

Radiology in Focus

The use of digital subtraction angiography in penetrating neck injury—a very instructive case

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Abstract

This case report illustrates the value of intravenous digital subtraction angiography (DSA) in cases of penetrating neck injury. The debate continues between a policy of mandatory exploration of all penetrating neck wounds *versus* one of selective exploration with observation of the remainder. The argument for the former policy is that vascular trauma can occur without clinical signs. Whichever policy is followed a DSA provides invaluable information in strengthening the decision either not to operate or if operating which operation to perform and which approach to use. DSA is a quick, simple and safe investigation that can be carried out at any time of day or night.

Key words: Neck; Wounds and injuries; Radiology

Case report

Case history

A 28-year-old man walked into the Accident and Emergency Department (Wexham Park Hospital) having been stabbed in the left side of the neck with a penknife. The wound had bled initially but had stopped bleeding at the time of presentation. He was referred to the general surgeon. On examination he was generally well but there was a 1 cm stab wound just lateral to the left lateral border of the thyroid cartilage at about mid-cartilage level. Deep to the wound was a diffuse nonpulsatile, nonexpanding swelling. There was slight deviation of the trachea to the right and he had a mildly husky voice. There was no airway problem. Indirect laryngoscopy was unsuccessful and chest X-ray was normal.

The resident ENT registrar and general surgical senior registrar felt that the wound should be surgically explored as soon as possible. The on-call consultants (a vascular surgeon), however, advised observation until he was able to assess the patient. Following his examination of the patient an urgent request was made to the radiologist to perform digital subtraction angiography. This demonstrated a false aneurysm of the common carotid artery 2 cm below the carotid bifurcation (Figure 1). The patient was taken to the operating theatre and the neck opened using an incision along the anterior border of sternomastoid. Proximal and distal control of the carotid artery was established. The false aneurysmal sac was opened and revealed a 320° transection of the common carotid artery. Clamping the artery caused a marked rise in blood pressure indicating the need for use of a shunt. A Javid shunt was used and the tear closed with 5–0 prolene. The internal jugular vein and vagus were reported as being intact. The blood loss was 500 ml. The patient made a very good post-operative recovery. Subsequent duplex Doppler examination of the carotid revealed good blood flow and no residual stenosis.

Discussion

If this neck wound had been explored without prior angiog-

raphy the outcome might have been very different. Neck stabblings are often referred to ENT surgeons who are taught that they should be surgically explored. With any penetrating neck wound the priority is to establish an airway and stop any bleeding. Haemostasis is best achieved using pressure and attempts at probing or blind clamping in a wound must be avoided. Even in an apparently stable patient it is important to establish venous access with a large bore cannula. The severity of the injury should be assessed and attempts made to identify covert laryngo-tracheal, vascular, oesophageal, neurological and pulmonary injury. This case illustrates the value of preoperative investigations particularly digital subtraction angiography.

Standard angiography is often thought of as a major radiological investigation with significant morbidity. Using the Seldinger technique an artery, usually the femoral, is cannulated and a catheter inserted such that the tip lies in the aortic arch. A flush injection of 15 ml at 12 ml s⁻¹ is adequate to demonstrate the major neck vessels although the best pictures are obtained by selective catheterization of the common carotid arteries. This route carries the possible complication of arterial puncture as well as the potential hazard of emboli to the brain. However as penetrating neck injuries are more common in the younger age group the risk of dislodging atheromatous plaque is much reduced when compared to an elderly arteriopathic patient.

The advances in technology, particularly with the use of digital subtraction angiography (DSA), means that very low concentrations of contrast medium can be detected and therefore it can be administered intravenously as well as intraarterially. In this case with venous access already established (using a large bore 16 G cannula) contrast was administered intravenously thus avoiding further trauma to the patient. Two separate bolus injections of 45 ml 'Iohexol 350' were injected by a pump at 15 ml s⁻¹ to obtain the images (Figure 1). The risk of anaphylaxis is extremely low with non-ionic contrast media and no other side effects are likely. The procedure is extremely quick, particularly if the cannula is already in place. In this case the whole procedure took about 10 minutes.

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FIG. 1

Digital subtraction angiography showing a false aneurysm of the left common carotid artery.

Penetrating neck injuries can be classified according to the zone in which the entry wound is sited and this classification gives a guide as to management. Zone 1 is below the cricoid/clavicle, zone 2 between the angle of the mandible and the cricoid/clavicle and zone 3 is above the angle of the mandible (Figure 2).

