



# Delayed presentation of a penetrating neck injury: diagnostic and management difficulties with retained organic material

George Barrett • Catherine Williams • David Thomas

Department of ENT, Gloucestershire Royal Hospital, Great Western Road, Gloucester GL1 3NN

Correspondence to: David Thomas. E-mail: david.thomas@glos.nhs.uk

## DECLARATIONS

### Competing interests

None declared

### Funding

The publishing fee will be covered by Gloucestershire Royal Hospital ENT Department

### Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images

### Guarantor

DMT

### Contributorship

GB and CW researched the background for the case as well as drafting for publication. DMT undertook and provided information on the surgical procedure as well as editing the case for re-drafting. All authors read and

Underestimating the extent of a seemingly superficial neck wound can result in severe complications requiring radical surgical intervention.

## Introduction

Penetrating neck wounds complicate approximately 10% of all trauma presentations.<sup>1</sup> While they are most commonly associated with violent acts, they are also encountered in road traffic collisions and other accidents. The adverse relationship between alcohol and trauma is well-documented.<sup>2</sup>

The mechanism of penetration is important in determining the extent of damage and treatment options. Ballistic missiles trauma can cause extensive damage which is highly correlated with the velocity. Stab wounds are relatively low velocity, but can still lead to serious injury. Management in both instances should initially follow ATLS guidelines, with careful attention to airway and cervical spine protection. As with any tissues, penetration and retention of foreign material carries an increased risk of infection.

The neck has a dense concentration of neurovascular and aerodigestive structures passing through it, which can be damaged by injuries which penetrate the platysma muscle. It is useful to divide the neck horizontally into three zones. Zone I extends between the clavicles and the cricoid cartilage; it carries the highest mortality because of vascular injury and high-risk surgical exploration.<sup>3</sup> Zone II is superior to Zone I and extends as far as the angle of the mandible. Zone III is the area between the angle of the mandible and the base of the skull. Zone II injuries are the most common followed by Zone 1 and finally Zone III.<sup>4</sup> Injuries may occur in more than one zone.

Inevitably vascular injury is the most frequent complication of penetrating neck trauma, occurring in one-quarter of all cases, and carrying a mortality of nearly 50%. Trauma to the trachea occurs in one-tenth of cases, and mortality in these cases approaches 20%.<sup>5</sup> Other structures at risk of damage include the oesophagus, which can cause leakage of digestive enzymes and bacteria into surrounding tissues; and the cranial nerves. Extensive penetration may result in oropharyngeal trauma. Currently it is thought that penetrating neck injuries carry a 3–6% mortality rate.<sup>6</sup> The mortality rate for Zone II stable injuries is generally perceived to be lower than this, although there are no large studies to back this up.

In the postwar era it was shown that the mortality associated with penetrating neck wounds dropped from around 35% to 6% when immediate surgical exploration was performed.<sup>7</sup> Now, with advanced imaging techniques and increasing experience, selected stable patients with no hard findings of injury can be managed by thorough examination and, if unremarkable, a period of observation rather than immediate surgical exploration. A review by Tisherman *et al.*<sup>8</sup> on penetrating Zone II neck trauma found that selective operative management and mandatory exploration of penetrating injuries to Zone II had similar diagnostic accuracy, therefore selective management is recommended to avoid unnecessary operations. Stable patients without clear signs of vascular and visceral injuries can avoid mandatory surgery. Instead high-resolution CT angiography was recommended to give detail about vascular, tracheal and oesophageal injuries. CT without angiography can be used to rule out significant vascular injury if the trajectory is shown to be away from vascular structures.

