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COMPARISON OF CONSERVATIVE AND SURGICAL TREATMENT IN SUPRACONDYLAR FRACTURES OF HUMERUS IN PEDIATRIC PATIENTS

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Abstract

Background: This study aimed to compare the outcomes of conservative treatment and surgical treatment, both radiologically and clinically, for pediatric Gartland type II/III supracondylar humerus fractures, which remains a controversial issue in the literature.

Methods: A prospective study was conducted involving 34 patients with Gartland type II/III humerus fractures. Seventeen patients received conservative treatment, while seventeen patients underwent open or closed reduction with percutaneous pinning. Radiological results were assessed based on the Baumann angle and anterior humerus line, while functional outcomes were evaluated using Flynn's criteria.

Results: According to Flynn's criteria, 72.09% of patients treated with percutaneous pinning after closed/open reduction achieved excellent results, compared to 23.52% in the conservative treatment group.

Conclusion: Early surgical intervention is recommended for supracondylar humerus fractures to minimize complications. Surgical treatment yielded better outcomes than conservative treatment, as assessed by Flynn's criteria. Cross-wire pinning showed superior outcomes compared to lateral pinning, although it was associated with a higher incidence of neuropraxias.

Keywords: Supracondylar humerus fracture, Gartland classification, Flynn's criteria

Introduction:

Supracondylar humerus fractures account for 55% to 75% of all elbow fractures in children (1). They are most common between the ages of 5 and 8 years and often occur during childhood, predominantly in boys and on the non-dominant side (2). Improper treatment of supracondylar humerus fractures can lead to neurovascular damage, malunion, and elbow stiffness.

Conservative measures, such as above-elbow plaster of Paris (POP) immobilization with the elbow at 90° flexion, are suitable for displaced type I fractures. Type II fractures can also be managed with closed reduction and POP immobilization. Various treatment options are available for type III fractures, including open reduction with percutaneous K-wire fixation, closed reduction with POP immobilization, closed reduction with skeletal traction, and closed reduction with percutaneous pinning (3).

The traditional conservative approach of closed reduction and POP immobilization has limitations, such as difficulties in maintaining reduction and subsequent complications like elbow stiffness and

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malunion during follow-up (4). Advances in biomechanics, implant quality, internal fixation principles, soft tissue care, antibiotics, and asepsis have led to significant modifications in the treatment of supracondylar fractures in children.

Surgical treatment options, including open reduction with internal fixation and closed reduction with percutaneous pinning, have emerged as viable alternatives for displaced supracondylar humerus fractures. These approaches offer advantages such as improved anatomical and functional outcomes and greater fixation stability (5). By utilizing Flynn's criteria to assess range of motion and carrying angle during follow-up, this study aims to evaluate the results of conservative and surgical treatments for supracondylar humerus fractures.

Materials and Methods

This study was conducted as a prospective comparative study at the Department of Orthopedics. The study period lasted for one year, from September 2021 to August 2022. Ethical clearance was obtained from the Institutional Ethics Committee prior to the start of the study. The inclusion criteria consisted of children up to 14 years of age with closed supracondylar fractures of the humerus, whose parents or guardians provided consent for participation. Children with previous deformities, open fractures, or associated fractures around the elbow were excluded from the study.

Children who presented at the outpatient department or emergency department with a history of falling on an outstretched hand and elbow injury were examined for various factors such as soft tissue swelling, deformity, punctured wound, and neurological and vascular status. X-rays were taken in two planes (lateral and AP views) to confirm the presence of a supracondylar fracture, which was classified according to the Gartland classification system (type I/II/III).

Patients with type II/III supracondylar fractures were included in the study and divided into two treatment groups: Group I, which received closed reduction and application of a plaster of Paris (POP) slab, and Group II, which underwent closed/open reduction and percutaneous K-wire fixation. Surgical procedures were performed under general anesthesia, and postoperatively, the patients were monitored for neurovascular deficits and treated with antibiotics and analgesics. Postoperative X-rays were taken on the first day and after one week to assess the maintenance of reduction. After three weeks, the POP slab was removed and active range of motion exercises were initiated. K-wires were removed after six weeks.

