



Physiotherapy Guideline for Children with Supracondylar Fracture of Humerus for Hospital Setting of Low-Income Countries: Clinical Commentary

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ABSTRACT

Background: This clinical commentary is aimed to intended to evidence based physiotherapy assessment and treatment of children with supracondylar humerus fracture and post fracture complication that could be used for physiotherapists working in university hospital setting and a base line, information resource and a quick reference for physiotherapists, and community based rehabilitation workers, nurses, orthopedist and pediatrician in the management of children with supracondylar humerus fracture and to prevent its complications.

Findings: The purpose of this clinical commentary is to summaries simple assessment tools based on international classification of functioning and disability and simples' physiotherapy intervention program for children with supracondylar humeral fracture. It is very important to establish an appropriate clinical guideline for physical rehabilitation based on setting resource.

Implication: Evidence based at the same time simple and cost-effective assessment, referral imputes and physical therapy treatment protocol can be more beneficial and easier to implement in resource limited pediatric care settings.

Keywords: Physical therapy; Rehabilitation; Exercise; Children; Fracture

ABBREVIATIONS:

ER: External Rotation; ICF-CY: International Classification of Functioning, Disability and Disease Child Youth; MeSH: Medical Subject Headings; PEDro: Physiotherapy Evidence Database; PT: Physiotherapy; RCT: Randomized Control Trials; ROM: Rang of Motion; RTA: Road Traffic Accident; SCHF: Supracondylar Humeral Fracture; TENS: Transcutanouse Electrical Nerve Stimulation.

INTRODUCTION

Fracture of supracondylar humerus is one of the most common fractures encountered in pediatric age group at all levels both rural and urban, which had a greater rate of poor results than any other type of extremity fracture [1,2]. It is the second most common injury in pediatrics' population after distal radial fracture as result of fall on an out stretch hand and fall from the height. Cubitusvarus with elbow range of motion (ROM) limitation is the most common associated deformity associated with supracondylar fracture in children. the most common mechanism of injuries was Hyperextension during fall on out stretching hand (FOOSH) with the elbow in extension, which indirectly puts force on the

distal humerus and displaces it posterior; this can occur with or without a valgus or varus force [3]. A supracondylar fracture is more common in children than in adults and often combination with other injuries such as a sprained or dislocated elbow or other fractures of the upper limb. Physiotherapy has major role in SCHF of children during immobilization period as well as post immobilization to prevent and treat complication [4,5].

Supracondylar fractures of humerus are classified based on mechanism of injury as Extension type (97%-98%). It occurs while falling on the palm when the elbow region of the arm is extended, and arm is in abduction (5-7). According to Garlands' classification extension type based on severity and the degree of fracture displacement classified as. Type I without displacement of fragment, Type II with displacement of fragment with contact. Type III complete displacement without cortical contact, Type IV the extended elbow exposed to rotation which has neurovascular sign. Flexion type (2%-3%) Flexion type of supracondylar fractures of humerus is considerably less frequent, and it occurs as a consequence of a direct stroke on the back-elbow region [6,7].

Upper extremity fractures are more common than lower extremity fractures in children. While the overall worldwide prevalence

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of SCHF is 16.6% of all childhood fractures with the annual incidence of SCHF is 177.3/100,000 children [8]. Supracondylar fractures mostly occur between the ages of 5-10, in males and on the non-dominant side. There are variations among incidence and prevalence estimates of 14.7%-34.4% from studies conducted in different years. There are many factors that can affect the estimates of SCHF such as gender, age, type of fracture, type of study, study population, and socio-economic status. In the study done in Malawi the prevalence of SCHF among children was reported to be 4.11/1000 which, most commonly occurred in 3-12 years children [8]. The retrospective study done in black lion hospital in Ethiopia showed that the prevalence of SCHF is 2.96/1000 children mostly occurred in 6-13 years with fall down failed by road traffic accident (RTA) [9].

The clinical presentation of children with supracondylar fracture depends on the type of injuries, mechanism of injuries, cause of injuries and the severity of fracture. Physiotherapist should screen for Neurovascular compromise. Swollen, localized tenderness, ecchymosed, painful elbow with decreased range of motion and gentle passive range of motion will be overtly painful, child typically presents to the external rotation (ER) holding arm straight in pronation and refusing to flex the elbow secondary to pain, for displace fracture, soft tissue injuries, bleeding, loss of pulse, exposed bone are observed [10,11].

