Case report 8

Supracondylar fracture humerus with pink pulseless hand and angiogram confirmed vascular injury – Case report

Key Words: supracondylar fracture humerus, paediatric, pink pulseless hand, vascular injury

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Abstract

- Supracondylar fracture of the humerus is a common injury in paediatric population. Neurovascular damage is a well-known serious complication of this injury. This should be managed urgently by the treating clinician in order to prevent severe disability to the child. In this case report, we illustrate the presentation, management and follow up of a 7-year-old boy presented with a supracondylar humerus fracture, highlighting the diagnostic and therapeutic measures taken in sequential manner.

- The child presented following a domestic fall and having pain, swelling and acute deformity of the left elbow. Clinically, no distal radial pulse or oxygen saturation using pulse oximetry detected on admission, even though the left hand was warm and pink with normal capillary refill time. X-ray confirmed the clinical diagnosis of supracondylar fracture humerus, and it was classified as Gartland type III.

- Manipulation and casting done without internal fixation on the next available casualty list and even after 72 hours of the procedure no return of distal pulse despite warm, pink hand. After vascular opinion, CT Angiogram revealed no flow segment of 2.2cm of brachial artery at the trauma site and minimum demonstrable flow distally. However, watchful waiting was selected as the management option by both vascular and orthopaedic teams as this child continues to have warm, pink hand with normal capillary refilling and minimal pain.

- In 6 months follow up, the child has gained both radial and ulnar pulses, full range of elbow motion, complete neurological recovery and good hand function.

Introduction

Supracondylar fracture humerus is one of the most common fracture seen in paediatric orthopaedic practice and it represents up to 1/5th of all paediatric fractures. [1-3]

During the initial assessment with advanced trauma life support protocol, once life threatening conditions has been ruled out, the distal neurovascular status is been assessed with the x-ray imaging.[4] Although neurovascular damage is relatively uncommon , it is a serious complication. Brachial artery injury following this fracture is reported between 0.4 and 11% in literature. [5, 6]

Vascular injury is assessed commonly be feeling distal pulse status and pulselessness can be of two main entities [7]. Firstly, frankly cold, pale, and pulseless hand and secondly a warm, pink hand without palpable pulses distally. Former has clear consensus for immediate fracture fixation and vascular repair [8]. However, in the case of latter- pink pulseless hand (PPH) the optimal management strategy has been widely debated. [7] [9]

In this case report, we would like to illustrate the management and follow up results of a child presented with PPH with angiogram confirmed vascular injury highlighting the diagnostic and therapeutic decisions made stepwise.

Presentation

A 7-year-old average-built boy for his age presented to paediatric accident and emergency unit with his parents at 11.00pm complaining of severe pain and swelling of left elbow (non-dominant) following a fall on staircase.

Immediate life-threatening conditions were ruled out and limb examination revealed a haematoma (not enlarging nor pulsating) in the cubital fossa and deformity in the left elbow. There were no radial or ulnar pulses felt and no distal saturation detected. However, the hand was warm and pink and capillary refill time was less than 2 seconds. Neurologically the child has difficulty in performing "OK sign", but all other motor and sensory examination was normal. No signs of other soft tissue swellings or contusions noted. Clinical diagnosis of supracondylar fracture humerus with pink pulseless hand and anterior interosseous nerve damage was made.

Initial radiographs confirmed a Gartland type III supracondylar fracture humerus (fig 1).

