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Ruptured superior thyroid artery from central vein cannulation: treatment by coil embolization

V. Jeganath[1]*, J. G. McElwaine[2] and P. Stewart[2]

[1]Department of Cardiothoracic Anaesthesia, Freeman Hospital, High Heaton, Newcastle-upon-Tyne NE7 7DN, UK. [2]Directorate of Anaesthesia and Intensive Care, City General, Newcastle Road, Stoke-on-Trent ST4 6QG, UK.

**Corresponding author*

Central vein cannulation is associated with several complications, some of which may be fatal. This case report describes a life-threatening complication after insertion of a central venous line. An obese female patient with end-stage renal failure due to nephrotic syndrome developed a huge neck swelling and sudden airway obstruction after attempted cannulation of the internal jugular vein for haemodialysis. Tracheal intubation was achieved using a gum-elastic bougie. Investigations revealed abnormal blood clotting. The coagulopathy was treated, but the neck swelling continued to increase in size. Carotid angiography showed a ruptured right superior thyroid artery. The haemorrhage was controlled by coil embolization of the artery. This case report demonstrates the usefulness of the gum-elastic bougie in the presence of a difficult airway and of interventional radiology in the management of vascular accidents.

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It is well known that central vein cannulation is associated with various complications such as carotid artery injury, arterial cannulation,[1] injury to the thoracic duct[2] and pericardial tamponade,[3 4] some of which can be life-threatening. This case report illustrates the management of ruptured superior thyroid artery and airway obstruction after attempted cannulation of the internal jugular vein.

Case report

A 44-yr-old, obese (120 kg) woman was admitted with nephrotic syndrome and end-stage renal failure. She was found to be anaemic (Hb 8 g dl^{-1}) and thrombocytopaenic (84×10^9 platelets $litre^{-1}$). Bone marrow biopsy suggested early small lymphocytic lymphoma. Treatment included steroids, chlorambucil and frusemide.

After 3 days, the patient required haemodialysis as her serum urea and creatinine concentrations were elevated (urea, 41 mmol $litre^{-1}$; creatinine, 587 μmol $litre^{-1}$). Insertion of a haemodialysis catheter was attempted via the internal jugular vein. After two unsuccessful attempts on the right side and one on the left, the dialysis catheter was inserted via the right femoral vein.

After the procedure, the patient developed a rapidly enlarging swelling round the neck. Two hours later, the patient was referred to the anaesthetic team for assessment of her airway. On examination, the patient was conscious and orientated but anxious. The neck swelling was huge and firm. It extended round the neck and up to the ears. The patient's cardiovascular condition was stable. Sp_{O_2} was 93% on air. There was no evidence of stridor and the patient's chest was clear to auscultation. However, the patient was drooling saliva and had dysphagia and hoarseness because of compression of the neck veins by the swelling with oedema and obstruction in the pharynx and larynx. After discussion with the consultant anaesthetist, it was felt that the safest course would be to transfer the patient to the operating theatre, as difficulty with intubation was anticipated and an attempt at awake fibre-optic intubation was planned. It was also planned to have a full range of equipment available for managing difficult airways.

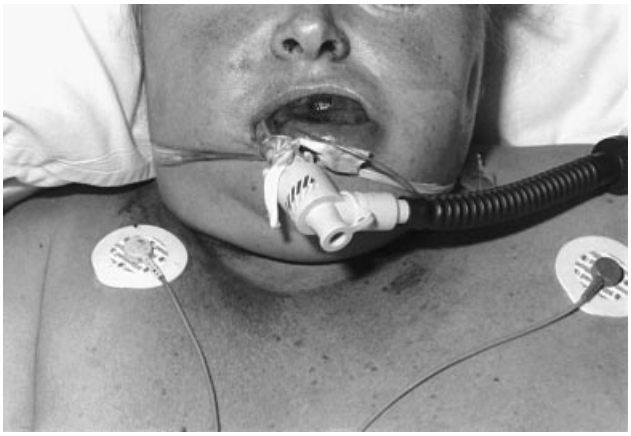

Fig 1 Photograph showing the severity and the extent of the haematoma. Note the swollen tongue.

Fig 2 Angiogram of the right external carotid artery (postero-anterior view) showing the characteristic 'blush' appearance of the ruptured superior thyroid artery, the first branch of the external carotid artery. Note the other features: 1, angiography catheter; 2, right external carotid artery; 3, superior thyroid artery; 4, lingual artery; 5, facial artery

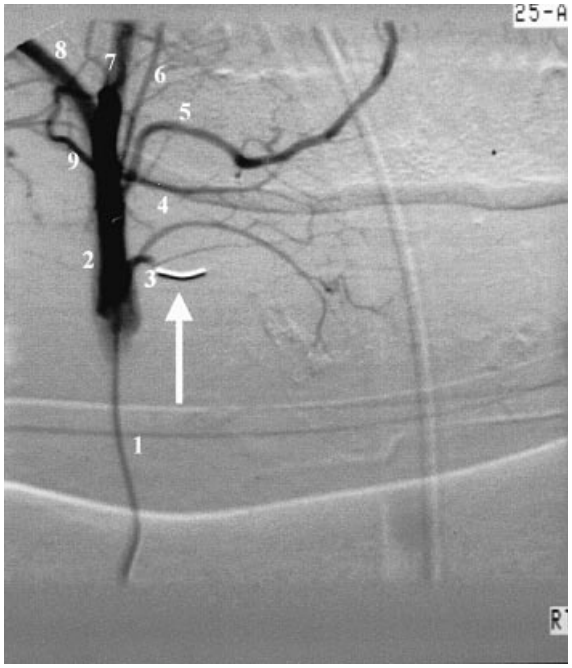

Fig 3 Angiogram (postero-anterior view) showing the intra-arterial coil in the superior thyroid artery after haemostasis had been achieved. Note the other features: 1, angiography catheter; 2, right external carotid artery; 3, superior thyroid artery; 4, lingual artery; 5, facial artery; 6, ascending pharyngeal artery; 7, maxillary artery; 8, superficial femoral artery; 9, occipital artery.

