

# Palliation of malignant tracheal strictures using silicone T tubes

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## Abstract

**The use of silicone T tubes for intubation of malignant tracheobronchial strictures may provide some degree of palliation of this distressing condition. It was used in seven patients with malignant lesions and two with benign strictures (resulting from tracheal trauma and lung transplantation). Four patients (two with cancer) are still alive and well with the tube in position. All patients noted improvement in dyspnoea and stridor. The main problems were tube migration (one patient), tracheo-oesophageal fistula (one patient), and blockage of the tube by tumour (two patients) or encrusted secretions (three patients). Airway patency was restored when the tube was blocked by cleaning or by laser resection of the tumour. With careful supervision and education of the patient intubation can give useful palliation to patients with distressing upper airways obstruction.**

Malignant strictures of the trachea or main bronchi may cause respiratory distress, with severe dyspnoea and stridor and inability to clear sputum. These symptoms are extremely alarming to the patient and necessitate urgent intervention. Traditional treatments, such as radiotherapy and dilatation of the stricture, may be inappropriate or may have only short lived effects.

An adequate airway lumen has been re-established in such cases by bronchoscopic laser resection of tracheobronchial tumour

tissue and this may be repeated as necessary.<sup>1-5</sup> Again, however, improvement in breathing may be short lived and problems have occurred with bleeding and with attenuation of the tracheal wall.

Tubes have been available for some years for splinting the trachea or for palliation of malignant obstruction.<sup>6</sup> These tubes are simple to introduce endoscopically or via a tracheostomy and may be left in place indefinitely, thereby offering a chance of long lasting relief from respiratory distress. We described our experience of the use of such tubes in patients with various problems.

## Patients and methods

Silicone tubes have been used to treat tracheal obstruction in nine patients over the past four years—seven for palliation of malignant lesions and two for recurrent benign strictures resulting from tracheal trauma and from lung transplantation. The details of the patients are summarised in table 1.

The method of insertion of the silicone tubes followed that previously described<sup>7,8</sup> and no particular difficulties were encountered with the technique. Straight or "Y" stents may be inserted endoscopically, whereas "T" or "T-Y" tubes are inserted via a permanent tracheostomy with the side arm protruding forward through the stoma. Figure 1 shows the position of a T tube in situ. Correct positioning may be confirmed by endoscopy or radiography. Examples of a T-tube and a T-Y prosthesis are shown in figure 2.

## Results

The results are summarised in table 2 and more detailed case histories of three of the patients follow. Figure 3 shows the chest radiographs of a patient with a squamous cell bronchial carcinoma before and after left upper lobectomy and subsequent insertion of a Montgomery type T tube.

This method of treatment proved highly acceptable, all the patients reporting little discomfort and commending the substantial improvement in dyspnoea and stridor. Five of the seven patients with cancer have died (mean survival 24 (median 13, range 6-34) weeks). Two patients with cancer are alive and well after 13 and 14 months with a T tube in place (table 2); both have returned to work.

Three patients reported no problems from their T tube. One patient died after tracheo-oesophageal fistulation. Three patients had

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Table 1 Details of patients undergoing tracheobronchial intubation

Patient No	Age (y)	Diagnosis	Previous treatment
1	37	Crush injury to chest	Tracheostomy, repeated dilatations
2	56	Lung transplant for fibrosing alveolitis	Repeated dilatations and laser resections
3	49	Recurrent adenoid cystic carcinoma of trachea	Repeated dilatations and laser resections
4	64	Squamous carcinoma of oesophagus with tracheo-oesophageal fistula	Repeated dilatations and intubation of oesophagus
5	40	Squamous carcinoma of right upper lobe bronchus	Radiotherapy and repeated dilatations
6	73	Squamous carcinoma of left upper lobe bronchus, thoracic aortic aneurysm	Left upper lobectomy
7	62	Adenosquamous carcinoma of trachea	Radiotherapy and laser resections
8	41	Metastatic squamous carcinoma in trachea	Radiotherapy and laser resections
9	53	Squamous carcinoma of carina	Laser resection

