The operative management of post-intubation tracheal strictures

Case reports

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Summary

The presentation and treatment of 2 patients with post-intubation tracheal strictures are reported. There was one subglottic and one supracarinal stricture, and they were treated by resection and anastomosis. The surgical procedures and special techniques for the facilitation of anastomosis are discussed, as is the subsequent management.

Tracheal stenosis is unfortunately an occasional consequence of any form of airway intubation and has been demonstrated in up to 21% of patients in reported series.1-3 It is classified according to the site of occurrence, the point of reference usually being the tracheostomy stoma, and can therefore be suprastomal, stomal (subglottic) or infrastomal (supracarinal).4,5 But combined lesions have also been reported.5 Stricture formation is related to the type of tube (rigid or soft) used, the duration of intubation (brief or prolonged), and the pressure of the cuff (small, low-volume, high-pressure) or any type of cuffed tube with uncontrolled cuff pressure.

Surgery for tracheal stenosis remains a challenging problem. The principles of operative techniques which allow performance of anastomosis of the divergent tracheal segments after excision of the stricture areas have been clearly defined,6,7 while the use of autografts or prostheses may occasionally be required. In this article 2 illustrative cases are presented: a subglottic stricture and a supracarinal stricture. The relevant clinical presentations and management are described.

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Case 1

A 28-year-old woman was transferred from a peripheral hospital with the diagnosis of tracheal stenosis after intubation.

Six weeks previously she had been admitted after having fallen head-down and sustained a head injury. She was managed by orotracheal intubation and ventilatory support. After clinical recovery she was extubated on the 5th day and discharged 2 weeks postoperatively, but 2 weeks later she was urgently readmitted with marked respiratory difficulty and stridor. Bronchoscopy revealed a subglottic tracheal stenosis, and a tracheostomy was performed.

On admission the airway proximal to the tracheostomy was completely blocked. Endoscopy showed a normal larynx and normal vocal cords, but the trachea immediately below the larynx was occluded by a mass of granulation tissue. Biopsy specimens showed florid granulation tissue infiltrated by acute and chronic inflammatory cells. Tracheoscopy through the stoma revealed a normal distal airway.

One week later resection of the tracheal stenosis was carried out through the tracheostomy using general anaesthesia. A rigid bronchoscope was guided through the stenosis, which was broken through with dilators. An endotracheal tube was then passed and the tracheostomy tube removed. A generous collar incision including the tracheostomy stoma was made in the neck. A large mass of fibrous tissue overlay the stricterd area and was dissected free. The trachea was then divided at about its seventh ring. A sterile endotracheal tube was passed into the operative field and secured in the distal airway, after which the strictured area, the uppermost limit of which was the cricoïd cartilage, was resected. Freeing of the anterior and posterior aspects of the distal trachea and extreme neck flexion made possible a tension-free end-to-end anastomosis of the cricoïd cartilage and distal trachea with interrupted 3-0 Vicryl stitches. The patient's head was fixed in forward flexion by stitching the chin to the sternum.

The procedure was well tolerated, the patient was extubated immediately after surgery, and bilateral intact laryngeal nerve function was documented.

The patient made an uneventful recovery, and full mobility of the head was allowed on day 14 postoperatively. On day 17 bronchoscopy revealed a circumferential short stenosis in the subglottic area, which nevertheless allowed easy passage of a large bronchoscope. She underwent repeat bronchoscopy and dilatation 1 week later, and is currently being followed up as an outpatient.

Case 2

A 22-year-old woman was transferred from a peripheral hospital with severe respiratory distress and stridor. Two weeks earlier she had undergone an emergency laparotomy for a ruptured uterus, after which mechanical volume ventilation through a tracheostomy and cuffed tracheal tube was necessary for approximately 2 weeks. Recovery was uneventful, and 1 week later she was weaned off the ventilator, her tracheostomy tube was removed and she was subsequently discharged. Ten days before referral she had been readmitted with dyspnoea on exertion and progressive respiratory distress.
On admission rigid bronchoscopy was performed; this revealed a stricture with a pin-hole opening midway down the trachea, about 3-4 cm from the main carina. Dilatation with gum-elastic bougies was attempted, but this resulted in tearing of the posterior tracheal wall and surgical intervention was undertaken. Right posterolateral thoracotomy was performed above the 4th rib, the mediastinal pleura over the trachea was opened and the area of stricture identified. The carina was freed from the right hilum, and the left side of the aortic arch and the trachea were mobilized anteriorly and posteriorly. The area of stricture, extending over approximately 3-4 cm, was excised, and tracheal continuity was re-established by means of a tension-free end-to-end anastomosis with interrupted 3-0 Vicryl sutures. Tension was taken off the anastomosis by cervical flexion which was maintained postoperatively by means of a chin-sternum stitch. During the procedure general anaesthesia was maintained through a sterile endotracheal tube passed into the operative field and secured to the supracarinal distal trachea. The patient was extubated immediately after surgery, and recovery was uneventful. Full mobility of the head was allowed on day 14 postoperatively. On day 17 bronchoscopy showed a normal, wide and patent trachea. Xerotomograms of the trachea taken on day 24 were normal, as were flow-volume loops (Fig. 1).