An operating theatre was organized and the patient immediately transferred there from the ward. During the transfer, the patient developed sudden airway obstruction, became cyanosed and had a cardiorespiratory arrest. Cardiopulmonary resuscitation was commenced. On arrival in the anaesthetic room, epinephrine 1 mg was administered intravenously and resuscitation was continued. Direct laryngoscopy was performed but no landmarks (including the epiglottis) could be seen because of the oedematous soft tissue swelling. A 7 mm tracheal tube was passed blindly but failed to enter the trachea. A gum-elastic bougie was then passed blindly through the soft tissue and an 8 mm tracheal tube was 'railroaded' over the bougie. The tube was confirmed to be in the trachea by capnography. Cardiac output was restored on establishing artificial ventilation. The patient made spontaneous attempts to breathe, but was sedated, paralysed and transferred to the intensive care unit for further management.

In the intensive care unit, the patient was positioned with head-up tilt and dexamethasone 8 mg was given. Investigations showed abnormal blood clotting (international normalized ratio, 1.8; activated partial thromboplastin time ratio, >5 (the normal range is 0.8–1.17); Hb, 6 g dl^{-1}) and it was realized that the patient had received heparin 5000 i.u. intravenously before insertion of the haemodialysis catheter. Red blood cells, fresh frozen plasma and protamine sulphate 50 mg were given. Coagulation tests were repeated after 2 h and were within the normal range. However, the neck swelling continued to increase in size, extending to the chest, shoulders and occiput (Figure 1). Chest x-ray showed a widened mediastinum.

A contrast computerized tomography (CT) scan was performed in an attempt to identify the source of haemorrhage, but the result was inconclusive. Carotid angiography was then performed by passing the angiography catheter up the right femoral artery. This revealed bleeding from a ruptured right superior thyroid artery (Figure 2). Coil embolization was performed by an interventional radiologist and haemostasis was achieved (Figure 3).

The patient required ventilatory support for the next 4 days, during which time haemodialysis was commenced. The neck swelling gradually reduced in size. The trachea was extubated uneventfully after 4 days and the patient was discharged to the ward.

Discussion

Various complications of central vein cannulation have been described, including pneumothorax, chylothorax,[2] carotid artery injury, stroke,[5] arteriovenous fistulae, pseudoaneurysms,[6] arrhythmias,[7] azygos arch cannulation,[8] acute airway obstruction,[9] diaphragmatic paralysis,[10] nerve injury,[11] blindness,[12] ventricular perforation and cardiac tamponade.[3 4 12] Some of these complications may be fatal. We have found no other report of a case of ruptured superior thyroid artery after central venous line insertion.

Though the abnormal clotting profile was not the main cause of bleeding in this case, we feel that it would have been a compounding factor in the rapid progression of the neck haematoma. This emphasizes the desirability of ensuring normal clotting function before attempting to cannulate the central vein.

Ultrasound-guided insertion of a central line has been shown to be safe and reliable, and can minimize several of the complications associated with central venous puncture.[13 14] The technique may be especially beneficial in high-risk patients, e.g. those with coagulation defects (inherited and acquired), obesity or haemodynamic instability. Moreover, inability to position the patient in the supine or Trendelenburg position (e.g. because of head injury or high intracranial pressure) or inability to rotate the neck (e.g. in patients with cervical spine injury) make insertion of a central line technically difficult with an increased risk of complications. It has been shown that ultrasound guidance increases the success rate and reduces the complication rate of central venous access in patients at high risk of complications or with unusual anatomy.[15] We, therefore, recommend that the technique should be adopted to gain central venous access in difficult and high-risk cases.

This case highlights the importance of recognizing impending airway obstruction and the need for prompt referral to the anaesthetic team.

The management of patients with obstructed airway has been criticized in recent years[16] and it is suggested that each patient should be managed according to the level and nature of the obstruction and the clinical circumstances.[17] Fibreoptic intubation may not be the answer for every airway problem and anaesthetists should be able to use other options. There have been several case reports where the gum-elastic bougie has been helpful in managing the difficult airway.[18–20] It has also been shown that tracheal intubation can be achieved more quickly and safely with the help of the bougie[21]. Although the gum-elastic bougie is commonly used in the UK, it is seldom used in the USA.[22] We believe that rapid tracheal intubation in our patient could not have been achieved by any other means. Similar circumstances may arise from a haematoma following carotid artery surgery, thyroid surgery, cervical spine surgery, radical neck dissection or trauma. The gum-elastic bougie may be useful in such circumstances and we recommend that every anaesthetist should be familiar with it.

Finally, this case illustrates the successful management of ruptured superior thyroid artery by interventional radiology. Though surgical exploration was considered as a means of controlling the haemorrhage, the surgeons were not sure whether the haemorrhage was from the right or left side of the neck. Moreover, the chest x-ray showed a widened mediastinum which raised the suspicion of possible injury to

a major blood vessel such as the arch of the aorta, innominate vessels or subclavian vessels. Carotid angiography was helpful in the diagnosis and treatment of the haematoma. Cases of vascular accidents and intractable haemorrhage have been managed by coil embolization.[23 24] We feel that this appears to be a rapid and effective method of treating vascular accidents and can be particularly helpful in cases with difficult diagnoses.

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