Regular follow-up visits were conducted every month for a period of six months. Clinical and radiological assessments were performed to identify any complications and to evaluate range of motion and carrying angle using Flynn's criteria. The results were categorized as excellent, good, fair, or poor based on the loss of range of motion and carrying angle.

The results were compared between the conservative and surgical treatment groups and analyzed using the chi-square test with $p<0.05$ considered significant.

Results: A total of 34 patients with supracondylar fractures of the humerus were included in the study. Among them, 17 patients (50%) were in the age group of 5-8 years. Four patients (11.7%) were below 5 years of age, 10 patients (29.4%) were in the age group of 9-12 years, and 3 patients (7.5%) were between 12-14 years of age. The majority of the patients were male, accounting for 19 (55.8%) cases, while 15 (44.2%) cases were female. The most common cause of injury was falling while playing (sports-related injury), which was observed in 25 (75%) patients, followed by falls from a height in 9 (25%) patients. Among the 34 patients, 76% (25) had fractures on the left side, while 20% (9) had fractures on the right side. All 34 fractures were classified as type II/III closed extension fractures according to the Gartland classification. No cases exhibited vascular

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compromise or compartment syndrome. In this study, Group I included 17 patients managed conservatively with closed reduction and the application of a POP slab, while Group II consisted of 17 patients treated with closed or open reduction and K-wire fixation. Among the surgically treated patients, 9 cases underwent cross K-wire pinning, and 8 cases underwent lateral K-wire pinning. Thirteen patients (76.47%) were operated on the first day of admission, while 4 patients (23.5%) underwent surgery on the second day. Three patients presented with associated radial nerve injuries at the onset, and three patients experienced iatrogenic ulnar nerve palsy during the surgery. All six patients with nerve injuries showed progressive improvement and achieved full functional recovery within 3-8 months of follow-up. Postoperatively, three children developed superficial pin tract infections, which were treated with antibiotics and resolved. During the six-month follow-up period, 3 patients developed cubitus varus deformity.

In our study of 34 patients, 16 patients (47%) had loss of carrying angle of 0-5°, 7 patients (20.5%) had loss of carrying angle 6-10°, 8 patients (23.5%) had loss of carrying angle 11-15° and 3 patients (8.8%) had >15° loss of carrying angle developed cubitus varus deformity . In group I, out of 17 patients, 4 (23.52%) patients had excellent results, 5 (29.41%) patients had fair results and 8 (47.05%) children had poor results. In group B, among 17 patients 12 (70.5%) had excellent outcome and 5 (29.5%) had fair outcome.

Discussion: Numerous studies have been conducted on the treatment of Type II and III Supracondylar Fracture Humerus, but there is still controversy surrounding the best approach. This can be confusing for orthopedic surgeons when deciding on treatment. The fracture is prone to losing its alignment and can result in poor functional and cosmetic outcomes, which may lead surgeons to opt for surgery. On the other hand, complications such as nerve and blood vessel injuries, infections, and pin migration are more likely with conservative treatment. While the Wilkins modification based on the Gartland classification is considered a simpler decision-making tool for treatment choices, it has shown limited reliability when it comes to assessing rotational deformities.

The most common complications associated with surgical treatment of supracondylar fracture humerus include pin migration, infection, and nerve damage. Conservative treatment can lead to complications such as recurvatum deformity and joint stiffness. Both treatment approaches can result in varus/valgus deformity and malunion if the reduction is not optimal. To prevent complications in either treatment modality, basic principles of casting and surgery should be followed, such as avoiding excessive flexion casting to prevent forearm compartment syndrome and being careful about the length and position of the K-wires to avoid compromising the nerves and blood vessels.