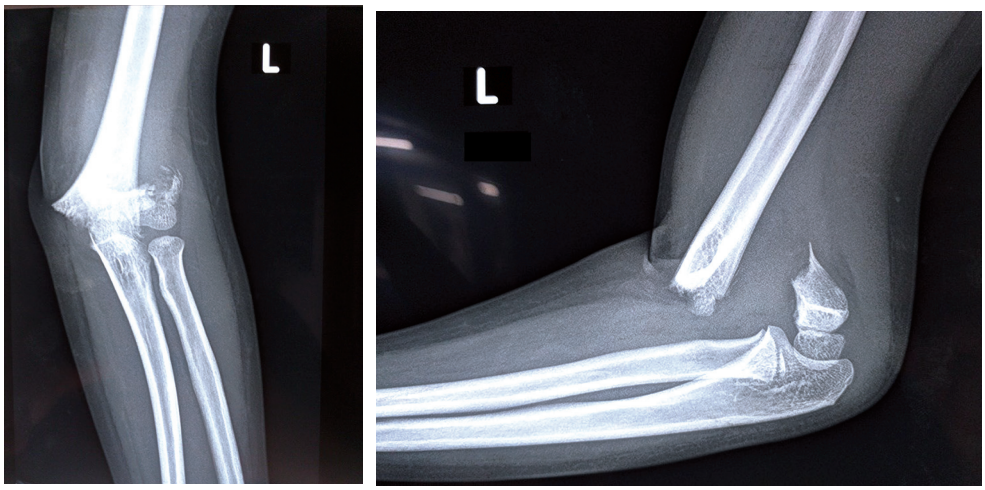

Fig 1 : Initial X rays

The child's left upper limb was put on a temporary splint to ease the pain and oral analgesics given. The limb was kept elevated with continuous monitoring for anxiety, agitation and increased analgesic requirements which are the key predictors of paediatric compartment syndrome. The child was prepared for surgical intervention on next morning casualty surgical theatre after proper counselling and obtaining informed written consent from both parents.

During surgery, about 8 hours after the presentation to A&E, the surgeon re-evaluated the neurovascular status and it was the same as presentation. Furthermore, preoperative 8 hour stay in A&E was unremarkable.

The fracture was manipulated under image intensifier by applying axial traction followed by elbow flexion and forearm pronation. After satisfactory manipulation, plaster of Paris (POP) back slab applied holding elbow in 90 degrees of flexion and keeping forearm pronated. No K wiring or any other internal fixation method attempted. (Fig 2)

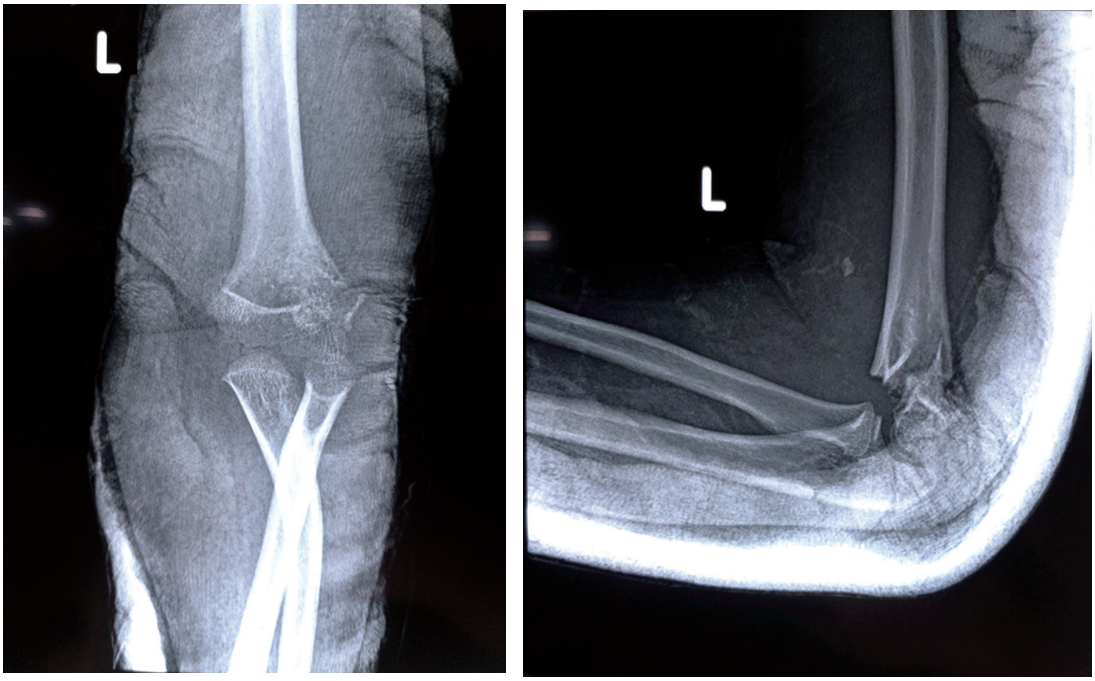

Fig 2 : immediate X-rays after manipulation

After the procedure, the pulse status remained the same with absent pulses and no detection of saturation, but the hand was warm, pink and capillary refilling time was less than 2s.

The child was sent to ward for further monitoring. Even after 72 hours of the procedure, the vascular status remained the same and vascular surgical opinion was sought. According to their advice, an angiogram was done to assess the vascular status.

Angiogram revealed non visualization of flow in a short segment of 2.2cm in the left distal brachial artery at trauma site and minimal demonstrable flow distally. (Fig 3) Furthermore since, the angiogram done after 72 hours of initial injury and manipulation, the possibility of arterial spasm was considered unlikely.

