The Journal of Laryngology and Otology
July 1999, Vol. **113**, pp. 689–691

Tracheocarotid artery fistula infected with methicillin-resistant *Staphylococcus aureus*

M. F. TUNGEKAR, F.R.C.PATH.

Abstract
Massive life-threatening haemorrhage from a fistula between the trachea and a major blood vessel of the neck is a rare complication of the tracheostomy procedure, well-recognized by anaesthetists and otolaryngologists. Although the lesion is likely to be encountered at autopsy, it is not described in histopathological literature. The possible causes are discussed together with the macroscopic and microscopic appearances of the lesion. Suitable procedures for its identification and for obtaining appropriate histopathological blocks are suggested. Presence of methicillin-resistant *Staphylococcus aureus* (MRSA) has not been documented before and might have contributed to the genesis of the fistula in this case.

Key words: Fistula; Haemorrhage; Tracheostomy; Staphylococcus infections; Methicillin resistance

Introduction

Massive fatal haemorrhage resulting from a fistulous tract between the trachea and a major blood vessel is an uncommon but recognized complication of the tracheostomy procedure (Jones *et al.*, 1972; Carson *et al.*, 1994). Although the surgical literature contains several reports of this lesion, its histopathological description is non-existent (Jones *et al.*, 1972; Carson *et al.*, 1994; Keceligil *et al.*, 1995). A recent autopsy case is reported here which was complicated by infection of the fistulous tract by methicillin-resistant *Staphylococcus aureus* (MRSA).

Case report

The patient, a 62-year-old female, had suffered from post-poliomyelitis quadriparesis for the past 30 years. Increasing difficulties with ventilation had necessitated a tracheostomy and use of an 'iron lung' for the past three years. She had suffered from nephrolithiasis 36 years ago. Three months before death, MRSA was isolated from pus drained from a perinephric abscess. In subsequent weeks she suffered from repeated respiratory tract infections. Swabs from the tracheostomy site and bronchial secretions grew MRSA for which antibiotic treatment was started with apparent improvement. Two days prior to death, she complained of tightness and pressure in the upper chest but no evidence of myocardial ischaemia was found. There was a sudden torrential and uncontrollable haemorrhage from the stoma 10 minutes after a routine change of her tracheostomy tube. Attempts to secure haemostasis by inflating the cuff of the tracheostomy tube failed and she died within 20 minutes of the onset of the haemorrhage. An autopsy was performed.

At autopsy, the tracheobronchial tree was filled with fresh blood. The tracheostomy site in the trachea was identified at the level of fourth and fifth tracheal rings. An ulcer covered with fresh blood clot over an inflamed floor, measuring 0.8 × 0.4 cm, was found 2.5 cm distal to the tracheostomy orifice. There was an area of induration with ecchymosis covering the anterior surface of the trachea and the right common carotid artery. Swabs for culture were taken from the tracheal surface and the floor of the ulcer. A block of tissue including the tracheal ulcer and ecchymotic segment of the right common carotid artery and innominate artery was excised for histopathological examination. After fixation, this was serially sectioned in the sagittal plane to obtain tissue blocks.

An acute and chronically inflamed fistulous tract linking the tracheal ulcer with a transmural breach in the carotid artery (Figure 1) was identified in one of the blocks. There was transmural inflammation of the arterial wall in the vicinity of the tract (Figure 1, lower inset). Abundant colonies of Gram positive cocci in clusters were identified within the fistulous tract (Figure 1, upper inset).

Discussion

The incidence of tracheoarterial fistula is estimated to be 0.6 per cent of all tracheostomies (Jones *et al.*, 1972). The innominate (brachiocephalic) artery is the most frequent vessel involved, followed by the right common carotid; other smaller arteries and even major veins may also be involved (Jones *et al.*, 1972; Carson *et al.*, 1994; Billy *et al.*, 1994; Keceligil *et al.*, 1995). Most of the fistulas occur within four weeks of the tracheostomy procedure, but may be delayed for several months (Jones *et al.*, 1972; Billy *et al.*, 1994). Various factors are implicated in the pathogenesis of the fistula, but these appear to be independent of the original indication for the tracheostomy itself (Jones *et al.*, 1972; Carson *et al.*, 1994; Billy *et al.*, 1994). The pressure from the improperly inflated cuff or the tip of the tracheostomy tube probably initiates the ischaemic damage and results in ulceration of the tracheal

From the Department of Histopathology, St Thomas' Hospital, (United Medical and Dental School), London, UK.
Accepted for publication: 12 March 1999.