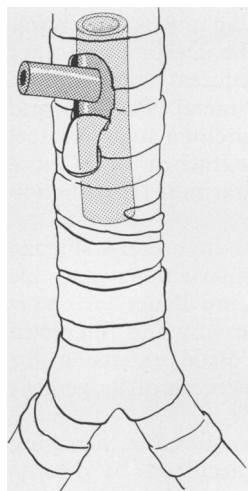


Figure 1 The position of a T tube in situ with the side arm passing through a tracheostomy.

episodes of respiratory restriction from encrustation of secretions in the T tube that required intervention. One of these patients also had a problem with migration of the tube and with obstruction of the tube by granulation tissue. In two patients the tube has become obstructed from progressive tumour growth. In all cases of obstruction appropriate cleaning or laser resection of recurrent tumour restored an adequate airway and allowed the tube to be kept in position.

### Illustrative case reports

#### PATIENT 4

A 61 year old woman with a squamous carcinoma of the oesophagus, treated initially by radiotherapy, had several oesophageal dilations for dysphagia. Three years later she developed a tracheo-oesophageal fistula, for which a Celestin tube<sup>9</sup> was inserted into the oesophagus. Respiration and swallowing were satisfactory after this and the patient was allowed home.

Three months later she was readmitted with stridor and respiratory distress due to tracheal obstruction. Tracheal dilatation was carried out, but when stridor recurred a few days later a silicone Montgomery T tube was inserted. Her breathing improved and coughing diminished, but her general condition deteriorated and she died two months later.

Necropsy showed extensive fistula formation between the two tubes with aspiration pneumonia and lung abscesses.

#### PATIENT 8

A 41 year old woman presented with a left tonsillar carcinoma, which was treated by radiotherapy. Four years later bronchoscopy, undertaken to investigate dyspnoea and hoarseness, showed a partially intrinsic tumour of the mid trachea occupying about 80% of the lumen. The endotracheal tumour was resected by carbon dioxide laser; histological examination confirmed that it was a metastasis from the

tonsillar tumour. Further laser resections were carried out for recurrent dyspnoea four and six months later, with only temporary improvement, and a further course of radiotherapy was carried out during this time.

Eight months after the diagnosis of recurrent tumour stridor and dyspnoea again necessitated admission. At this time the forced expiratory volume in one second (FEV<sub>1</sub>) was 0.25 litres. At bronchoscopy the tracheal lumen was almost completely occluded by tumour. A silicone Montgomery T tube was inserted, producing considerable symptomatic relief and an improved FEV<sub>1</sub> of 1.95 litres.

After discharge from hospital the patient returned to her job as a sales assistant and remains well. There has been further tumour infiltration along the side arm of the T tube but this has been controlled by local fulguration of the tumour tissue.

#### PATIENT 2

A 56 year old woman received a single lung transplant for fibrosing alveolitis. Five weeks later bronchoscopy and dilatation of granulation tissue at the bronchial suture line was required to relieve progressive stridor. At this time her FEV<sub>1</sub> was 0.89 l and vital capacity (VC) 1.62 l. Over the next two months combined dilatation and laser resections of the anastomotic stricture were required on four further occasions.

Three months after transplantation a cylindrical silicone stent was placed across the anastomosis. Further laser resections were required for distal occlusion of the tube by granulation tissue three times in the next two months.

Six months after transplantation migration of the stent caused blockage of the upper lobe bronchus. On this occasion the stent was replaced by a custom made silicone tube with a distal side arm for the upper lobe bronchus. The patient has remained well now for 18 months apart from two episodes of mucus retention, one of which cleared spontaneously. The FEV<sub>1</sub> has been maintained around 2 l and the VC around 2.85 l, with a peak expiratory flow of 340 l/min.

### Discussion

The idea of intubation of inoperable malignant strictures has been developed over many years. Intubation is most frequently used for oesophageal strictures and various tubes have been designed for this purpose.<sup>9</sup> Newer methods, such as laser resection of tumour, have given greater scope for the palliation of upper airway obstruction.<sup>1-5</sup> In some cases, however, such management is inadequate because of the frequency with which resection is required or because of damage to the tracheal wall, which may not remain sufficiently rigid to maintain an adequate airway. In these cases the idea of clearing the airway by laser resection and then introducing a tube to maintain patency is attractive.