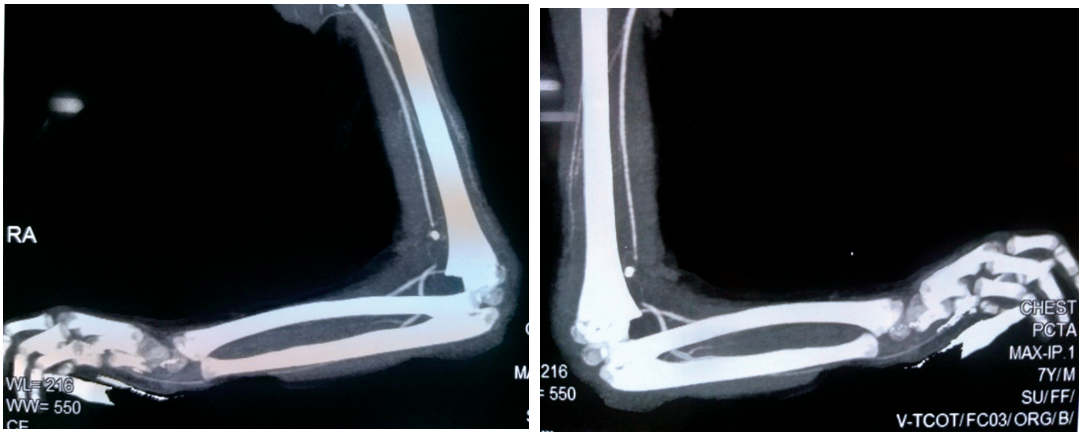

Fig 3: Angiogram

However, despite angiogram findings, both orthopaedic and vascular teams agreed to continue vascular status monitoring without embarking on open exploration as the child was clinically well. No heparin was administered. Child was monitored for 5 days inward and discharged.

On the 7th day postop the child was seen at vascular outpatient clinic and revealed vascular

status to be the same with no palpable pulses. However, triphasic vascular flow revealed in distal radial artery with saturation of 96%. The child had pointing index and unable to perform OK sign. Follow up x-rays on the same day shows maintenance of satisfactory reduction.

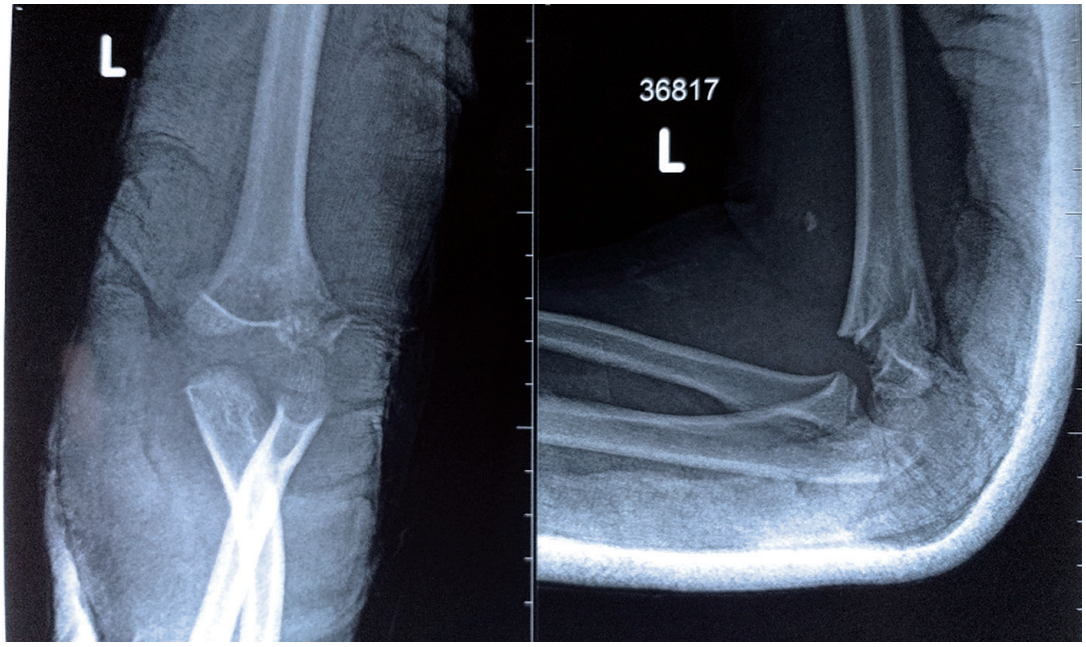

Fig 4 : 1 week post MUA x-ray

Follow up x-rays in 3 weeks shows excellent fracture healing with satisfactory bony alignment. However, distal pulses were not felt. Child had a little improvement with his AIN injury. POP cast was removed in 3 weeks and encouraged elbow movements as tolerated by pain.

At 6-month follow up, the x rays show perfect bony union. Child was able to do full range of elbow movements with flexion more than 110 degrees and no extension lag. No pointing index and he was able to do OK sign with completely intact distal neurology.

