

Outcome of Non-operative Treatment of Paediatric Elbow Fracture: A Cross-Sectional Study

Dr. Md. Reazul Haq¹, Dr. Anika Zaman², Dr. Debdulal Debnath³, Dr. Shaikh Md. Monirul Islam⁴

¹ Senior Consultant, Department of Orthopedic, Central Police Hospital (CPH), Dhaka, Bangladesh.

² Assistant Professor, Department of Physical Medicine & Rehabilitation, Shahabuddin Medical College & Hospital, Dhaka, Bangladesh.

³ Senior Consultant, Department of Orthopaedic, Central Police Hospital, Dhaka, Bangladesh.

⁴ Junior Consultant, Department of Orthopaedic, Central Police Hospital, Dhaka, Bangladesh.

Corresponding Author: Dr. Md. Reazul Haq
Senior Consultant, Central Police Hospital, Dhaka, Bangladesh

Abstract:

Introduction: Elbow fractures are the most common traumatic injury in children, accounting for approximately 15% of all pediatric fractures. Research shows that 85% of orthopedic surgeries in this group are due to elbow fractures. These injuries encompass supracondylar, lateral condyle, radial neck, medial epicondyle, olecranon, radial head, and intercondylar fractures. **Objective:** This study aimed to evaluate the outcomes of non-operative treatment for pediatric elbow fractures in two centers in Bangladesh. **Methods:** This descriptive cross-sectional study was conducted at Lab in Diagnostic and Consultation Centre, Manikdi, Dhaka Cantonment, and Faisal Hospital (Pvt.) Limited, Araihaazar, Narayanganj, Bangladesh, from January 2022 to January 2024. A total of 200 non-operative pediatric elbow fracture cases, aged 1.5 to 10 years regardless of sex, were purposively enrolled in this study. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 23.0. **Results:** A total of 200 non-operative pediatric elbow fracture cases aged 1.5 to 10 years irrespective of sex were purposively enrolled in this study. The highest age group was (3-5) years which includes 55(27.5%) of the study children. The majority of the study children were the males 120(60%). A significant number of the children were from the rural areas 140(70%). The highest portion of the study children were from lower socio-economic condition 120 (60%). The most common type of fracture was found supracondylar fracture in 30 (15%) children. The most common treatment was close reduction, applied on 140(70%) of the study children. 80(40%) of the study children achieved excellent outcomes, 60(30%) had good outcomes 40 (20%) had fair outcomes, and 20(10%) had poor outcomes, which indicates a generally positive functional recovery in the majority of cases. Cubitus valgus 10(5%), cubitus varus 10(5%) and elbow stiffness 20(10%) were observed the late complication with the study children. **Conclusion:** This study investigated that the majority of the pediatric non-operative elbow fractured cases (40%) had excellent outcome, 30 % had good outcome, 20% had fair outcome and only 10% had poor outcome of conservative treatment approach with the major complications of cubitus valgus, cubitus varus, and elbow stiffness.

Key words: Outcome, Non-operative, Treatment, Pediatric Elbow, Fracture.

I. INTRODUCTION

Elbow fractures are the most common traumatic injury in children, representing about 15% of all pediatric fractures [1]. Studies show that these fractures constitute 85% of orthopedic surgeries in children [2,3]. These injuries encompass supracondylar, lateral condyle, radial neck, medial epicondyle, olecranon, radial head, and intercondylar fractures, with supracondylar fractures being the most frequent in children under 17. While limb fractures are rarely life-threatening, they can cause significant morbidity, work incapacity, increased disability-adjusted life years, and psychological distress [4]. Prompt diagnosis and treatment are crucial due to serious complications. The unique elbow anatomy and proximity to neurovascular structures often result in various injuries with potential long-term disabilities [5, 6]. Nerve injury incidence with these fractures' ranges from 12-20% for traumatic causes and 2-6% for iatrogenic causes [7]. In low and middle-income countries, trauma-related mortality and disability are rising, with children making up about 13% of global trauma-related deaths. Injuries in children can lead to indignity, exclusion, pain, and poverty [8-10]. Disability from injuries can disrupt a child's education and impact future employment, significantly affecting their families and communities economically [11-13]. A recent study on pediatric elbow fractures reported 99 cases, with 63% being boys and 37% girls, and a mean age of 7.3 years. The majority of elbow fractures in the study were supracondylar (78%), categorized using the Gartland classification, with sports, recreational activities, and falls from low heights being the most common

causes. Nerve and arterial injuries were documented in some cases of type III supracondylar fractures. Surgical intervention was the primary treatment approach (79%) [14]. However, data are scarce on outcomes of non-operative management of pediatric elbow fractures in Bangladesh, which this study aims to address by evaluating such outcomes in two orthopedic centers in the country.