Some experience has been gained with tubes designed for such a purpose. In most cases the

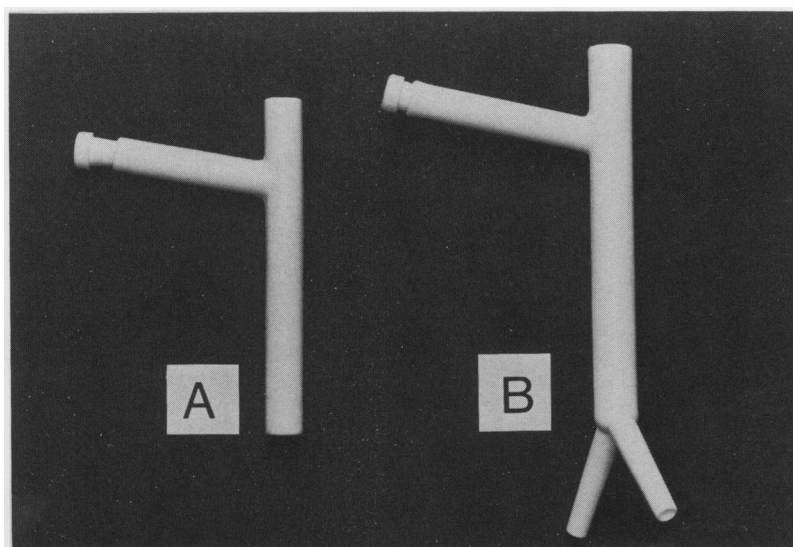


Figure 2 Examples of silicone airway prostheses: (a) a Montgomery type T tube; (b) a Westaby type T-Y tube.



