

# Open Injuries of the Brachial Plexus: A Case for Immediate Exploration and Repair

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## Citation

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## Abstract

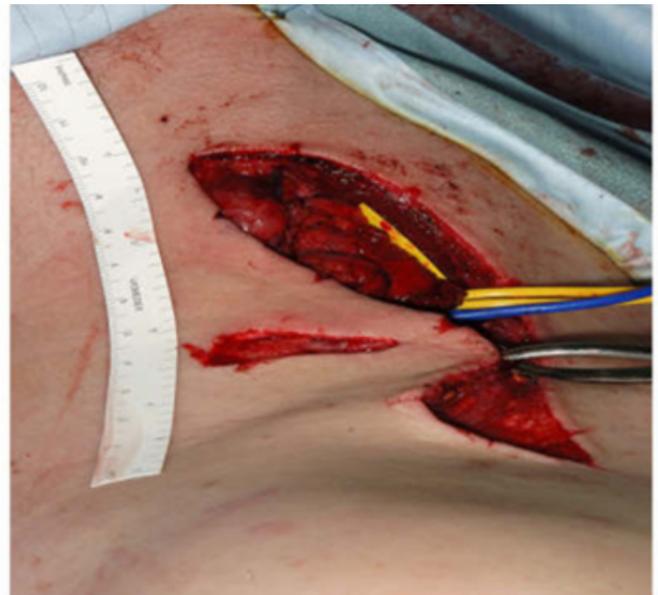
Penetrating injuries to the neck may be associated with damage to the brachial plexus. Primary repair is advocated for these injuries, but in practice they rarely present acutely to units with appropriate surgical expertise. The level of the injury is usually determined by thorough pre-operative clinical examination avoiding unnecessary investigations and delay. We present a case of a patient who sustained a stab injury to the neck. Clinical examination revealed the level of brachial plexus injury (BPI). An early exploration under general anaesthesia was undertaken and a primary repair of the brachial plexus was performed without the need for nerve grafting techniques.

## CASE REPORT

A 30 year-old right hand dominant male construction worker was involved in an altercation and was allegedly assaulted with a knife. He sustained a stab wound to the right side of the neck (Figure 1) in the posterior triangle. He presented to his local emergency department the following morning with pain and paraesthesia radiating down the lateral aspect of his right arm and difficulty abducting his arm. On examination there was a 4 cm wound in the right posterior triangle of the neck. A plain chest radiograph excluded a pneumothorax and there was no elevation of the right hemidiaphragm to suggest a phrenic nerve injury. There was no evidence of spinal cord injury and neurological examination of the lower limbs was normal.

## Figure 1

Figure 1: 4cm stab wound in the right posterior triangle of the neck.



The emergency physician contacted the neurosurgical resident on call. They requested a Magnetic Resonance Imaging (MRI) scan. The MRI revealed a signal abnormality within the neck musculature and extending throughout the supraclavicular brachial plexus. The radiologists were unable to identify the level or extent of the brachial plexus injury.

The neurosurgical unit were unable to take over the patient's

care as they did not manage brachial plexus injuries. The patient was subsequently referred to the regional hand surgery unit for definitive care.

A careful neurological assessment of his upper limb was performed. This revealed light touch sensation was reduced in the C5 and C6 dermatomes. He was unable to initiate abduction at the shoulder and was only able to abduct the arm when gravity was eliminated (MRC grade 2). Elbow extension was weaker and more painful than his contralateral limb (MRC grade 4). The remainder of the examination was normal.

Peripheral pulses were normal in the limb and there was no significant haematoma or surgical emphysema in the neck. The wound was clean.

The phrenic nerve was intact, confirmed by the normal position of the right hemidiaphragm on chest radiographs.

The inability to initiate abduction at the shoulder is suggestive of a C5 root injury or more distal division of the suprascapular nerve. Winging of the scapula was absent and therefore the long thoracic nerve was assumed to be intact. It was concluded that the injury involved a laceration through C5 distal to the long thoracic nerve.

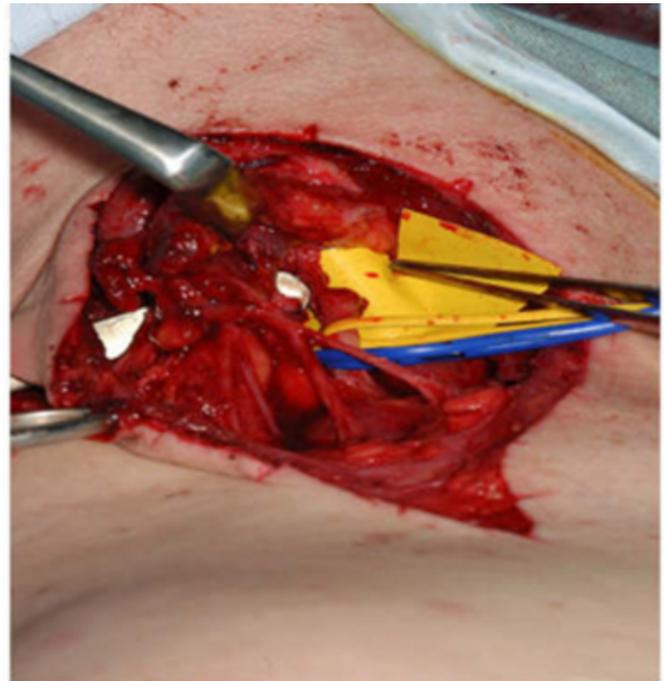
The decision was made for surgical exploration and the patient was consented for nerve grafting and both legs were prepared for possible sural nerve harvesting.

An incision separate to the wound was made along the posterior border of the sternomastoid muscle and extended to the superior border of the clavicle. The omohyoid was divided and the external jugular vein was ligated and divided.

