CASE REPORT

Aberrant innominate artery may complicate a potentially safe surgery

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SUMMARY

Surgeries of the anterior neck include thyroid surgery, open or percutaneous dilatational tracheotomy, bronchoscopy, mediastinoscopy and oesophagoscopy. These are potentially safe surgeries with mortality rates less than 1%. Today, the most common cause of death following a tracheotomy is haemorrhage and, following thyroid surgery, the causes are haemorrhage, giant goitres and upper airway complications. Bronchoscopies and mediastinoscopies are almost never fatal. While operating around the trachea, no major vessel is encountered in the surgical field. We report a case in which an aberrant innominate artery was encountered crossing anterior to the trachea just below the thyroid isthmus. As it is an uncommon finding, even minor complacency can lead to torrential bleeding culminating in death. Thus, we recommend surgeons to be vigilant for any aberrant artery in the surgical field rather than finding it accidentally; thereby preventing any complications in a potentially safe surgery.

BACKGROUND

Anterior neck surgeries are among the most common and safe procedures of the head and neck. The presence of the great vessel, the brachiocephalic artery, in the operative field is uncommon and dangerous as even minor trauma to the artery can lead to torrential bleeding and death of the patient. We report a case of a patient in whom the brachiocephalic (innominate) artery was seen hugging the lower border of the thyroid. We were surprised to find such a big vessel in the vicinity. We want to sensitise surgeons and radiologists to be aware of it preoperatively, thereby preventing not only intraoperative complications but also helping the surgeon to avoid trouble in an otherwise straightforward and safe surgery.

CASE PRESENTATION

A 40-year-old woman presented with anterior neck swelling for the last 1 year. It was insidious in onset and gradually progressive. No history of difficulty in breathing, noisy respiration, voice change or difficulty in swallowing was found. On examination, a swelling of 4×3 cm over the anterior neck was revealed, which was firm, non-tender and moving, with deglutition but not with protrusion of the tongue. Examination of the rest of the neck was normal.

INVESTIGATIONS

Indirect laryngoscopy was normal. Ultrasonography of the neck suggested a colloid cyst in the centre of

the right lobe of the thyroid with adenomatous nodules in both lobes of the thyroid. Fine needle aspiration cytology was suggestive of colloid goitre. The benign nature of the disease and both treatment options (either conservative management with regular follow-up or surgery) were explained to the patient. She opted for surgery.

Intraoperative

A collar neck incision was made, subplatysmal flaps elevated and strap muscles were dissected. Dissection of the right lobe of thyroid from surrounding structures was begun. As the lower border of the thyroid isthmus was inspected, a large arterial vessel was seen crossing the front of the trachea from the left to the right ([figure 1](#)). The vessel was dissected and its course followed. To the left, it continued its subthyroid course and took a sharp turn inferiorly from where it descended into the thorax. To the right, after travelling about 3 cm, it divided into two major vessels, one of which continued laterally into the right arm, while the other ascended upwards joining the internal jugular vein in the carotid sheath. Thyroid dissection was resumed while paying special attention so as not to damage this artery. The recurrent laryngeal nerve was identified and hemithyroidectomy performed uneventfully.

Postoperative

On postoperative day 4, a carotid artery Doppler study was conducted ([figure 2](#)). The brachiocephalic (innominate) artery was found to originate anomalously from the left side of the aortic arch, from where it ascended upwards without crossing the midline into the neck up to the lower border of the left lobe of thyroid, after which it turned to the

Figure 1 The innominate artery crossing anterior to the trachea.

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Figure 2 The innominate artery seen radiologically.

right, crossing the trachea anteriorly at the level of the fourth tracheal ring below the isthmus, and branched into the right subclavian and right common carotid artery at the level of the fifth tracheal ring. The right common carotid artery then ascended in the carotid sheath along the right internal jugular vein and the rest of its course was normal. The right subclavian artery also followed its normal course. The patient was discharged uneventfully.

