic contracture in Type 3 SCHF [8].

Figure 6: Radiograph at 6 months showing complete healing of the fracture.

Tahira et al described 'Gravity method' of closed reduction for type II & III SCHF in children under 12 years of age. In their technique, they described hanging the child by his own weight using the elbow as the fulcrum and lifting off the table by about 22.5 cm. This position allows gravity to reduce the soft tissue tension and thereby reducing the fracture. The technique was effective in reducing 90% of the fractures [9]. Recently, Sanders et al compared nonoperative versus operative management for type IIa SCHF in children in 99 patients. They reported 90%

Figure 7: Clinical photographs of the patient showing full range of motion of both elbows (left affected).

success rate with nonoperative management (fracture reduction with or without sedation and long arm cast) and recommended close monitoring of these fractures for loss of reduction requiring early surgical intervention. They also recommended modification of American Academy of Orthopaedic Surgeons (AAOS) guidelines to include nonoperative treatment for type IIa SCHF in children [10].

The "Figure of 8" cast application technique described in this study offers several advantages over previously reported techniques. It is specifically designed for minimally displaced SCHF (Type 1 and 2A) and has several key benefits:

1. Maintenance of fracture reduction: The "Figure of 8"cast application, with the elbow at 100–110° flexion, effectively preserves fracture reduction. This is crucial for optimal healing.

2. Reduces risk of Compartment syndrome: By avoiding the cast in the elbow crease, this technique prevents direct compression of neurovascular structures in the cubital fossa. This reduces the risk of compartment syndrome, a significant concern in SCHF treatment.

3. Accommodation of swelling: Allowing for the accommodation of fracture-related swelling is another advantage. The use of a soft cast facilitates this and provides the ease of cast removal at home or in a clinic setting.

Conclusion

"Figure of 8" cast application technique presents a unique, easy-to-implement, and effective approach that can be readily adopted by orthopedic surgeons involved in managing pediatric fractures. It is well suited for treating Type 1 and 2A SCHF in children, maintaining fracture reduction in 100–110° elbow flexion and minimizing the risk of compartment syndrome.

Clinical Message

The "Figure of 8" cast application technique for Type 1 and Type 2A pediatric supracondylar fractures of humerus is advantageous than traditional casting in maintaining the fracture reduction and minimizing the risk compartment syndrome and preventing complications.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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