The prognosis of SCHF in children depends on the type of fracture and early intervention of appropriate treatment. If treated properly, elbow fractures typically heal within 6 to 8 weeks for adults and 4 to 6 weeks in children. An understanding of the fracture presentation, anatomic details, and surgical applications with early physiotherapy rehabilitation can optimize the chances for successful outcomes [12].

The complication of supracondylar fracture depends on the type of fracture and the type of treatment. The most common complications of supracondylar fracture are shown on (Table 1).

Table 1: Shows the most common noticeable complication of supracondylar fracture [9,12].

Early complication	Late complication
Vascular injury	Infection
Skin and soft tissue damage	Elbow joint stiffness
Nerve injuries	Arm, for arm muscle weakness and atrophy
Associated for arm injuries	Scar and contracture
	Gun stroke deformity
	Volkman's ischemic contracture
	Myositis ossificans
Code 71	Compartment syndrome
	Mal union, non union and delayed union

Rationale of the guideline and physiotherapy interventions

Incidence of early childhood fracture may lead long-term effects like impairments of gross and fine motor skills, lifelong complication, psychological effect, and physical disability. These

effects more likely to be continued into adulthood [12,13]. The indication for physiotherapy intervention after supracondylar humeral fractures in children are not seen in the hospitals and in the literature, even if the presence of elbow joint motion limitation and significant cubitusvarus and valgus deformities seen. The authors therefore developed physiotherapy guideline by reviewed literatures to reduce late complication, disability in children and addressing developmental skill of children [14].

List of problems in SCHF in children according to ICF-CY model

The problem related to supracondylar humeral fractures are different. It depends on the age, the type of fracture, the severity and the type of treatment. Most of the problems occur in the age of 5-16 years of children and most of the time all problems may not happen in a child with SCHF (Table 2) [15-17].

Table 2: Shows the list of problem seen in children with supracondylar fracture according to international classification of functioning, disability, and health children and youth version (ICF-CY).

Body function and structure	Activity limitation	Participation restriction
Bone fracture and loss of bone integrity	Difficulty of eating on the affected side	Difficulty of playing with peers, family members, spouses and others
Soft tissue injuries like skin, nerves, arteries, veins and muscles with swelling, pain full elbow	Difficulty of grasping, holding, reaching, washing, combing hair on the affected side	Less in rigorous and recreational activities and playing activities
ROM limitation in elbow, shoulder commonly ER	Difficulty of lifting and carrying bags	missing/withdraw from schooling
Elbow dislocation/subluxation, Mal union		
Post immobilization stiffness		
Scare and Wound infection		
Weakness, disuse atrophy		
Compartment syndrome (pain, paresthesia, paresis, pulselessness)		
Deformity, cubitusvarus (gun stroke deformity)		
Personal related factor	Environmental related factor	
Cooperativeness, alertness	Lack of family support/over support,	
Age of child, type of fracture,	Address of the children	
other medical treatment	Stigma/social rejection and loneliness	
Motivation problem	Maternal depression	
Depression,	Lack of stimulation	

METHODS

Sampling

This article reviews the best available evidence-based literature pertaining the assessment and rehabilitation of children with supracondylar fractures. Using this information in combination with the interdisciplinary expert opinion including the present authors, we present a physical rehabilitation protocol for children with supracondylar fracture.

The search strategy was designed to this local physiotherapy guideline by using PICO

P=children with supracondylar fracture, post SCHF

I=conservative treatment, physiotherapy, rehabilitation with surgical intervention/physiotherapy treatment, during immobilization/post immobilization.

C=conservative treatment with surgical management

O=improve elbow range of motion, functional activity, weakness, and reduce complication

Electronic databases of Pub Med, Google scholar, PEDro, Google and Cochrane data base were used to search the articles. Articles published between 2000 and recent were included. Searching was limited to physiotherapy management of children with supracondylar fracture using the key words. Supracondylar humeral fracture in children during immobilization or post immobilization, post SCHF complication and physiotherapy, rehabilitation, ROM, exercise, functional activity, full search was then undertaken using all identified keywords and index terms across all included databases using Boolean letters like "AND", and "OR" on MeSH term. Finally, the reference lists of some identified systematic reviews and RCT's were searched for additional studies. Full text articles written in English and studies done on children and adolescent until age 18 with SCHF and studied done on children post SCHF complication, which are considered to be, relevant to physiotherapy assessment and intervention were included.