Discussion

Tracheal stenosis is a rare but severe consequence of airway intubation, and the management thereof is a demanding task usually carried out in specialized centres. Various alternatives for restoring and maintaining a satisfactory airway are currently available: dilatation, endoscopic resection, laser therapy, cryosurgery, and stenting, but surgery is probably the method of choice, especially in cases involving severe stenosis. Although the first successful tracheal anastomosis was reported by Vuester in 1884, it is only during the last 3 decades that tracheal surgery has become popular. Despite hopes that autografts or prostheses might prove to be successful tracheal substitutes, it is clear that at present optimal repair, even of large defects, is best effected by primary anastomosis of the trachea.

The problems associated with tracheal anastomosis can be summed up as follows: (i) choice of incision (cervical or thoracotomy); (ii) safe dissection (preservation of recurrent and laryngeal nerve function and tracheal blood supply); (iii) approximation of divergent parts (mobilization of the trachea, tension-free anastomosis); and (iv) anastomotic technique. In approximating divergent tracheal parts after resection of the strictured area, 4 cm of trachea can be excised and primary end-to-end anastomosis effected. Tracheal lengths of more than 4 cm require adjuvant measures in order to facilitate mobilization and tension-free anastomosis. The procedures include suprahyoid and infrahyoid laryngeal release, right hilar dissection and division of the inferior pulmonary ligament, transection and supra-aortic reimplantation of the left main bronchus, and intrapericardial dissection of the pulmonary artery and vein. Neck flexion is probably the most effective technique; it delivers the whole trachea into the chest, while extreme flexion (chin to sternum) can give 4-6 cm of length.

The present cases demonstrate two types of tracheal stenosis with different pathogeneses, each requiring different incisions in order to provide unhampered access to the area of stricture. Case 1 illustrates the importance of preservation of recurrent nerves and intact bilateral laryngeal nerve function. From the various techniques available to achieve approximation, that of neck flexion with anterior and posterior dissection of the trachea, used in both cases, gives excellent results, allowing satisfactory anastomosis even after the resection of seven tracheal rings (case 1). In addition, chin-sternum immobilization proved efficient in maintaining freedom of tension for the anastomosis with minimal discomfort. Release is effected on the 14th day after operation. Finally, as shown in recent experimental studies, anastomosis performed with absorbable suture material (3-0 Vicryl) proved

![Fig. 1. Left: postoperative xerotomogram demonstrating the tracheal lumen; right: flow-volume loop demonstrating unrestricted air flow postoperatively.](image-url)
superior to that using other materials, and caused less granulation. Xerotomograms and flow-volume loops are well-established non-invasive methods for both the diagnosis and follow-up of obstructive tracheal lesions (case 2).

The anaesthetic management of these patients needs a detailed consideration of options since unexpected operative findings or complications may arise, rendering conventional techniques inadequate.

Tracheal stricture after airway intubation is an iatrogenic lesion, and the principles for the avoidance thereof are well reported. The exclusive use of soft tubes and high-volume, low-pressure cuffs, with frequent manometry of the balloon pressure, is vital. All patients who have undergone sustained airway intubation should be evaluated at discharge and subsequently checked for evidence of airway obstruction.

REFERENCES


Brainstem encephalitis or the Miller Fisher syndrome — a variant of acute idiopathic polyneuropathy

Case reports

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Summary

A syndrome comprising ophthalmoplegia, ataxia and areflexia was described by Miller Fisher in 1956. While some consider it to be a benign variety of acute idiopathic (Guillain-Barre) polyneuropathy, there are reports of the need for ventilatory support and of the benefits of plasmapheresis.

Two further cases are described. The first patient was seen in 1972 and was well 10 years later. The second patient gave cause for concern and might have benefitted from plasmapheresis, but nevertheless he recovered spontaneously.

Miller Fisher believed that the pathological process was located in the peripheral nerve, but others have produced evidence that the cranial nerve nuclei and central connections within the brainstem are involved.

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Case 1

A 38-year-old Asian man became ill on 7 July 1972, complaining of generalized weakness and difficulty in walking. The illness progressed, and frontal headaches, blurring of vision and vomiting were experienced. When examined a week later the patient was found to have dysarthria, drooping of the eyelids and difficulty in swallowing. The pulse rate was 100/min and the blood pressure 120/80 mmHg. He had total bilateral paralysis of