The blade had entered tangentially, penetrating the platysma and the superficial cervical fascia (Figure 2) and passing between the C5 and C6 roots.

**Figure 2**

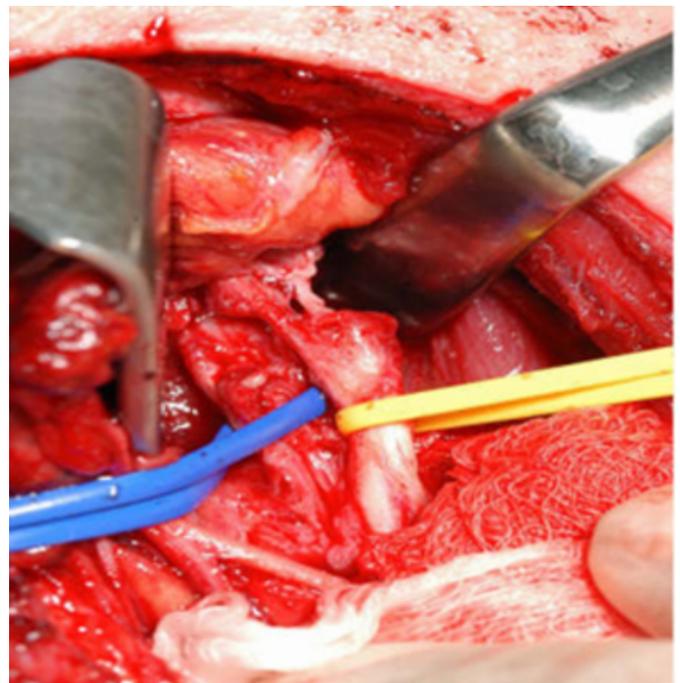
Figure 2: Direction of blade, injuring the brachial plexus.



A 95% injury to the C5 root and a 5% injury to the C6 root had occurred (Figure 3).

**Figure 3**

Figure 3: Nearly complete division of C5 and partial injury to C6.

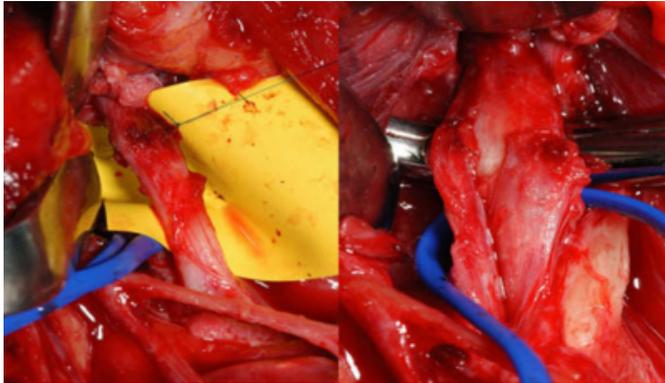


A direct epineural repair of both trunks was performed using an 8-0 nylon suture (Figure 4) assisted by intra-operative

magnification.

**Figure 4**

Figure 4: The repaired C5 and C6 roots.



**DISCUSSION**

The management of brachial plexus injuries (BPIs) represents one of the most complex challenges facing a peripheral nerve surgeon. The complex anatomy and variability of the potential injuries present a wide variety of pathological entities, clinical deficits, potential treatments and prognoses. Management of this condition remains controversial. Historically the outcome of primary repair has been poor (1). Some believe that lesions in continuity would spontaneously recover and others believe that useful recovery is so unlikely after proximal injuries that repair is not worthwhile (2, 3).

Low velocity open wounds make up a minority of injuries to the brachial plexus in the UK, although the literature regarding the prevalence of each injury is sparse. Peach reported on 218 patients. 17% were related to stab wounds, 19% to gunshot wounds and 51% to traction injuries (4).

The patient should be assessed in a systematic manner with priority going to the stabilisation of life threatening injuries. Once this has been achieved, patients with a suspected vascular injury should be explored immediately (5). In the ideal setting stab injuries involving the brachial plexus should be explored and repaired expediently (6).

A review of 64 stab injuries to the brachial plexus by Dunkerton and Boome in 1988, recommended immediate repair, but found that this was rarely achievable due to the delay in referral. The majority of patients were operated within one to seven months after the injury (6). They noted that a number of patients investigated for signs and symptoms of BPIs were found to have false aneurysms compressing elements of the plexus. The authors discovered

that on careful examination deep pressure sense remained in the fingertips of these patients, whereas it was absent when the nerve had been divided.

The initial treatment for any contaminated wound is also extended to these types of injuries with wound excision and thorough debridement of all non-viable tissue. In the presence of a “Tidy Injury”, a phrase coined by Rank, Wakefield and Hueston, the wound should be explored immediately and repaired primarily (7). A repair of C5 and C6 in this setting can be expected to yield an excellent result and return to a nearly normal level of function (6) due to the short course required for axonal regeneration to muscle endplate.

Kline and Judice reported good recovery in 78% of patients who sustained sharp injuries to the brachial plexus and underwent immediate repair. Only 50% of those who underwent secondary repair recovered function. They also commented that nerve grafting was more likely for patients undergoing secondary repair (8).

**CONCLUSION**

Careful history and examination can allow prompt recognition of these injuries. In order to achieve the best results for stable patients with isolated injuries of this nature and to reduce the need for interposition grafting, immediate exploration and repair should be undertaken (8) and we would recommend that local referral pathways are implemented to ensure prompt referral to a specialist unit. Complex imaging should not form part of the pre-operative assessment when no evidence of spinal cord injury is identified on initial assessment and in this case it delayed transfer of this patient to the appropriate treatment facility.

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