II. OBJECTIVES

To determine the outcome of non-operative treatment of paediatric elbow fracture in two centres of Bangladesh.

III. METHODS

This descriptive cross-sectional study was conducted at a lab in the Diagnostic and Consultation Centre, Manikdi, Dhaka Cantonment, and Faisal Hospital (Pvt.) Limited, Araihasar, Narayanganj, Bangladesh, from January 2022 to January 2024. The study's purpose, benefits, and risks were explained to the children's legal guardians in the local language. Written informed consent was then obtained from the parents, caregivers, or legal guardians. A total of 200 non-operative pediatric elbow fracture cases, aged 1.5 to 10 years, were enrolled. Data were collected using a pre-structured questionnaire. All children received conservative treatment. Plaster was kept 2-3 weeks. 3-6 months follow up was done and elbow function (flexion/extension range and carrying angle) was assessed using a goniometer and compared to the uninjured arm, employing the Flynn criteria to categorize outcomes as excellent, good, fair, or poor based on the degree of loss compared to the healthy limb [15]. The collected data were systematically organized and entered into a computer for analysis using SPSS software, version 23.0. Descriptive statistical analysis was performed, and the results were presented in tables, graphs, and charts. The inclusion and exclusion criteria of this study were as follows:

Inclusion Criteria:

1. Age: 1.5-10 years.
2. Elbow fractured cases.
3. Willing to participate in the study.

Exclusion Criteria:

1. Age: >10 years.
2. Operative paediatric elbow fractured cases.
3. Unwilling to participate in the study.

IV. RESULTS

Table-1: Socio-demographic characteristics of the study children (N=200).

Socio-demographic characteristics	Frequency N	Percent %
Age(years)		
1.5-2	23	11.5
2-3	45	22.5
3-5	55	27.5
5-6	36	18
6-8	42	21
9-10	12	6
Gender		
Male	120	60
Female	80	40
Residence		
Rural	140	70
Urban	60	30
Socio-economic condition		
Upper	20	10
Middle	60	30
Lower	120	60

Table-1 presents the socio-demographic characteristics of the study population, highlighting the distribution across various age groups, genders, residences, and socio-economic conditions. The highest age group was observed (3-5) years which includes 55(27.5%) and followed by (2-3) years 45(22.5%), (6-8) years 42 (21%), (5-6) years 36(18%), (1.5-2) years 23 (11.5%) and (8-10) years 12(6%). The study children consists of 120(60%)

males and 80 (40%) females. A significant majority of the children resided in rural areas 140 (70%) and 80(40%) in urban areas. A significant majority of the study children resides in rural areas 140 (70%) and 60(30%) resides in urban areas. The majority of the study children were from lower socio-economic condition 120 (60%) followed by 60(30%) middle socio-economic condition and 20(10%) upper socio-economic condition.