There are no studies on the management of retained organic material in stable Zone II neck

approved the final manuscript

#### Acknowledgements

Robert Jackson provided information on the microbiology for this case, providing explanations for the likely sources and pathogenicity of the different bacteria identified

#### Reviewer

Muhammad Khan

injuries or data on the management of cases that have a delayed presentation. In general, however, it is recommended that patients with retained wood or vegetative material and pain have foreign body removal.<sup>9</sup> Retained material such as thorns can lead to granulomatous formation. In one autopsy study of patients with tendon injuries organic matter was associated with purulent tendonitis, necrosis, foreign body granuloma, fibrosis and peritendonitis and calcification.<sup>10</sup> Penetrating ingested foreign bodies can remain quiescent for years but can cause late mortality from diffuse and local suppurative processes especially if leading to vascular injuries.<sup>11</sup>

This case describes the delayed diagnosis of a penetrating neck injury by a piece of bamboo which missed all the major structures of the neck, and considers the consequences of retained organic foreign bodies in the soft tissues.

## Case history

A 26-year-old woman presented to the Emergency Department in the early hours of the morning following an alcohol-related fall. She was seen by an emergency medicine practitioner who recorded a history of falling from a low wall onto a bamboo garden plant support, and sustaining a 2 cm graze over the middle third of sternocleidomastoid on the right. There was no history of loss of consciousness, and as the patient had walked into the department alert and orientated; a full ATLS approach was not adopted. Neck examination findings clearly documented that there was no penetrating injury, no soft tissue exposure and no foreign body present. The wound was glued, and a sterile dressing applied. Examination was otherwise unremarkable, and the patient was deemed safe to go home.

Twelve hours later, the patient re-presented to the emergency department with painful neck movements and a swelling over the left mandible. The history was reviewed by the ear nose and throat SHO, and the patient recalled pulling a small fragment of bamboo from her neck after falling, but could recall little else of the event. On examination, the neck wound was clean, with no swelling, erythema or fluctuance. There was a soft, diffuse tender swelling along the inferior border of the left mandible. Trismus was

noted with mouth opening limited to 15 mm, but no temporomandibular joint tenderness. There was no airway compromise or difficulties swallowing. Neck movements were limited by pain, so the patient was assessed by an emergency department doctor who ruled out a cervical spine injury on clinical grounds. Plain posterior-anterior neck and orthopantomographic films were unremarkable, and the patient was reviewed by the maxillary-facial SHO who diagnosed an incidental dental abscess and advised starting oral augmentin. The patient was allowed home, and advice was given to return if the swelling increased or the pain intensified.

Forty-eight hours later, the patient presented to the Emergency Department for the third time, with stridor, worsening trismus, extensive left-sided neck swelling and left otalgia. She was haemodynamically stable, but pyrexial with a temperature of 37.6°C. The swelling was firm and non-fluctuant with no crepitus over it, and extended from the angle of the jaw down to the root of the neck and the posterior triangle. Crepitus was felt over the right side of the neck. A lateral neck plain film showed extensive soft tissue swelling anteriorly with locules of gas extending into the root of the neck (Figure 1). An urgent contrast CT was requested which showed an ill-defined left-sided para- and retro-pharyngeal mass containing gas locules suspicious of developing necrotizing fasciitis, which extended into the mediastinum medial to the left lung apex (Figure 2). No foreign material was visualized. Doses of gentamicin, tazocin and clindamycin were given immediately after discussion with the consultant microbiologist. Adrenaline nebulizers, hydrocortisone and regular dexamethasone were administered for airway maintenance. Blood results revealed a white cell count of  $13.5 \times 10^9/L$  (neutrophils  $10.76 \times 10^9/L$ ) and a CRP of 113 mg/L.

The patient was taken to emergency theatre to explore the neck. Due to the severity of her trismus, a conscious fibre optic intubation was performed in the anaesthetic room, where the anaesthetist noticed soft tissue swelling of the left lateral pharyngeal wall.

## Procedure

The neck was initially opened via a left-sided skin crease incision below the angle of the mandible.

