CASE REPORT

Innominate artery injury: a catastrophic complication of tracheostomy, operative procedure revisited

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Accepted 5 March 2014

SUMMARY

A patient presented with profuse bleeding from the oronasal cavity following orofaciomaxillary trauma associated with tracheolaryngeal injury and suspected cervical-spine injury due to collapse of a wall on the face, neck and upper chest. The patient was gasping, coughing blood and was unable to speak. Threatened airway was diagnosed. Inability to maintain oxygenation on cricothyroidotomy, forced emergency department surgeons to shift the patient to the operating room for definitive airway. During tracheostomy a major vessel was injured. Application of vascular clamp in the event of achieving haemostasis resulted in disappearance of saturation and pulse in the right upper limb, thus we suspected innominate artery (IA) injury. High tracheostomy performed and endotracheal tube passed into the trachea after removing clot and overcoming compromised narrow tracheal lumen. The injured IA was repaired and the patient survived for 14 days. On postoperative day 14 he died following profound bleeding into the tracheobronchial tree and asphyxia/apnoea. Tracheoinnominate artery fistula was detected at autopsy.

BACKGROUND

Innominate artery (IA) arching anterior to the trachea up to the second tracheal ring is well known. Intraoperative knowledge about vascular anatomical variations has clinicosurgical importance in patients needing emergency room tracheostomy (ET) for obstructed injured airway (orofaciomaxillary trauma associated with tracheolaryngeal injury and suspected cervical-spine injury). There is a need to revise the surgical steps while performing ET, which is required during tracheolaryngeal injury.

CASE PRESENTATION

A 40-year-old man was brought to the hospital with a history of blunt trauma face, neck and chest (collapse of wall on the face, neck and chest), presented with profuse bleeding from the oral and nasal cavity, coughing blood, gasping and was unable to speak. Threatened airway was detected immediately and cricothyroidotomy was performed. He was not maintaining oxygenation. He had sustained massive tracheolaryngeal injury apart from orofaciomaxillary trauma and had subcutaneous emphysema along with tenderness in the cervical spine. As he was not maintaining oxygenation on cricothyroidotomy, emergency department (ED) surgeons decided to shift the patient to the operating room for definitive airway.

INVESTIGATIONS

Laboratory tests performed in the intraoperative and the postoperative period were normalised with blood transfusion and adequate ventilation.

DIFFERENTIAL DIAGNOSIS

IA pseudoaneurysm, aneurysm of the arch of aorta, vascular anomalies in the neck.

TREATMENT

During tracheostomy there was a forceful gush of blood coming out of the incision site. Bleeding could not be arrested by packing. Vascular haemostatic forceps were applied in the event of achieving haemostasis; as the saturation and palpable pulse suddenly disappeared in the right upper limb, we made a provisional diagnosis of the right side IA injury. Immediately a high tracheostomy was performed at the first to second tracheal rings and endotracheal tube passed after clearing the airway off the clot and compromised trachea, thus definitive airway was achieved. The case was further discussed with senior surgeons, under whose guidance right-sided trap door procedure performed for complete exposure of all the major vessels in the retrosternal and suprasternal area. Anomalous course of IA visualised, IA arching in the midline in front of the trachea above the sternum noticed. The injured right IA was repaired ([figure 1](#)). The patient was shifted to the intensive care unit for further resuscitation with blood and crystalloids. On postoperative day 2 (POD-2), the patient was conscious (E4VtM6), bilateral pupils reacting to the light and moving all four limbs without lateralising.

OUTCOME AND FOLLOW-UP

The patient survived for 14 days postoperatively. On POD-14 he had a sudden bout of massive

Figure 1 Intraoperative photograph of trap door procedure for repair of injured innominate artery.