The level of evidence of all articles has been ranked based on the criteria of Oxford's Centre for Evidence-Based Medicine [18] (Appendix A). A systematic review included in this review was level AI while the rest of studies were on level AII. The level of evidence of individual studies relates to the significance of the overall conclusion about the effectiveness of an intervention.

The synthesis and results of the included studies on this pediatrics' protocol

A randomized control trial radiographic assessment in the treatment of supracondylar humeral fracture in children is to identify the healing stage after physiotherapy treatment with a result of incidence of complications is low, with excellent outcome of treatment and a faster return of children to their daily activities [8]. Another therapeutic randomized control trial done to assess the Effectiveness of Physiotherapy after operative treatment of supracondylar humeral fractures in children to improving the elbow range of motion concluded that postoperative physiotherapy is unnecessary in children with supracondylar humeral fractures without associated neurovascular injuries it may be due to the severity of the fracture and the complication was mild and the early intervention and the quality of surgical

management [12].

A RCT aimed to determine importance of physical therapy in treatment of displaced supracondylar humeral fractures in children with a full range of motion in the elbow joint following the treatment of supracondylar humeral fractures were assessed, together with the effects of physical therapy on improvement in the range of motion., with experimental group with SCHF treated with closed reductions with early physiotherapy (PT) intervention thermotherapy,interferential current, TENS and active and passive exercise of elbow without come measure of pain (pediatrics' pain rating scale) and elbow ROM (plastic goniometry) and control group resulted that early physiotherapy intervention recover full elbow ROM and function. In patients who underwent physical therapy following cast removal, there was a significantly greater recovery of motion at eight weeks compared to the group that did not undergo physical therapy [19]. However, the randomized control study done by [20] aimed to evaluate the efficacy of physical therapy in restoring function and mobility after pediatric supracondylar humeral fracture showed the return of elbow motion following a supracondylar humeral fracture in children, noting that recovery of motion took longer after a more severely displaced fracture but early PT intervention and active functional training improve the quality of life of children.

Systematic review study described the role of physiotherapy in supracondylar fracture in pediatrics' population Joint mobilization to improve ROM; Electrotherapy (therapeutic ultrasound) to reduce pain and facilitate the healing process; taping or bracing to prevent further damage and facilitated healing; Exercises to improve strength and flexibility; exercises to improve strength and flexibility; and family and patient Education and home based exercise improve range of motion and functional activities [21]. This study was supported with a prospective cohort study on the effect of PT on post traumatic elbow contracture in children recommend that physical therapy and rehabilitation on the range of the motion of the elbow joint in the post-traumatic elbow contractures in the childhood has a good out come in range of motion [22] and the study on the effect of rehabilitation treatment on elbow contracture after supracondylar fracture in children recommends that thermotherapy and kinesiotherapy increase soft tissue elasticity to increase ROM and TENS to relieve pain. Passive joint mobilization and active stretching with home base exercise are effective in improving elbow joint ROM and the functional activity of children [23].

Assessment of children with supracondylar fracture

A well-integrated holistic assessment which includes medical, psychosocial plan of management or advice a long with physical therapy intervention plan is more likely to improve outcomes [24]. Assessment of children with supracondylar fracture begin in a patient enter in the OPD or in the examination room. Before assessing a child with SCHF or post fracture begin with establishing and maintaining a good relationship with the child as well as with the care givers. Positive interaction will contribute to better therapeutic processes [25].

Subjective assessments are important domain in guiding the physical examination and to set out treatment plan. Taking subjective history is a key marker for the total assessment and indicator of patient, family/caregiver expectation. History taking provides the time and room to build a sense of understanding

between the family and the physiotherapist. During interview patients use simple and direct communication and start with by introduce the name with demographic data of the patient such as; name, age, gender, address, parent's name with its relationship to children, and asking Request for help/presenting complaint[26].

History of present illness which is the main part of subjective assessment, a full patient history should be realized, including: time of injury, onset, mechanism of injury, is it a flexion or extension injury?, was the hand supinated or pronated?, the time of the fall/trauma, review what type of treatment was done, is there improvement, if there has been any loss of consciousness, if the parents or himself is able to offer appropriate explanations, the location of the pain, the type,nature, and frequency of pain.