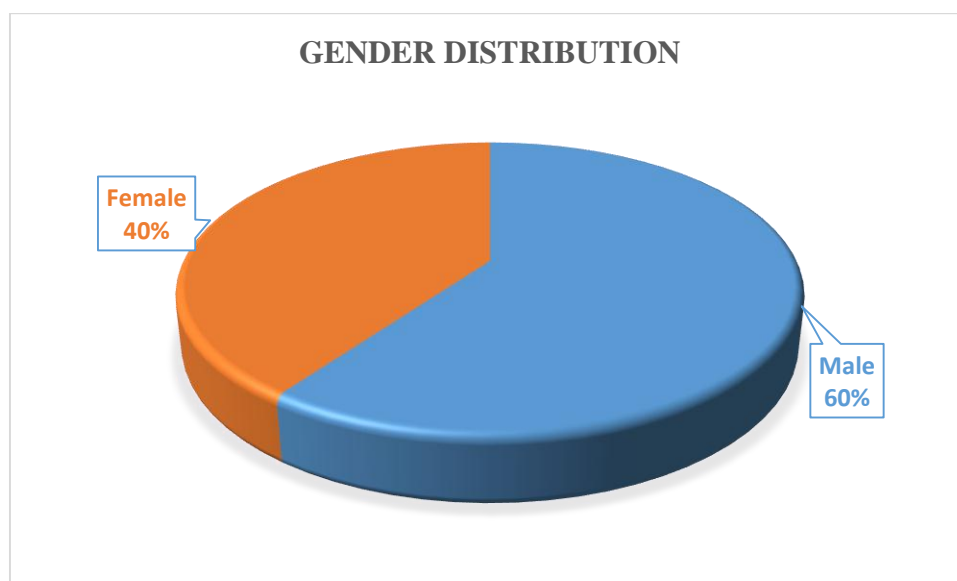


Fig-1: Gender Distribution of the study children (N=200).

Table-2: Type of elbow fractures observed with the study children (N=100).

Type of elbow fractures	Frequency N	Percent %
Medial epicondyle apoplysis	20	10
Lateral epicondyle apoplysis	6	3
Lateral condyle fracture	15	7.5
Medial condyle humerus	10	5
Capitellar fracture	6	3
Trochlear fracture	6	3
Supra condylar fracture	30	15
Radial Head Fracture	7	3.5
Physeal fracture	10	5
Combined:	90	45
More than one side	60	30
More than two sides	25	12.5
More than three sides	5	2.5
Total	200	100

Table-2 categorizes various types of elbow fractures by their frequency and percentage. Medial epicondyle apoplysis occurs in 20(10%) children, while lateral epicondyle apoplysis, capitellar fracture, and trochlear fracture each account for 6(3%). Lateral condyle fracture makes up 15(7.5%), medial condyle humerus and physical fractures each contribute 10(5%), and radial head fracture was present in 7(3.5%) of the study children. The most common type is supracondylar fracture at 30 (15%). Combined fractures, involving more than one side, more than two sides, or more than three sides, collectively account for 90(45%) of cases, with respective incidences of 60(30%), 25(12.5%), and 5 (2.5%). This comprehensive breakdown provides a clear overview of the prevalence of different elbow fractures in the study sample.

Table-3: Types of treatment applied to the study children (N=200).

Types of Treatment	Frequency	Percent
	N	%
Closed reduction	140	70
Long arm posterior cast/ long arm posterior splint	20	10
Long arm full plaster	20	10
Plster single	10	5
Plaster two times	10	5
Total	200	100

Table-3 categorizes types of treatments for elbow fractures by frequency and percentage. The most common treatment was close reduction, applied on 140(70%) of children. Both long arm posterior cast/long arm posterior splint and long arm full plaster treatments were used in 20(10%) of cases each. Single plaster and plaster applied two times were less frequent, each accounting for 10(5%) of the study children. This distribution highlights the prevalence of close reduction as the primary treatment method for elbow fractures in the study children.

Table-4: Functional outcome observed with the study children by Flynn Functional Scores (N=200).

Flynn Functional Scores	Frequency	Percent
	N	%
Excellent	80	40
Good	60	30
Fair	40	20
Poor	20	10
Total	200	100

Table-4 categorizes the functional treatment outcome of the study children in Flynn Functional Scores showing that 80(40%) of the patients achieved excellent outcomes, 60(30%) had good outcomes, 40 (20%) had fair outcomes, and 20(10%) had poor outcomes, which indicates a generally positive functional recovery in the majority of cases.