DISCUSSION

Aberrant innominate arteries can be of two types

Retro-oesophageal aberrant innominate artery: Here, the arch of the aorta is on the right, and the right common carotid and subclavian arteries arise directly from the arch of the aorta.^{1 2} The left common carotid artery arises from the descending aorta. Another artery arises from the descending aorta, which crosses the midline from right to left, posterior to the oesophagus, and then continues laterally in the arm. This artery is the retro-oesophageal aberrant innominate artery.^{3 4}

Subisthmic innominate artery: This originates from the left side of the aortic arch, ascends left to the trachea and reaches the left lobe of the thyroid, crossing the trachea in front of it and dividing into the right subclavian and right common carotid in the neck at a level inferior to the right lobe of the thyroid.

In the presented case, we encountered the subisthmic variety of aberrant innominate artery.

Surgical importance

Mortality rates following percutaneous dilatational tracheotomy (PDT) are as low as 0.17%⁵ and, following thyroid surgery, are even lower, at 0.06%.⁶ Haemorrhage is the most common cause in both cases, but the chances of haemorrhage following these surgeries is only 2%.^{5 7} A major vessel is not routinely encountered while operating near the trachea and thyroid. While the presence of such a large aberrant artery in the surgical field may not be dangerous in an open thyroid surgery in experienced hands, it can complicate a PDT or thyroidectomies performed by inexperienced surgeons, as even minor trauma may lead to torrential bleeding and death in a potentially safe surgery. It is recommended that the surgeon look for signs of an aberrant innominate artery preoperatively, such as a second swelling/pulsation in the anterior neck below the thyroid swelling. It is important to sensitise radiologists as well to look for it preoperatively and a Doppler study should be carried out whenever indicated. This may not only prevent intraoperative complications but could also help the surgeon avoid trouble in an otherwise straightforward and safe surgery.

Tracheoinnominate fistula

Tracheoinnominate artery fistula is a rare but an important and a fatal complication of tracheotomy.⁸ In today's critical care medicine, the practice of PDT is a very common procedure. However, in cases of high riding subisthmic innominate artery or a low tracheal incision, a tracheoinnominate fistula (TIF) can occur due to pressure necrosis from high cuff pressure, mucosal trauma from malpositioned cannula tip, neck movements and radiotherapy. This leads to blowing out of the innominate artery and profuse bleeding into the trachea, which is usually fatal. TIF may also mimic an endotracheal mass, which may rupture during bronchoscopy.⁹ Massive haemorrhage occurring between 3 days and 6 weeks post-tracheotomy should be considered as TIF unless proven otherwise.¹⁰ TIF incidence post-surgical tracheostomy is considered 0.1–1%. Netzer *et al*¹¹ devised a procedure where an inferiorly based, U-shaped flap from the anterior tracheal wall averted over the innominate artery is used to protect it from erosion, with considerable success. However, TIF is usually fatal if immediate treatment is not instituted.^{12 13} Facilities for endoscopic examination of the trachea, neck exploration and possibly for sternotomy to ligate the artery should be available. Different methods such as simple ligation and repair of the anterior tracheal wall defect,¹⁴ embolisation of the artery,¹⁵ and using an endovascular stent graft,¹⁶ to stop the bleeding and repair the fistula, have been used with significant success.

Tracheomalacia

Tracheomalacia is a rare congenital condition in which the trachea is weak and floppy. While primary tracheomalacia is due to malformed tracheal cartilages, secondary tracheomalacia is seen in patients with oesophageal atresia with or without tracheo-oesophageal fistula or an aberrant innominate artery pressing on the trachea. The child may present with persistent dry cough with no other identifiable cause.¹⁷ This may even lead to breathing difficulties, stridor, recurrent infections and impaired growth of the child. In cases of compression of the trachea due to an innominate artery, an aortopexy to elevate the artery away from the trachea and up to the sternum is indicated.¹⁸

Thus, although rare, an aberrant innominate artery can lead to threatening complications not only for the patient but also for the surgeon, who may end up complicating a safe surgery.

Learning points

- ▶ The subisthmic aberrant innominate artery is a very rare occurrence.
- ▶ Although asymptomatic, it can be potentially fatal in any surgery involving the neck and thorax, particularly in a percutaneous tracheotomy.
- ▶ A surgeon should always be aware of and look for the aberrant innominate artery perioperatively.
- ▶ Radiologists should look for the innominate artery preoperatively and a Doppler study should be carried out whenever indicated.

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