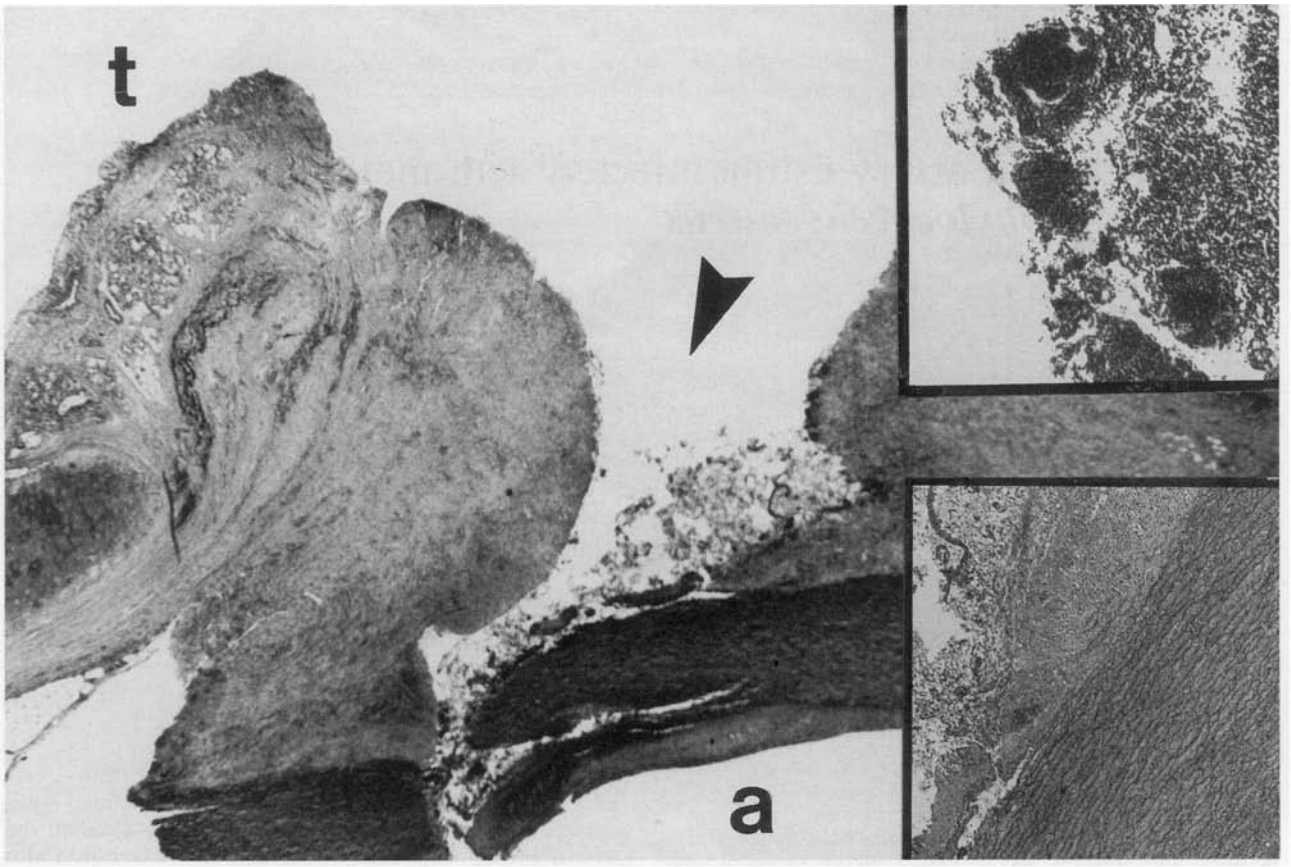

FIG. 1

A panaromic view of the fistula showing the tract (arrow head) between the tracheal lumen (t) and carotid artery lumen (a). There is active inflammation of the fistulous tract and arterial wall beneath it (lower inset) and colonies of Gram positive cocci coat the tract (upper inset). (Main figure: H & E; ×2. Upper inset: Gram's stain, ×500. Lower inset, H & E; ×50).