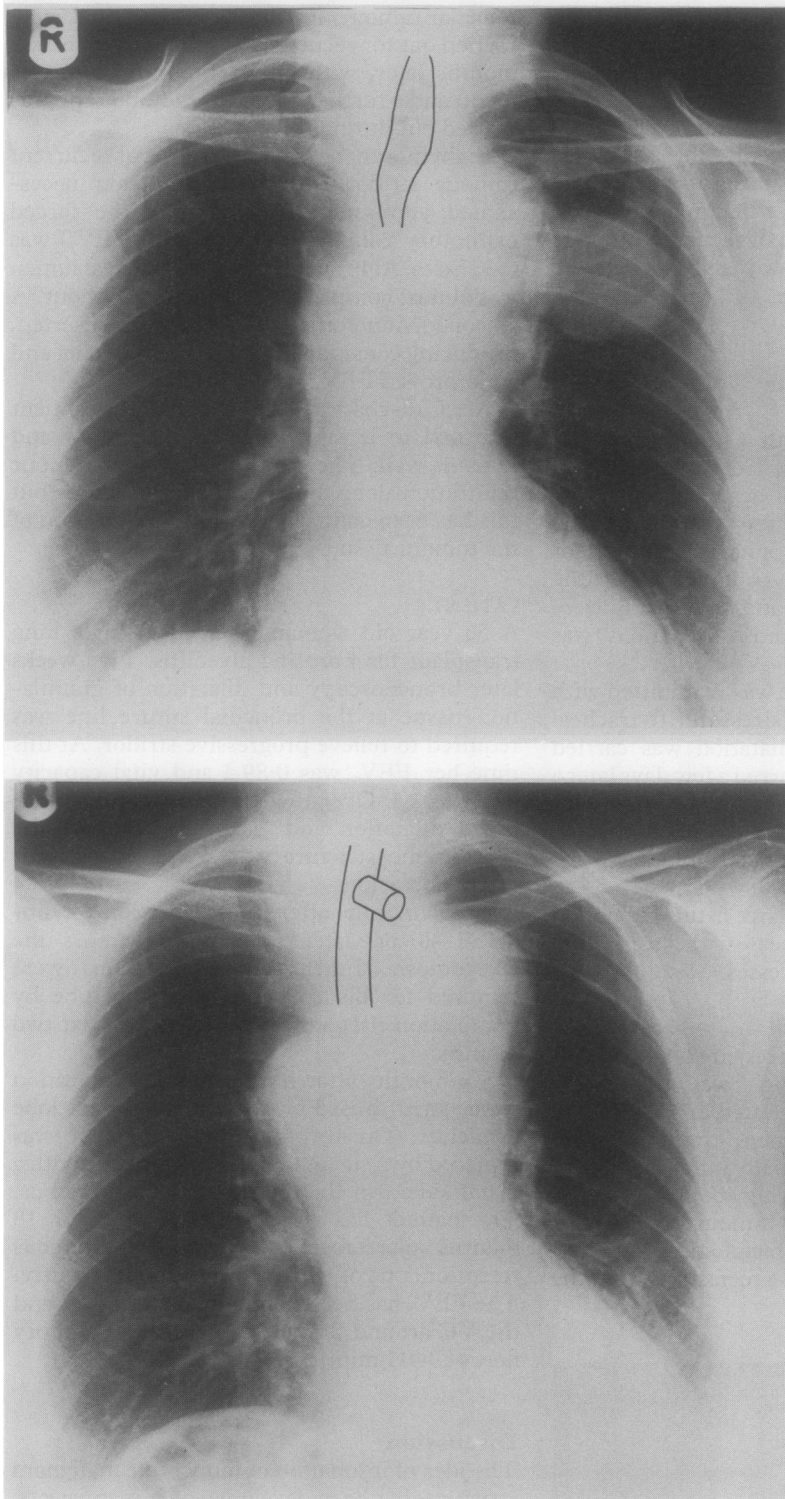


Figure 3 Chest radiographs of a patient (No 6) with squamous cell carcinoma of the left upper lobe bronchus showing (a) displacement and compression of the trachea by the tumour (outlined) and insertion of a Montgomery type silicone T tube after left upper lobectomy (position of T tube outlined).

tube has been used to splint the trachea for benign conditions, including trauma, and often as a temporary measure after surgery.<sup>10</sup> In cases of inoperable malignancy in which palliation is attempted there may be particular problems with tumour control and airway patency, as discussed below.

In 1952 Harkins described the results of some experimental and clinical work using a metal alloy tube for tracheal intubation.<sup>6</sup> There

were problems with clearing mucus, which was found to collect in the tube. Despite this other workers have reported success with straight tubes constructed from metal. Pagliero and Shepherd described the use of a stainless steel wire coil used to splint the trachea<sup>11</sup> and Clarke reported the use of a Souttar tube for palliation of malignant strictures.<sup>12</sup>

Montgomery described the use of a silicone T tube after tracheal reconstructions<sup>13</sup> and this was modified by Duvall and Bauer for endoscopic introduction.<sup>14</sup> Westaby and Shepherd suggested a Y shaped distal extension for support at the carina to prevent dislodgement of the tube.<sup>15</sup>

An outline of the care required in managing such tubes has been discussed by Montgomery.<sup>7</sup> Our experience emphasises the particular importance of regularly clearing the tube of mucus. The patients described all suffered from recurrent respiratory infections and in the debilitated patient preventing obstruction of the tube by inspissated mucus may prove difficult. For satisfactory palliation the patient or an attendant must be able to carry out regular suction of the tube at home and there must be adequate resources to provide suitable portable suction equipment.

Even with adequate suctioning there is a "blind" area on the anterior wall of the T tube, just below the entry point of the side arm, which is not easily accessible to the suction tube. In one of our cases an accumulation of secretions at this point necessitated removal of the tube. This complication may be avoided by regular fiberoptic bronchoscopy to ensure complete clearance of secretions from the tube.

The problem of failure of the material of the tube occurred in one patient. This is a problem common to the long term use of all prosthetic materials but may in this case have been related to misuse of the tube by the patient. Again, the importance of good education of the patient and attendants must be emphasised.

