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Case Report Open Access

Gartland Type III Supracondylar Humerus Fracture in a Child: To Intervene at the Right Time for a Vascular Injury

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Abstract

Supracondylar humerus fractures (SHF) are seen more than half of all fractures in the elbow. SHF may cause to vascular and neurologic injury. The most causes of the vascular injury are thrombosis with intimal tear, brachial artery entrapment in the fracture site, compression of the artery due to deformity/swelling and partial or complete transection of the artery (by the perforating spike of the fractured bone). Emergency vascular reconstruction is required for a functional recovery of the limb.

Keywords: Supracondylar humeral fracture; Vascular injury; Children

Introduction

Supracondylar humerus fractures (SHF) are seen more than half of all fractures in the elbow [1]. SHF may cause to vascular and neurologic injury. SHF account for 17.9% of all fractures in children aged 0-16 and especially are the most common fractures in children under the age 7 (The incidence increases between the ages 4 and 6). SHF are accompanied with a high rate (7% -16%) of nerves and vessels injury. Present with higher complications rates than any other pediatric fracture. Most of them are caused by hyperextension (97.7%). The typical cause is falling on an outstretched arm. In the Gartland classification SHF are classified as type I, II, or III. Gartland type III is defined as the loss of continuity between distal and proximal portions of the humerus. Type III is the most difficult to repair and are commonly associated with neurovascular injury. Completely displaced of the sharp edges of the humerus may cause median-ulnar nerve injury and brachial artery injury due to adjacent to the elbow [2]. However, the incidence of brachial artery injuries in grade 3 SHF is 3—12%. The most causes of the vascular injury are thrombosis with intimal tear, brachial artery entrapment in the fracture site, compression of the artery due to deformity or swelling and partial or complete transection of the artery (by the perforating spike of the fractured bone). Emergency vascular reconstruction is required for a functional recovery of the limb. Vascular claudication, Volkmann's ischemic contracture, distal ischemia, tissue injury, gangrene and subsequent amputation can be seen as sequelae on account of the vascular injury. Diagnosis and treatment of vascular injuries as a result of SHF are considered a surgical emergency and treatment strategy remains controversial. We report a rare case of compression of the brachial artery due to a close supracondylar fracture treated with open surgery.

Case

An 8-year-old boy fell on his outstretched arm presented with a Grade III close supracondylar fracture of his right humerus within 4 hours of injury. On examination he had a swollen elbow with small wound (1 cm) over the anteromedial aspect of the elbow. He had an impalpable radial and ulnar pulse and paraesthesia in the median nerve distribution. His brachial pulse was poor but axillary pulse was strong. Fore arm looked pale with a capillary refilling time of 3 s (normal <2 s). X-rays revealed a spiral postero-laterally displaced supracondylar fracture of the humerus with the spiked proximal fragment. First an dublex ultrasonography (US) was performed for any vascular injury, but failed to diagnose. Then a computed tomography angiography (CTA) was performed and failed to provide appropriate imaging too (Figure 1). We decided to perform an emergency exploration. Under general anesthesia brachial artery was explorated at the elbow with a skin incision made at the level with elbow, incision extended longitudinally along the line of the brachial artery proximally and distally. The brachial artery was found to be completely compressed at the level with elbow with visible pulsation 4 cm above the bifurcation. We made a transvers arteriotomy to the proximal portion of the brachial artery. A Fogarty embolectomy catheter was introduced through the proximal brachial artery to ensure patency of the vessel. Contracted brachal artery dilated with catheter and papaverine was applied externally (Figure 2). At the end of the surgery he had complete restoration of his radial and ulnar pulse. There was no nerve damage. The bone ends were reduced and held with three Kwires (1.25 mm) by orthopedic surgeons. Postoperatively the patency of the vessel was monitored. No infections or varus deformities were found.

Discussion and Conclusion

Angiography is the gold standard for diagnosis of upper extremity vascular arterial injuries. However, angiographic imaging prior to surgery is controversial and some authors favour exploration without angiogram and claim that the arterial lesion is always located at the fracture site and that carrying out an arteriogram only delays surgical treatment, worsening prognosis. However, 4% of cases an arteriogram results in secondary complications [3]. On the other hand non-invasive diagnostic modalities also exist. Duplex US can be used with low reliability, except with minor injuries, and also depending on the experience of the physician. CTA can also be used as an alternative imaging technic instead of angiography [4]. If angiography and CTA do not exist, tight and repeated clinical examination is needed, and surgical exploration must be took into consideration to diagnose and treatment of arterial lesion. It is important to limit the period of ischemia and ischemia-reperfusion injury and the systemic consequences. Incidence of vascular injury is higher in open injuries than closed injuries [5].