Identify status of the child during objective assessment (depressed, shyness, alert/cooperative, not focused and follow only what he/she want to do). As much as possible, use attractive new things for them and interactive way of playing by considering their cognitive effect [15].

Observation is the integral part of objective assessment which including facial expression, localized swelling, ecchymosed, deformity, and other skin changes at the fracture site, physical deformities especially on the hand, elbow and shoulder and the position of the elbow, Signs and symptoms of compartment syndrome (pain, pulselessness, par aesthesia, pallor, paralysis), the attitude of limb, and functional activity like eating, grasping, holding toys. In addition, palpation of temperature, isolated point tenderness over area of humerus that was fractured and lateral supracondylar humeral fractures tend to present with greater deformity than lateral humeral supracondylar fractures are a part of objective assessment [12].

Assessment based on body functions and structure level

It is important to remember that gunstock deformity and elbow and wrist joint were the main common complication associated with supracondylar fracture.In order to measure used plastic goniometry with use range of motion for children according to (Bern beck) (Appendix B).

Through examination will be one of the key components in the assessment of children with SCHF. Among them measuring the range of motion of elbow, shoulder wrist; muscle strength with manual muscle testing; neurological examination like sensation; assess radial nerve injury with wrist extension and sensation in the dorsal aspect of the first web space and assess median nerve injury with the patient's ability to make the "ok sign" and sensation over the palm tip of the index finger (autonomous area of the median nerve) ulnar nerve injury with strength testing of intrinsic muscles of the hand and sensation over the palm tip of the little finger; muscle girth measurements; and vascular examination by check the pulse [15].

Physical therapy interventions for children with supracondylar fracture

The management of supracondylar humeral fracture is a multidisciplinary team the physiotherapist should involve in decision making, assessment and treatment. For older children from age 4-16 passive joint mobilization with soft tissue manipulation and active functional exercise after surgical intervention are highly recommended for improving elbow ROM

and strengthen arm, for arm and hand muscle [12,26].

Early physiotherapy treatment in displaced supracondylar humerus fractures in children with other medical discipline reduce the complication, transcutaneous electrical nerve stimulator, active and passive elbow range of motion exercise are effective for improve elbow range of motion and functional activity and reduce pain after crossed reduction without sensory deficit. Children sustained closed supracondylar humeral fracture without nerve injury treated either with casting or with closed reduction. Cryotherapy reduce swelling and immediately after removing cast active strengthening exercise and elbow range of motion exercise are effective for improving elbow and hand function [15].

Early physiotherapy active/active assisted, mechanical resistance exercise of children after supracondylar elbow fracture highly recommended have better elbow functioning, with treatment supposed to begin within two weeks after removal of cast immobilization. For children with displaced supracondylar fracture associated with nerve injury after open reduction of 6-week muscle reeducation with biofeedback, kinesio taping and electrical nerve stimulation are highly effective [27,28]. Children with supracondylar fracture have difficulty of fine motor activity like writing gripping, grasping, holding, pick objects due to for arm muscle weakness, range of motion limitation and lack of coordination. Functional activity training, hand muscle strengthening, and coordination training in the form of play are the basic treatment.

CONCLUSIONS AND RECOMMENDATIONS

TSupracondylar fracture is an injury with great magnitude and a considerable soft tissue injury. Although the metaphysical bone in pediatrics age is healing rapidly, after removal of the cast after three weeks, loss of range of motion is common. The major functional problem appears to be changes in elbow mobility, either loss of flexion or loss of extension or hyperextension. Active range of motion is started at the child's own pace followed by physiotherapy. The goals of physical therapy are rapid recovery of motion and avoidance of late complications. Physiotherapy has vital role during immobilization and post immobilization in children with supracondylar fracture to maintain and restore range of motion, prevent complication. Elbow range of motion, elbow function, reduce pain, swelling good hand function and radiological finding are the main outcome indicator for discharge. Children with displaced supracondylar fracture associated with nerve injury after open reduction muscle reeducation with biofeedback, kinesio taping are highly effective and passive mobilization with activity modification stretching are the best treatment for elbow contracture followed with supracondylar humeral fracture.

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AVAILABILITY OF THE DATA AND MATERIALS

Not applicable

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Not required

COMPETING INTERESTS

The authors declare no conflict of interest

SUPPLEMENTARY DATA

Appendix A: Criteria of Oxford center for evidence-based medicine

Appendix B: Range of motion for children according to Bernbeck

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