Patient 4, who had both a tracheal and an oesophageal tube, highlights the problems that may be caused by pressure and movement between two closely applied pieces of foreign material. In this case pressure necrosis may have encouraged extension of the tracheo-oesophageal fistula, culminating in the death of the patient. Provided that palliation may be achieved by other means, every effort should be made to avoid double intubation in such circumstances whenever possible.

Notwithstanding the difficulties encountered we conclude that intubation of malignant tracheal strictures may give excellent palliation of distressing upper airway obstruction in suitably selected patients. Dyspnoea and stridor improved considerably leading to a high level of satisfaction on the part of the patients, some of whom returned to a near normal existence, including employment.

Regular follow up of the patients is required to detect and deal with any developing problems as soon as possible. Patients and their families should receive continuing support, both mental and physical, to assist them to cope with the stresses of this difficult problem.

Table 2 Summary of results in patients undergoing tracheobronchial intubation

Patient No	Tube in situ	Outcome	Problems
1	4 years	Alive and well, tube in situ	None
2	18 months	Alive and well, tube in situ	Blockage of tube with mucus
3	3 months	Died 9 months later	Growth of tumour distal to tube
4	2 months	Died with tube in situ	Fistula formation between tubes in oesophagus and trachea
5	6 weeks	Died with tube in situ	None
6	7 weeks	Tube exchanged for a standard tracheostomy tube, died 4 months later	Recurrent blockage of tube with mucus
7	8 months	Died with tube in situ	Protracted chest infection, blockage of tube with mucus
8	14 months	Alive and well, tube in situ	Tumour infiltration around side arm of tube
9	13 months	Alive and well, tube in situ	None

- 1 Strong MS, Jako GJ, Polyani T, Wallace RA. Laser Surgery in the aerodigestive tract. *Am J Surg* 1973;126:529-33.
- 2 Laforet EG, Berger RL, Vaughan CW. Carcinoma obstructing the trachea: treatment by laser resection. *N Engl J Med* 1976;294:941-3.

- 3 George PJM, Garrett CPO, Hetzel MR. Role of the neodymium YAG laser in the management of tracheal tumours. *Thorax* 1987;42:440-4.
- 4 Hetzel MR. Endoscopic applications of lasers in the bronchial tree. *Br J Hosp Med* 1988;40:180-3.
- 5 Hulks G, Thomson NC. Laser treatment of tracheobronchial tumours. *Scott Med J* 1988;33:323-4.
- 6 Harkins WB. An endotracheal metallic prosthesis in the treatment of stenosis of the trachea. *Ann Otol Rhinol Laryngol* 1952;61:663-75.
- 7 Montgomery WW. Silicone tracheal T-tube. *Ann Otol Rhinol Laryngol* 1974;83:71-5.
- 8 Westaby S, Jackson JW, Pearson FG. A bifurcated silicone rubber stent for relief of tracheobronchial obstruction. *J Thorac Cardiovasc Surg* 1982;83:414-7.
- 9 Postlethwait RW. Dilatation and intubation of the oesophagus. *Surgery of the oesophagus*. 2nd ed. Norwalk, Connecticut: Appleton-Century-Crofts, 1986:412-5.
- 10 Cooper JD, Todd TRJ, Ilves R, Pearson FG. Use of the silicone tracheal T-tube for the management of complex tracheal injuries. *J Thorac Cardiovasc Surg* 1981;82:559-68.
- 11 Pagliero KM, Shepherd MP. Use of stainless steel wire coil prosthesis in treatment of anastomotic dehiscence after cervical tracheal resection. *J Thorac Cardiovasc Surg* 1974;67:932-5.
- 12 Clarke DB. Palliative intubation of the trachea and main bronchi. *J Thorac Cardiovasc Surg* 1980;80:736-41.
- 13 Montgomery WW. The surgical management of supra-glottic and subglottic stenosis. *Ann Otol* 1968;77:534-46.
- 14 Duvall AJ, Bauer W. An endoscopically-introducible T-tube for tracheal stenosis. *Laryngoscope* 1977;87:2031-7.
- 15 Westaby S, Shepherd MP. Palliation of intrathoracic tracheal compression with a silastic tracheobronchial stent. *Thorax* 1983;38:314-5.