**Figure 1**  
Plain lateral film of the neck showing soft tissue swelling and gas anteriorly in the neck



This was then extended to improve access. There was severe soft tissue swelling, and pockets of gas were noted within the neck tissues. The sternocleidomastoid was then retracted laterally, and with careful dissection a large pocket of pus was found and drained beneath and medial to the submandibular salivary gland.

As the abscess loculi were digitally divided, it became apparent that foreign material could be palpated deep to the angle of the left mandible. All visible and palpable fragments of bamboo were removed. The wound was then irrigated with aqueous betadine.

The original right neck entry wound was opened and explored, and a track was evident extending across the midline superior to the body of the hyoid.

The wound was loosely closed and a corrugated drain was left *in situ*. Swabs taken at surgery subsequently grew *Clostridium perferingens*, viridans type *Streptococcus*, *Staphylococcus aureus* and *Streptococcus intermedius*. She was ventilated overnight and extubated uneventfully on intensive care the following morning before being transferred back to the ENT ward where she completed five days of intravenous tazocin and clindamycin. She was discharged on a 10-day course of oral augmentin. Recovery was uneventful, with inflammatory markers returning to normal over the following months.

## Discussion

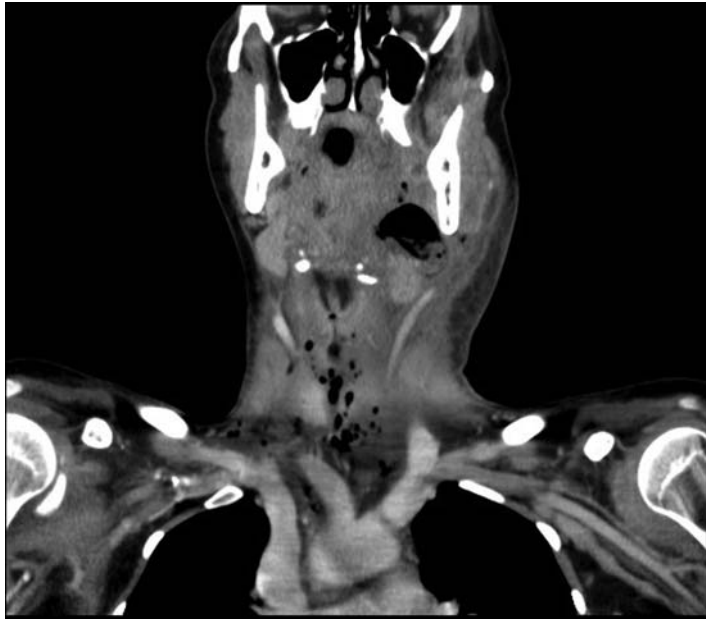
It is recommended that stable Zone II injuries are investigated by CT angiogram to exclude vascular, tracheal and oesophageal injuries as described in the review by Tisherman *et al*. The scope of this guidance, however, does not include injuries with a low index of suspicion for penetration or suggested management for injuries with potentially retained organic material.

This case illustrates two important diagnostic difficulties. First, patients under the influence of alcohol are poor historians leaving doubt as to the mechanism or seriousness of a neck injury. Second, an unremarkable neck examination does not exclude the possibility of penetration and retention of foreign or organic material. With hindsight the diagnosis of retained foreign body should have been considered, with management consisting of either imaging or surgical evaluation.

Materials such as bamboo are incredibly difficult to visualize with imaging. A study investigating the radiographic visibility of various woods and plastics found that identification was unreliable even with digital enhancement, and that fresh woods were invariably invisible.<sup>12</sup> There is some suggestion that MRI is a useful adjunct in these cases as CT is not sensitive to identifying these types of foreign body<sup>13</sup> and consequentially may have been normal if done at the original presentation of this patient. However, a delayed CT may demonstrate gas loculi resulting from *clostridium perfringens* infection which in our case prompted urgent surgical exploration.