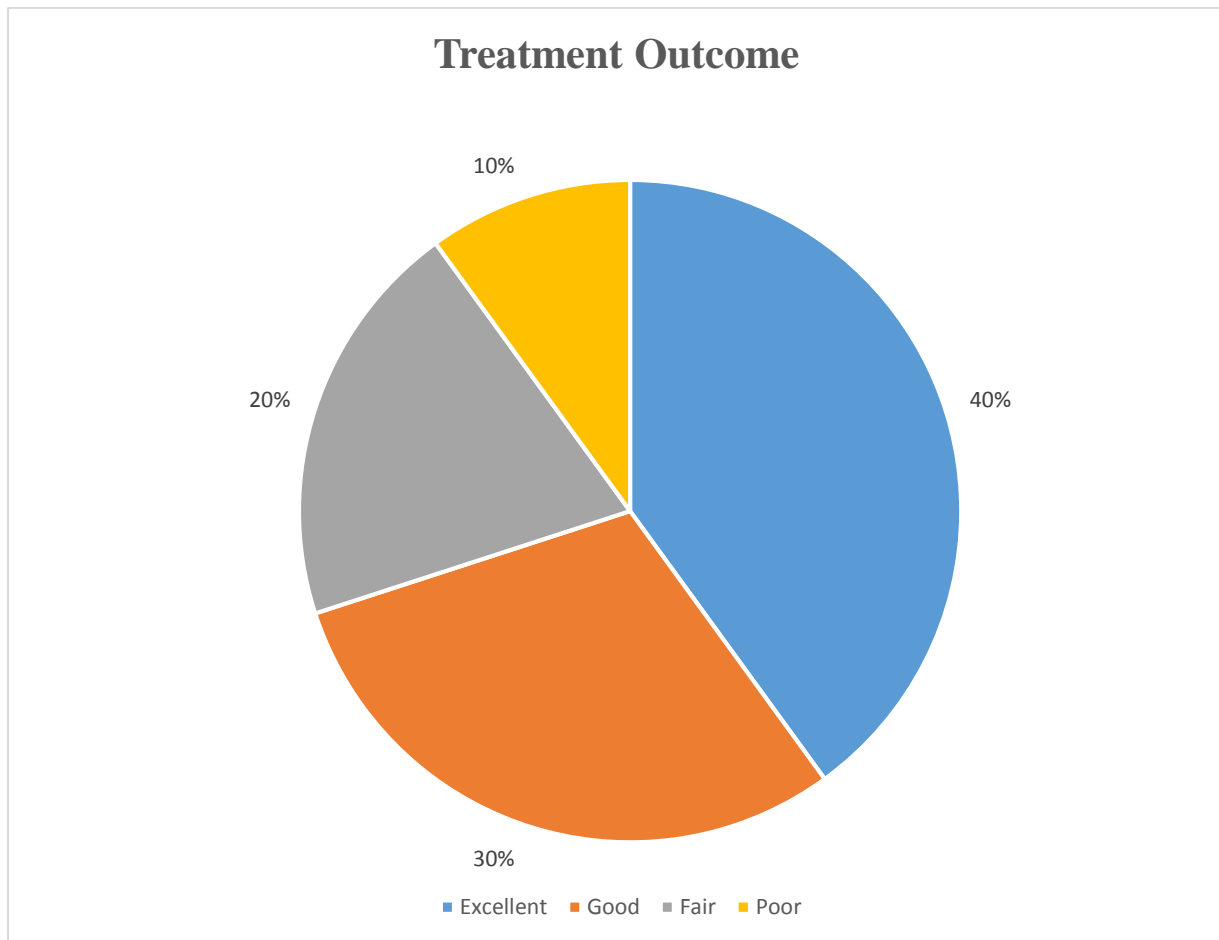


Fig-2: Distribution of treatment outcomes in the study children (N=200).

Table-5: Late complications observed with the study children (N=200).

Late Complications	Frequency	Percent
	N	%
Cubitus valgus	10	5
Cubitus varus	10	5
Elbow stiffness	20	20

Table-5 summarizes late complications of the treatment of the study children, with cubitus valgus and cubitus varus each occurring in 10 (5%) of the study children, while elbow stiffness is more prevalent, affecting 20(10%) of the study patients.

V. DISCUSSION

In this study, the largest age group among the children was 3-5 years, comprising 55 children (27.5%), followed by 2-3 years with 45 children (22.5%), 6-8 years with 42 children (21%), 5-6 years with 36 children (18%), 1.5-2 years with 23 children (11.5%), and 8-10 years with 12 children (6%). Our findings indicate a slightly higher percentage of children in the 3-5 year age group (27.5%) compared to 30% in Flynn et al.'s study [15], which might reflect differences in populations or conditions studied. Additionally, 120 (60%) of the non-operative elbow fracture cases were male, and 80 (40%) were female. This male-to-female ratio is similar to that found in a study by Skaggs, D.L., et al. (2017), where 65% of the elbow fracture cases were male and 35% were female [16]. In this present study, we also found a significant majority of the children resided in rural areas 140 (70%) and 80(40%) in urban areas. Our study has a higher percentage of children from rural areas (70%) [17]. In our study, we found that the majority of the study children were from a lower socio-economic condition 120 (60%) followed by 60(30%) middle socio-economic condition and 20(10%) upper socio-economic condition. These findings are comparable with another study [18]. In this present study we observed that the most common type is supracondylar fracture at 30 (15%). Combined fractures, involving more than one side, more than two sides, or

