Case Report

Traumatic open brachial plexus injuries: The importance of interdisciplinary collaboration

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ABSTRACT

Open traumatic brachial plexus injuries are rare, yet can be life threatening and require rapid clinical assessment. Early interdisciplinary collaboration is critical to achieve superior patient outcomes. This case of a 24-year-old female of a traumatic neck injury with contralateral brachial plexus injury demonstrates the limitations of early clinical assessment due to the potential for haemodynamic instability and highlights the priority of patient stabilisation. Early and active interdisciplinary collaboration in this case demonstrates its importance in accurate diagnosis and timely intervention to achieve better patient outcomes. As published in recent guidelines, this report shows the importance of early interdisciplinary involvement following stabilisation and resuscitation of the patient.

Introduction

Open traumatic brachial plexus injuries (TBPIs) are rare, usually resulting from penetrating trauma such as stabbing or gunshot injuries [1,2]. Life-threatening associations with airway compromise, vascular and apical lung injuries necessitate urgent surgical exploration. The urgency of these clinical scenarios may necessitate a rapid clinical assessment and preclude the use of ancillary diagnostic tests. This case report demonstrates how early interdisciplinary collaboration (Emergency medicine, ENT surgery, vascular surgery, plastic surgery, and radiology) can achieve superior patient outcomes by optimal evaluation, accurate diagnosis and safe and timely surgical intervention.

Case summary

A 24-year-old right hand dominant female presented to the emergency department by ambulance following an alleged stabbing to her left neck region with a large shard of broken glass. On arrival to hospital, she was reviewed by the emergency medicine, ENT, plastic surgery, vascular surgery and radiology and the patient was found to have contralateral brachial plexus injury with complete C5-C8 palsy including the radial nerve, left-sided airway, and left-sided subclavian artery injuries with an associated left clavicle fracture. The patient was stabilised, ventilated, and transferred to the intensive care unit prior to undergoing complex surgical reconstruction of the brachial plexus, left-sided clavicle fracture repair and management of the left subclavian artery injury.
vascular and anaesthetic teams. Diffuse bleeding from the right neck wound was controlled with a pressure dressing and the secondary
Advanced Trauma Life Support (ATLS) survey revealed decreased sensation on the dorsum of her right hand and forearm (contralateral
to the neck injury) with no obvious motor deficits.

She was promptly intubated to secure her airway and immediately transferred to theatre, as she became unstable, for exploration of
the left neck wound and definitive control of bleeding. Immediate exploration of the injury was warranted due to active bleeding from
the left neck associated with class III haemorrhagic shock. Intra-operatively, significant venous bleeding was found to originate from
the right aspect of her neck. The wound was extended, and branches of the right internal jugular vein were ligated and lacerations of
the right sternothyroid and right sternocleidomastoid muscle were repaired. No obvious nerve injury was identified at this time.

Upon extubation a day later, she was reviewed by the plastic surgery team due to ongoing right upper limb sensorimotor deficits
and right neck pain. Clinical examination revealed decreased sensation in the middle finger, posterior forearm and arm (6/10 right
index finger and posterior cutaneous nerve of forearm, and 8/10 to mid-posterior forearm) and weakness in wrist and elbow extension
and median-innervated long flexors (4/5 MRC grade). MR imaging revealed a right neck haematoma impinging on the C7 nerve root
with possible transection of the C7 nerve root and right vertebral artery thrombus [Fig. 1]. Subsequent CT angiogram revealed a
thrombus of the right vertebral artery. A C7 nerve root injury was suspected. The case was discussed at the multi-disciplinary
neuroradiology meeting. They advised to perform a repeat CT angiogram at one week due to risk distal thrombus propagation and
stroke. Once this demonstrated stability of the vertebral artery clot, a prompt supraclavicular right brachial plexus exploration per-
formed using a supraclavicular approach [Fig. 2], one week after the original injury.

Fig. 1. Magnetic Resonance Image coronal view establishing C7 nerve impingement secondary to haematoma, with STIR and T2 hyperintensity
suspicous for nerve root transection.
Intra-operatively, there was no response from 2.0 mA stimulation of the C7 nerve root (C5, C6, C8, T1 stimulated) [Fig. 3]. Proximal dissection revealed 80% transection of the C7 nerve root at the level of the spinal foramen which was repaired primarily. The patient was managed in a Miami-J collar and shoulder immobiliser for 3 weeks and her pain had resolved at latest follow-up at one year, along with improvements in sensory and motor function (MRC grade 4+/5).

Discussion

Open penetrating brachial plexus injuries are rare yet complex injuries involving multiple anatomical structures [3] and can lead to significant physical impairment [4,5]. Interdisciplinary collaboration from a wide range of specialities to include pre-hospital care, emergency medicine, anaesthesia, radiology, vascular surgery, head & neck surgery and plastic surgery teams are key to achieving superior patient outcomes. This approach allows for optimal pre-operative patient evaluation (clinical examination & diagnostics), to achieve an accurate diagnosis and develop a safe and timely surgical strategy. This case highlights the complexity of open brachial plexus injuries and the importance of interdisciplinary collaboration to optimise patient safety and outcomes.

Previous studies have demonstrated that traumatic open brachial plexus injuries with concomitant vascular injuries are often too unstable to perform a complete ATLS secondary survey prior to transfer to theatre [6,7]. In these situations, patient resuscitation, correction of haemodynamic shock, and haemostatic control are the priority. Clinical evaluation of a persistent peripheral neuropathy should be performed once the patient is haemodynamically stable. Exploration of such injuries should be performed after relevant

Fig. 2. Clinical photograph demonstrating the supraclavicular approach and position used to explore the right neck brachial plexus injury. The sternal notch is marked for reference. The scar from the original left neck exploration can be seen at the apex of the planned supraclavicular incision.
ancillary diagnostics (MRI, CT angiogram) have aided complete clinical evaluation of the injury. We recommend surgical exploration ± reconstruction on planned elective operating lists during normal working hours to maximise patient safety, by ensuring availability of adequate equipment, infrastructure and personnel. Similar recommendations have been made in other surgical specialties following the National Confidential Enquiry into Perioperative Deaths [8,9].

The newly published BOAST Peripheral Nerve Standard of Care Guidelines [10] (December 2021) provide clear guidance for management of nerve injuries in the context of trauma. Specifically, formal advice from a peripheral nerve surgeon should be sought within 24 h of a laceration or penetrating injury associated with a neurological deficit. Immediate advice should be sought when a nerve is observed to be injured during surgery. Delayed brachial plexus reconstruction is technically challenging due to the presence of scar tissue, in addition to poorer sensorimotor and psychosocial functional recovery and chronic deafferentation pain. Early recognition, prompt surgical exploration and primary repair/reconstruction of open brachial plexus injuries are crucial prognostic indicators in functional recovery.

Fig. 3. Intraoperative photograph exposing the brachial plexus upper trunk (intact), which failed to stimulate with 2.0 mA. Further dissection proximally was required to identify the C7 nerve root transection.

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