One common complication of supracondylar fracture humerus is varus deformity, which is strongly associated with changes in Bauman's angle and carrying angle. An increase in Bauman's angle indicates a medial tilt of the distal fragment, leading to cubitus varus deformity. Radiological assessment of treatment outcomes should consider the anterior humeral line since recurvatum-hyperflexion is a common complication, particularly with conservative treatment.

In our study, patients treated with closed/open reduction and percutaneous K-wire fixation had excellent outcomes in 70.5% of cases and fair outcomes in 29.5% of cases (Group II). In Group I, where children were treated conservatively with closed reduction and a plaster of Paris cast, 47.05% had poor outcomes. There was a significant association between the treatment approach and the

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outcome of supracondylar fracture humerus, with surgical treatment showing better results than conservative treatment.

Conclusion:

In conclusion, it is recommended to operate on supracondylar fracture humerus as early as possible to reduce the risk of complications. Surgical treatment was found to have better outcomes compared to conservative treatment, as evaluated using Flynn's criteria. Percutaneous K-wire fixation was superior to cast application after closed reduction, but it was associated with a higher rate of nerve injuries.

BIBLIOGRAPHY

1. Omid R, Choi PD, Skaggs DL. Supracondylar humeral fractures in children. J Bone Joint Surg. 2008;90:1121-32. Vinay N et al. Int J Res Orthop. 2020 Jul;6(4):817-82
2. International Journal of Research in Orthopaedics | July-August 2020 | Vol 6 | Issue 4 Page 822 Cheng JCY, Lam TP, Maffulli N. Epidemiological features of supracondylar fractures of the humerus in Chinese children. J Pediatr Orthop Part B. 2001;10(1):63-7.
3. Picado VA, Moran G, Moraleda L. Management of supracondylar fractures of the humerus in children. British Editorial Society Bone Joint Surg. 2018;3:526-40.
4. Chateau FPW, McIntyre ML. An Analysis of Open Reduction of Irreducible Supracondylar Fractures of the Humerus in Children. Can J Surg. 1998;41(2):112-8.
5. Weiland AJ, Meyer S, Tolo VT, Berg HL, Mueller J. Surgical treatment of displaced supracondylar fractures of the humerus in children. Analysis of fifty-two cases followed for five to fifteen years. J Bone J Surg. 1978;60(5):657-61
6. Camus T, Maclellan B, Cook PC, Leahey JL, Hyndman JC, El-Hawary R. Extension type II pediatric supracondylar humerus fractures: a radiographic outcomes study of closed reduction and cast immobilization. J Pediatr Orthop 2011; 31: 366-371.
7. France J, Strong M. Deformity and function in supracondylar fractures of the humerus in children variously treated by closed reduction and splinting, traction, and percutaneous pinning. J Pediatr Orthop 1992; 4: 494-498.
8. Leung S, Paryavi E, Herman MJ, Sponseller PD, Abzug JM. Does the Modified Gartland Classification Clarify Decision Making? J Pediatr Orthop 2018; 38: 22-26
9. Skaggs DL, Sankar WN, Albrektson J, Vaishnav S, Choi PD, Kay RM. How safe is the operative treatment of Gartland type 2 supracondylar humerus fractures in children? J Pediatr Orthop 2008; 28: 139-141. F.L. Umur, M. Aydın, S. Surucu 6276
10. Miranda I, Sánchez-Arteaga P, Marrachelli VG, Miranda FJ, Salom M. Orthopedic versus surgical treatment of Gartland type II supracondylar humerus fracture in children. J Pediatr Orthop B 2014; 23: 93-99.
11. Silva M, Pandarinath R, Farng E, Park S, Caneda C, Fong YJ, Penman A. Inter- and intra-observer reliability of the Baumann angle of the humerus in children with supracondylar humeral fractures. Int Orthop 2010; 34: 553-557.