more than three sides, collectively account for 90(45%) of cases, with respective incidences of 60(30%), 25(12.5%), and 5 (2.5%). This comprehensive breakdown provides a clear overview of the prevalence of different elbow fractures in the study sample. These findings are in line with the findings of another study [19]. In our study, we observed that the most common treatment was close reduction, applied in 140(70%) of children. Both long arm posterior cast/long arm posterior splint and long arm full plaster treatments were used in 20(10%) of cases each. Single plaster and plaster applied two times were less frequent, each accounting for 10(5%) of the study children. This distribution highlights the prevalence of close reduction as the primary treatment method for elbow fractures in the study children. Similar treatment procedures were followed in another study by Derrick M. Knapik et al. titled "Outcomes of Nonoperative Pediatric Medial Humeral Epicondyle Fractures with and Without Associated Elbow Dislocation" found that nonoperative management, primarily involving immobilization, resulted in successful outcomes. This study reviewed cases of medial epicondyle fractures both with and without associated elbow dislocations, revealing that the majority of children experienced minimal clinical or functional disabilities at follow-up[20], similar to the high success rate of closed reductions in our study. In our study we categorized the functional treatment outcomes using Flynn Functional Scores, showing that 80 (40%) of the patients achieved excellent outcomes, 60 (30%) had good outcomes, 40 (20%) had fair outcomes, and 20 (10%) had poor outcomes. These findings indicate a generally positive functional recovery in the majority of cases. These findings of our study can be compared to some other studies, such as the one by Moraleda et al. (2013) titled "Natural history of unreduced Gartland type-II supracondylar fractures of the humerus in children," published in the Journal of Bone and Joint Surgery American Volume, the distribution of outcomes aligns quite well. In their study, they found that the majority of children treated non-operatively also showed favorable outcomes, with a significant percentage achieving good to excellent functional results[21]. Another study by Cheng et al. (2001) titled "Epidemiological features of supracondylar fractures of the humerus in Chinese children," published in the Journal of Pediatric Orthopedics B, reported similar functional outcomes. They observed that children treated with nonoperative methods, including closed reduction and casting, often had good to excellent functional outcomes [22] comparable to those observed in our study. However, finally we observed some late complications with study children which were cubitus valgus and cubitus varus each occurring in 10 (5%) of the study children, while elbow stiffness was more prevalent, affecting 20(10%) of the study patients.

VI. CONCLUSION

This study investigated that the majority of the paediatric non-operative elbow fractured cases (40%) had excellent outcomes, 30 % had good outcomes, 20% had fair outcomes and only 10% had poor outcomes of a conservative treatment approach with the major complications of cubitus valgus, cubitus varus, and elbow stiffness.

LIMITATIONS OF THE STUDY

This study was conducted at only two centers with a limited purposive sample size, so the results may not be representative of the entire country.

RECOMMENDATIONS

A multicenter study is recommended with a large sample size on a national scale to justify the results of this study.