**Figure 2**

**Contrast CT showing locules of gas extending into the root of the neck and a cavity beneath the mandible**



Surgical exploration of the entry site is an alternative to imaging, although would not be recommended as first line intervention in stable Zone II penetrating neck injuries. Superficial probing under local anaesthetic in the Emergency Department may have revealed a tract which would have prompted formal surgical evaluation and avoided potentially life-threatening complications, but without appropriate expertise and a sterile environment this practice is unadvisable. Despite current guidance suggesting otherwise we, therefore, recommend mandatory surgical exploration in cases involving organic material to allow for its removal and irrigation of the wound.

## Conclusion

Injuries to the neck require a multidisciplinary approach, and it is reassuring that in this case members of the ENT, Emergency Medicine and Max-fax teams were all involved. However, there was no senior input into the management until the third presentation of the

patient to the Emergency Department. It has been suggested that all patients returning to the Emergency Department should have a senior review.

This case has been disseminated to both the ENT and Emergency Departments at the local hospital, and a collaborative protocol to deal with neck trauma is being discussed. It is hoped that by reporting this case, medical practitioners will have a high index of suspicion for retained foreign bodies in a neck wound.

In conclusion, this case illustrates the complexities of managing neck wounds, where the extent of injury cannot be accurately assessed. Neck stiffness and trismus may be the only early clinical features of residual foreign body. While a thorough examination at the time of acute presentation is crucial in excluding penetration of the platysma, circumstances may make it difficult to perform, and it is easy to underestimate the extent of damage. Imaging has a role in investigation, but may be misleadingly normal. There is a vogue for conservative management of penetrating injuries, but retained organic foreign material rapidly causes life-threatening mixed bacterial infection for which early surgical exploration and removal is the only definitive management.

## References

- 1 Nason RW, Assuras GN, Gray PR, *et al*. Penetrating neck injuries: analysis of experience from a Canadian trauma centre. *Can J Surg* 2001;**44**:122–6
- 2 Lowenfels A, Miller T. Alcohol and trauma. *Ann Emerg Med* 1984;**13**:1056–60
- 3 Thal ER, Meyer DM. Penetrating neck trauma. *Curr Probl Surg* 1992;**29**:1
- 4 McConnell DB, Trunkey DD. Management of penetrating trauma to the neck. *Adv Surg* 1994;**27**:97
- 5 Bryant AS, Cerfolio RJ. Esophageal trauma. *Thorac Surg Clin* 2007;**17**:63
- 6 Singh R, Bhandary S, Karki P. Managing a wooden foreign body in the neck. *J Emerg Trauma Shock* 2009;**2**:191–5
- 7 Fogelman MJ, Stewart RD. Penetrating wounds of the neck. *Am J Surg* 1956;**91**:581–96
- 8 Tisherman SA, Bokhari F, Collier B. Clinical practice guideline: penetrating zone II neck trauma. *J Trauma* 2008;**64**:1392–405
- 9 Halaas GW. Management of foreign bodies in the skin. *Am Fam Physician* 2007;**76**:683–8
- 10 Jozsa L, Reffy A, Demel S, Balint JB. Foreign bodies in tendons. *J Hand Surg Br* 1989;**14**:84–5
- 11 Remsen K, Lawson W, Biller HF, Som ML. Unusual presentations of penetrating foreign bodies of the upper

- aerodigestive tract. *Ann Otol Rhinol Laryngol Suppl* 1983;**105**:32–44
- 12 Roobottom C, Weston M. The detection of foreign bodies in soft tissue – comparison of conventional and digital radiography. *Clin Radiol* 1994;**49**:330–2
- 13 Imokawa H, Tazawa T, Sugiura N, Oyakea D, Yosino K. Penetrating neck injuries involving wooden foreign bodies: the role of MRI and the misinterpretation of CT images. *Auris Nasalis Larynx* 2003;**30** (Suppl.):S145–7

© 2010 Royal Society of Medicine Press

This is an open-access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by-nc/2.0/>), which permits non-commercial use, distribution and reproduction in any medium, provided the original work is properly cited.