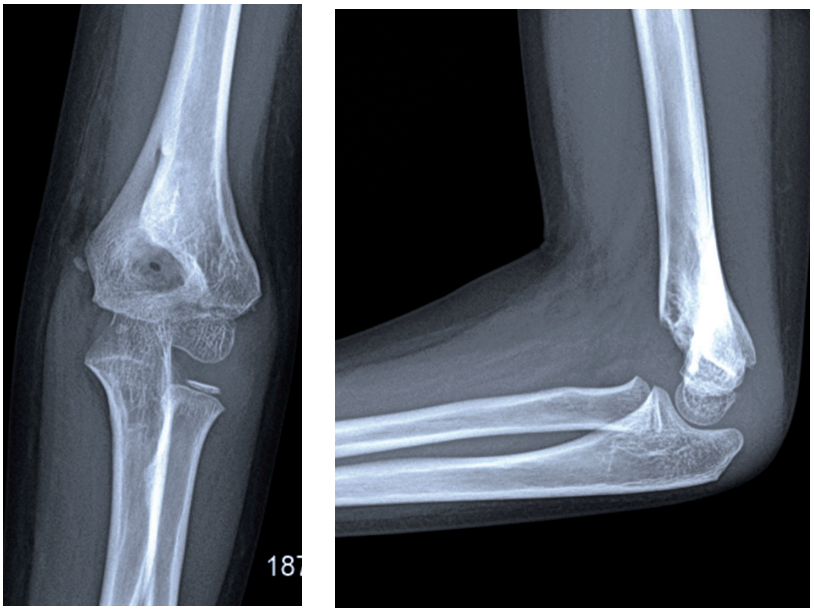

Fig 5: 6 months follow up x-ray

Fig 6: Child after 6 months

Discussion

Child with a suspected supracondylar fracture humerus following a possible high energy trauma must be assessed thoroughly to exclude immediate life and limb threatening conditions. This includes detailed neurovascular examination of the injured limb. Clinical examination coupled with initial x rays will help in determining the possible soft tissue structures at risk. For instance, a lateral displacement of fracture fragment will damage the radial nerve along with AIN and brachial artery while a medial displacement will damage the median nerve. This case demonstrated lateral displacement of fracture fragments along with radial artery and AIN damage. [10]

During the initial hours pink pulseless nature of the hand can be assumed due to local arterial spasm. Hence, watchful waiting while careful attention for major and minor vascular injury signs and impending signs for paediatric compartment syndrome is warranted. However, if its for spasm, the effect should settle with time and during general anaesthesia since it is an adaptive response mediated by sympathetic nervous system. [11]

On the other hand, mostly the literature reveals the majority of the patients presents with PPH had brachial artery entrapment at manipulated or pinned fracture site or local brachial artery thrombosis due to intimal tear. [12]

A case reported by Choi at el, reported a similar case of PPH where fracture reduction is offered in all cases. They also noticed that the patients never had compartment syndrome. However, with signs of severe soft tissue damage such as ecchymosis and severe swelling, the risk is high. [13]

On the contrary in a review by White at el states that in their study population, 70% of PPH patients had brachial artery injury whereas only 9% had brachial artery spasm. They conclude that absence pulse should be considered as an indicator for arterial injury. [14]

Nonappearance of pulses and doppler undetectable perfusion and no detectable distal saturation after 72 hours was alarming and CT angiogram is warranted.

However, in this case the treating surgeons relied more on clinical signs than on clear vascular damage depicted on CT angiogram.

In contrast, it must be stressed that if a child is presented with pale, pulseless hand with cold extremity, then the emergency exploration with vascular team must be performed immediately.

In this patient, during reduction the axial traction is given to restore the extremity length, bowman angle, olecranon fossa shadow and medial and lateral condylar contours. Then the elbow is flexed and assessed under image intensification whether anterior humeral line is crossing the humeral condyle in its anterior 1/3 and whether mid radial line bisects the capitellum.

Then the stability of the reduction is assessed and if stable POP back slab applied above elbow to MCP joints.

If the fracture is not stable or close reduction is not possible an internal fixation and/or open reduction with internal fixation is performed, usually by K wires. As this technique and procedure is beyond the scope of this article, it is not discussed.

Take away lessons

- Pink Pulseless hand following supracondylar fracture humerus is a relatively common clinical scenario. However, PPH presenting with frank vascular injury is a rare entity.
- After successful and satisfactory closed manipulation, if the patient is clinically showing no features of compartment syndrome and continue to have pink, warm hand, watchful waiting is advised.

Consent

- To write this article informed verbal consent taken from both parents of the child.

Conflict of interest

- The authors have no conflict of interest.

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