To cite: Maruti Pol M, Gupta A, Kumar S, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-201628

Figure 2 Suggested operative steps while performing tracheostomy in emergency room tracheostomy.

haemorrhage into the oronasal cavity and tracheobronchial tree through the site of tracheostomy during extubation. He died of sudden hypoxic arrest. Autopsy revealed eroded tracheal rings, massive blood aspiration into the lungs and tracheoinnominate artery fistula (TIF). Learning from our own experiences we suggest steps of surgical procedure (figure 2) for ET in patients with tracheolaryngeal injury associated with cervical-spine injury not maintaining oxygenation on cricothyroidotomy.

DISCUSSION

Tracheostomy is a lifesaving surgical intervention described since ancient time. Frequency of tracheostomy varies widely depending on the hospital policy. As reported in one study, the prevalence of tracheostomy was 10% in the long-term ventilated patients and 1.3% of all patients.¹ One can notice a changing trend in the indications for tracheostomy from prolonged mechanical ventilation in critically ill patients to upper airway trauma in the past two decades.^{2,3} It is rare to witness patients with combined orofacio-maxillary trauma and tracheolaryngeal injury reaching ED alive. ET is indicated in tracheolaryngeal injury. Tracheostomy-related complication rates range between 21% and 38% and mortality is about 2%; they occur more frequently in emergency than in elective indication.^{3,4} Generally in trauma patients, no imaging studies are performed before securing the airway. All patients with neck injury are assumed to have sustained cervical-spine injury and preventive measures applied to protect the cervical spine while establishing or maintaining airway. Surgical intervention in zones 1 and 2 neck injuries will have to be performed without extension of the neck when cervical-spine injury is not excluded preoperatively. Abnormal neck position during tracheostomy is associated with TIF in 48%.⁵

Injury to IA, though rare, can be a catastrophic complication. The incidence of TIF varies from 0.6% to 0.79%.^{6,7} IA is commonly eroded due to pressure necrosis of the tracheal rings, commonly during initial POD-21.⁸ Mortality due to TIF ranges

between 75% and 100% unless treated with immediate resuscitation and surgery as they present with massive haemorrhage in the tracheobronchial tree.⁹ IA of normal width reaching suprasternal fossa is not rare; a high bifurcation of the IA at the second tracheal ring is rare and has been described.¹⁰⁻¹² Preoperative knowledge about vascular anatomical variations has clinicosurgical importance. Diagnostic ultrasound can be used to study the vascular abnormality in the neck preoperatively.¹³⁻¹⁵ In this case, we revived the patient by maintaining adequate airway and repaired the injured IA. The patient died due to TIF on POD-14. Inability to control haemorrhage results in inadequate ventilation and hypoxic arrest. Several surgical procedures involving IA repair have been described including ligating IA and reconstruction of flap surgery or by extra anatomical bypass to prevent the recurrence.¹⁶⁻¹⁹ Even then outcome in TIF tends to be poor and it depends on the extent of bleeding, aspiration, hypoxic brain injury and residual ventilator capacity following aspiration pneumonia. We suggest an algorithm for ET, as prevention is the best way of avoiding such a catastrophe.

Learning points

- Preoperative knowledge about vascular anatomical variations guides intraoperative surgical technique and postoperative tracheostomy care.
- Innominate artery (IA) coursing at the second to the fifth tracheal rings has the risk of injury during surgical procedure performed at zones 1 and 2.
- Early recognition of IA injury and repair with adequate resuscitation in time can save life.
- Early decannulation is encouraged in cases with abnormal coursing of IA.

Acknowledgements The authors acknowledge the support provided by Professor MC Misra, Head, Department of Surgical Discipline and Chief, JPNATC; Dr Maneesh Singhal MS, MCh, Additional Professor, Department of Surgical Discipline, JPNATC, Dr Sushma Sagar, MS, Additional Professor, Department of Surgical Discipline, JPNATC; cofaculty members from Emergency Medicine, Anaesthesia, Radiology, Orthopaedics and Lab Medicine; and not the least the residents and nursing staff of Department of Trauma Surgery, JPNATC.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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