Zone 1 contains the apex of the lung and large vascular structures which continue into the thorax. In zone 1 injuries routine angiography is advised and exploration may require the skills of a thoracic surgeon. The structures in zone 3 are usually protected by the mandible, mastoid and skull base. Due to the confined space an injury in this area may present with minimal external swelling. Intra-oral examination is essential and may reveal an expanding haematoma displacing the lateral pharyngeal wall. Finding a cranial nerve injury greatly increases the chances of

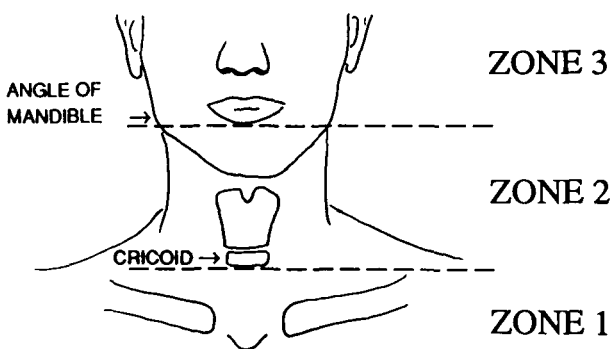


FIG. 2

Zones of the neck.

there being an associated vascular injury due to the close proximity of nerves and vessels. Routine angiography is recommended for all zone 3 injuries. Exploration of this area can be difficult and may need displacement of the mandible and in some cases a craniotomy. Zone 2 accounts for about 75 per cent of injuries. Indications for angiography in this zone include: persistent haemorrhage, expanding haematoma and neurological injuries compatible with adjacent vessel damage e.g. Horner's syndrome (sympathetic plexus), or hoarse voice (vagus).

There is still debate over the best form of management for penetrating neck wounds. Some centres advocate a policy of mandatory exploration of all penetrating neck wounds that breach the platysma (Fogleman and Stewart, 1956; Farley *et al.*, 1964; Jones *et al.*, 1967; Ashworth *et al.*, 1971; McInnis *et al.*, 1975; Roon and Christensen, 1979; Shotton, 1988). This is based on the observation that neck wounds which appear innocent may harbour life-threatening injuries (Ashworth *et al.*, 1971). An alternative policy is one of selective surgical intervention with observation of some patients (Stein and Kalk, 1974; Sheely, 1975; Blass *et al.*, 1978; Lundy *et al.*, 1978; Cabasares, 1982; Demetriades and Stewart, 1985). In many patients the need for exploration is not in doubt, some requiring immediate surgery as a lifesaving procedure. However there is a group of patients who appear quite stable and those advocating a selective policy undertake careful assessment and observe those patients who show none of the symptoms or signs which the teams feel is an indication for surgical exploration (Table I). Some authors have suggested angiography whereas others felt it was an unnecessary delay. However the papers noted here were all written over 10-15 years ago when the availability of DSA was much less widespread.

Whether one uses a policy of mandatory exploration or selective surgery the use of DSA can be extremely valuable. One author practicing mandatory exploration and using arteriography reported that the investigation changed the operative approach in 29 per cent of positive studies (Roon and Christensen, 1979). For those practicing a selective policy a negative angiogram would certainly add weight to the decision to observe a patient with no obvious clinical signs. However it is possible for an angiogram to miss pathology and a normal angiogram in the presence of clinical signs should not delay surgical exploration.

A case of penetrating neck injury was recently presented at the Royal Society of Medicine (Hargreaves and Baskerville (1993)) in which no angiogram was performed at presentation of a patient with a zone 2 penetrating neck wound. There was no active haemorrhage, haematoma or surgical emphysema. The

TABLE I

CRITERIA USED FOR CONSIDERATION OF SURGICAL EXPLORATION*

- Bleeding
- Shock
- Haematoma – expanding/pulsatile/large
- Subcutaneous emphysema in absence of pneumothorax
- Neurological deficits
 - Hemiplegia or TIA
 - Horners syndrome
 - Cranial nerve defects
- Dysphagia/pain on swallowing
- Hoarse voice
- Dyspnoea
- Haemoptysis/bloodstained sputum
- Haematemesis
- Absent pulses
- Bruits
- Bubbling of air through wound
- All high velocity gunshot wounds
- Haemothorax with continued bleeding through chest drain
- CXR – widened mediastinum
- Positive angiography

*Composite of the various criteria different authors used to decide on exploration.

patient was stable and appeared well. A limited surgical exploration of the tract was performed and the patient was discharged after four days: 10 weeks later he represented with an embolic stroke and an angiogram at this time showed a traumatic false aneurysm of the common carotid artery filled with thrombus and presumed to be the site of origin of his cerebral embolus.

Conclusions

Cases of penetrating neck injury described in this paper and by Hargreaves and Baskerville (1993) remind us of the importance of a thorough pre-operative clinical assessment and the availability and value of angiography as an investigation in this form of trauma. It highlights the point that digital subtraction angiography (DSA) is a quick, simple, safe and informative investigation that can be carried out at any time of day or night. Apart from those needing immediate surgical intervention, DSA should be considered for all penetrating neck wounds even when the criteria discussed in this paper are absent. If damage to the major vessels is detected it is advisable to enrol the help of a vascular surgeon.

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