Conflict of Interest: None declared

Funding: Self

REFERENCES

- [1]. Shrader MW. Pediatric supracondylar fractures and pediatric physeal elbow fractures. *Orthop Clin North Am.*2008;39(2):163-71.
- [2]. Manning Ryan L. Evaluation and Management of Supracondylar Fractures in Children. *Hand Clin.*2006;22(1):77.
- [3]. Hart ES, Turner A, Albright M, Grottkau BE. Common pediatric elbow fractures. *Orthop Nurs.*2011;30(1):11-7.
- [4]. Polinder S, Meerding WJ, Mulder S, Petridou E, van Beeck E. Assessing the burden of injury in six European countries. *Bull World Health Organ.*2007;85(1):27-34.
- [5]. Chai KK, Aik S, Sengupta S. Supracondylar fractures of the humerus in children-an epidemiological study of 132 consecutive cases. *Med J Malaysia.*2000;55:39-43.
- [6]. Milbrandt TA, Copley LAB. Common elbow injuries in children: evaluation, treatment, and clinical outcomes. *Curr Opin Orthop.*2004;15(4):286-94.
- [7]. Ramachandran M, Birch R, Eastwood DM. Clinical outcome of nerve injuries associated with supracondylar fractures of the humerus in children: the experience of a specialist referral centre. *J Bone Joint Surg Br.*2006;88(1):90-4.
- [8]. Alavi Y, Jumbe V, Hartley S, Smith S, Lamping D, Muhit M, Masiye F, Lavy C. Indignity, exclusion, pain and hunger: the impact of musculoskeletal impairments in the lives of children in Malawi. *Disability and rehabilitation.* 2012 Oct 1;34(20):1736-46.
- [9]. Gosselin RA, Spiegel DA, Coughlin R, Zirkle LG. Injuries: the neglected burden in developing countries. *Bulletin of the world health organization.* 2009 Apr;87(4):246-a.
- [10]. Hunduma F, Leulseged B. Trends of Road Traffic Injury in Ethiopia, 2015 to 2017: National eHMI data analysis. *Journal of Clinical & Experimental Immunology.* 2022 Apr 18;7(2):452-8.

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- [11]. Kiser MM, Samuel JC, Mclean SE, Muyco AP, Cairns BA, Charles AG. Epidemiology of pediatric injury in Malawi: burden of disease and implications for prevention. *International Journal of Surgery*. 2012 Jan 1;10(10):611-7.
- [12]. Banks LM, Kelly SA, Kyegombe N, Kuper H, Devries K. "If he could speak, he would be able to point out who does those things to him": Experiences of violence and access to child protection among children with disabilities in Uganda and Malawi. *PloS one*. 2017 Sep 19;12(9):e0183736.
- [13]. Agarwal-Harding KJ, von Keudell A, Zirkle LG, Meara JG, Dyer GS. Understanding and addressing the global need for orthopaedic trauma care. *JBJS*. 2016 Nov 2;98(21):1844-53..
- [14]. Sananta P, Sintong L, Prasetyo B, Putera MA, Andarini S, Kalsum U, Dradjat RS. Elbow fracture in children at saiful anwar general hospital, nine years experiences. *Open Access Macedonian Journal of Medical Sciences*. 2019 Dec 12;7(23):4069.
- [15]. Flynn JC, Matthews JG, Benoit RL. Blind pinning of displaced supracondylar fractures of the humerus in children. Sixteen years' experience with long-term followup. *J Bone Joint Surg Am*. 1974 Mar;56(2):263-72.
- [16]. Chan P, Skaggs DL, Sanders AE, Villamor GA, Choi PD, Tolo VT, Andras LM. Pain is the greatest preoperative concern for patients and parents before posterior spinal fusion for adolescent idiopathic scoliosis. *Spine*. 2017 Nov 1;42(21):E1245-50.
- [17]. Hedström EM, Waernbaum I. Incidence of fractures among children and adolescents in rural and urban communities-analysis based on 9,965 fracture events. *Injury epidemiology*. 2014 Dec;1:1-5.
- [18]. Mwaura KK. Pediatric Elbow Fracture Pattern And Association With Body Mass Index (Doctoral dissertation, University of Nairobi).
- [19]. Sananta P, Sintong L, Prasetyo B, Putera MA, Andarini S, Kalsum U, Suryanto Dradjat R. Elbow Fracture in Children at Saiful Anwar General Hospital, Nine Years Experiences. *Open Access Maced J Med Sci*. 2019 Dec 15; 7 (23): 4069-4071.
- [20]. Knapik DM, Fausett CL, Gilmore A, Liu RW. Outcomes of nonoperative pediatric medial humeral epicondyle fractures with and without associated elbow dislocation. *Journal of Pediatric Orthopaedics*. 2017 Jun 1;37(4):e224-8.
- [21]. Moraleda L, Valencia M, Barco R, González-Moran G. Natural history of unreduced Gartland type-II supracondylar fractures of the humerus in children: a two to thirteen-year follow-up study. *JBJS*. 2013 Jan 2;95(1):28-34.
- [22]. Cheng JC, Lam TP, Maffulli N. Epidemiological features of supracondylar fractures of the humerus in Chinese children. *Journal of Pediatric Orthopaedics B*. 2001 Jan 1;10(1):63-7.