mucosa (Jones *et al.*, 1972). Continuing pressure combined with inflammation induced by infection of the tract by a presumably mixed tracheal luminal flora facilitates the formation of the fistulous tract by rendering the tissues friable. In this context identification of MRSA as the infecting agent makes this case report unique. In recent years MRSA has emerged as an important nosocomial pathogen, particularly in patients requiring intensive care and necessitates specific strategies for its control (Humphreys and Duckworth, 1997). There is evidence that MRSA is as virulent as sensitive strains and therefore may have contributed to tissue destruction in this case (Humphreys and Duckworth, 1997). A low position of the tracheostomy orifice (below the fourth tracheal ring) would allow the fistulous tract to reach the major vessels of the neck (Jones *et al.*, 1972; Carson *et al.*, 1994; Billy *et al.*, 1994). In most cases the haemorrhage occurs abruptly without warning, however occasionally there may be history of minor 'herald' bleeds (Billy *et al.*, 1994).

The emergency management of the haemorrhage is by inflation of the cuff, however, eventual surgical intervention is essential to control the bleeding with excision of the fistula; with non-surgical management the mortality is almost 100 per cent (Billy *et al.*, 1994; Keceligil *et al.*, 1995; Wright, 1996).

At autopsy the fistula may be overlooked and fistulous tract may well be cut through if the conventional methods of dissection of the neck are pursued. The characteristic history of sudden fatal tracheopulmonary haemorrhage in a patient with tracheostomy should alert the pathologist to the possibility of this lesion. The larynx and trachea should be opened posteriorly and mucosa scrutinized for presence of the ulcer which may represent the tracheal end of the fistula. The presence of a fistula is best confirmed histologically. Therefore, a block of tissue incorporating the larynx, trachea and great vessels of the neck should be taken *in toto* and fixed. Histological documentation of the fistula is desirable in view of the possible medicolegal implications of the diagnosis. Serial blocks from the fixed tissue should be examined, if there is doubt about the exact course or location of the tract.

References

Billy, M. L., Snow, N. J., Haug, R. H. (1994) Tracheocarotid fistula with life-threatening hemorrhage: report of case. *Journal of Oral and Maxillofacial Surgery* **52:** 1331–1334.

Carson, L., Stransky, R. (1994) A 75-year-old woman with tracheostomy site bleeding. *Journal of Emergency Nursing* **20:** 79–80.

Humphreys, H., Duckworth, G. (1997) Methicillin-resistant *Staphylococcus aureus* (MRSA) – a reappraisal of control measures in the light of changing circumstances. [Review]. *Journal of Hospital Infection* **36:** 167–170.

Jones, J. W., Reynolds, M., Hewitt, R. L., Drapanas, T. (1976) Tracheo-innominate artery erosion: Successful surgical management of a devastating complication. *Annals of Surgery* **184:** 194–204.

Keceligil, H. T., Erk, M. K., Kolbakir, F., Yildirim, A., Yilman, M., Unal, R. (1995) Tracheoinnominate artery fistula following tracheostomy. *Cardiovascular Surgery* **3:** 509–510.

Wright, C. D. (1996) Management of tracheoinnominate artery fistula. [Review]. *Chest Surgery Clinics of North America* **6:** 865–873.

Address for correspondence:
Dr M. F. Tungekar,
Histopathology Department,
Second Floor, North Wing,
St Thomas' Hospital,
Lambeth Palace Road,
London SE1 7EH.

https://doi.org/10.1017/S0022215100144871 Published online by Cambridge University Press