Figure 1: Poor CTA imaging prior to the surgery.

Absent radial pulse must alert the surgeon considering the severity of injury. An early exploration reduces the possibility of further ischemia. Exposure of the brachial artery in the arm should always approach with a medial incision in the line of the sulcus separating the biceps from the triceps muscle. The median nerve must be identified and separated from the artery [6]. All patients with nerve injuries detected preoperatively or during the surgery and should be referred to the plastic surgeons for further evaluation and treatment. The ulnar nerve lies behind the medial condyle inferiorly before entering the forearm. The radial nerve lies around the humerus as it moves toward the forearm, enters laterally over the lateral epicondyle. The median nerve and the brachial artery lie inferiorly from the medial aspect of the upper arm to the antecubital fossa, where the brachial artery splits up into the ulnar and radial arteries. Venous injuries generally remain unrecognized until surgical exposure. In open injuries the spiked end of proximal fragment penetrates the skin. This spiked end may perforate the brachialis muscle and cause injury to the neurovascular structures. The repair of the artery was either by direct repair or using vein interposition/a synthetic polytetrafluoroethylene (PTFE) graft. Ligation should be performed as a last resort procedure in multiple trauma patients with life-threatening. A compartment syndrome may develop either due to insufficient arterial flow or following restoration of the circulation. A fasciotomy can be performed to prevent a secondary ischemia if necessary. Exploration of the antecubital fossa should be done in an attempt to relieve the arterial obstruction. The open supracondylar fractures treated with internal fixation resulted in 81% good results [7]. Normally, vascular repair should be performed before orthopedic repair. After bone repair, attention must be paid for patency and freedom of the vessels from tension. The controversy exists regarding the exploration of the brachial artery in closed injuries. Clement recommended immediate exploration of the artery if there is "no improvement in circulation" but did not specifically discuss those patients with pulseless well-perfused hand [8]. On the other hand some authors preferred to observe and rely on collateral circulation rather than treating it more aggressively when the arm remains pink, pulseless and well perfused following stabilization [9]. In conclusion, our opinion is surgical exploration should be done without hesitation when ischemia is suspected.

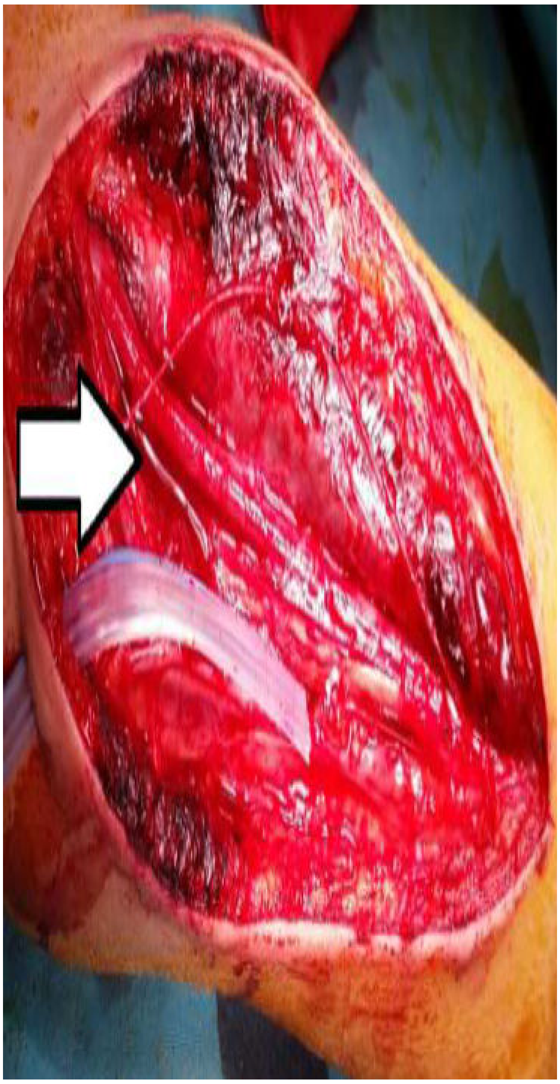

Figure 2: Exploration of the brachial artery.

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