

# Mediastinal tracheostomy: unilateral resection of the anterior chest wall

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## Abstract

Since the first reliable mediastinal tracheostomy described by Grillo *et al.* in 1966, many new techniques have been described in order to reduce the number of complications. We here report the case of a 55-year-old man who was referred for surgery with post-radiochemotherapy recurrence of a double neoplasm of the pharyngolarynx extending to the proximal trachea and the medial part of the oesophagus. Through a median sternotomy, a pharyngolaryngoesophagectomy was performed with an extended tracheal resection. The reconstruction of the upper digestive tract was performed with a gastric pull-up. The mediastinal tracheostomy was performed with a pectoralis major muscular flap through a right unilateral resection of the manubrium, the right clavicular head and the right first and second costal cartilages. Historically, the mediastinal tracheostomy was performed through a large bilateral resection of the anterior chest wall, in order to prevent the tension on the tracheocutaneous sutures. Nowadays, with the possibility of various pedicled flaps, bilateral resection no longer seems to be necessary. This unilateral resection leads to a reduction in post-operative sequelae.

**Keywords:** Tracheostomy; Mediastinum; Sternum; Surgical Flaps

## Introduction

Mediastinal tracheostomy allows for stomal reconstruction after resection of tumours extending to the trachea. A number of procedures have been published since 1966, when Grillo<sup>1</sup> described the first reliable mediastinal tracheostomy. He performed a large resection of the anterior chest wall (the manubrium, the clavicular heads and the first and second costal cartilages) to allow the skin flap to fall down into the mediastinal valley. This technique minimizes the tension on the sutures between the trachea and the skin. In 1970, Stell<sup>2</sup> described a technique with unilateral resection of the manubrium, clavicular head and first and second costal cartilages. However, this technique requires a longer tracheal stump to avoid tension on the stomal sutures. In the 1980s, several myocutaneous pedicled flaps were used successfully to set up the mediastinal tracheostomy. We report an original technique combining unilateral resection as described by Stell and the use of a pectoralis major flap.

## Case report

A 55-year-old man was referred to our centre with a recurrent double neoplasm of the oesophagus and the right pyriform recess invading the cervical

trachea. We performed a right radical neck dissection through a cervical incision. In order to assess the inferior extension of the tumour we performed a medial sternotomy and a mediastinal dissection using a bivalve retractor. The total laryngectomy was then performed en bloc with a right radical neck dissection. As the tumour was invading the trachea, cervical tracheostomy could not be performed. After performing the oesophagectomy and the gastric pull-up, we began the anterior chest wall resection as described by Grillo.<sup>1</sup> Having removed the right side of the manubrium, the right clavicular head and the right first and second costal cartilages, we noticed that this resection was large enough for a mediastinal tracheostomy. We therefore stopped the resection and set up the mediastinal tracheostomy through the resection of the half side of the manubrium with a pectoralis major flap.

Post-operatively, the patient presented a right phrenic paralysis that required temporary assisted ventilation. The post-operative course was simple, with total oral intake on day 22 and withdrawal of the assisted ventilation on the same day. The hospital stay was 39 days, and the patient was able to return home with a tracheostomy cannula in place (Provox<sup>R</sup> Larytube,™ HME Cassette and Adhesive, Atos Medical AB, Hörby, Sweden) (Figure 1). The patient

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FIG. 1

Photograph of the patient two months after the operation.

died one month after he left the hospital from unknown causes, but with digestive bleeding (no tracheal bleeding).

### Surgical technique

A mediastinal tracheostomy may be required in different types of surgery, such as total laryngectomy, oesophagectomy, or resection of stomal recurrence following total laryngectomy. Whatever the type of surgery, the mediastinal dissection can be performed through a medial sternotomy (Figure 2). Using a sternal saw, we first made a vertical incision in the midline of the manubrium, then a second one transverse to the right second costal interspace, in order to obtain an L-shaped opening. We then performed the mediastinal dissection and removal of the tumour using a bivalve retractor. The patient is ventilated with a tracheostomy tube (Laryngoflex<sup>R</sup>, Rüsch, Teleflex Medical, Germany) in the remaining part of the trachea and the oropharyngeal intubation tube is then removed. This tube must be carefully placed above the carina in order to ventilate both

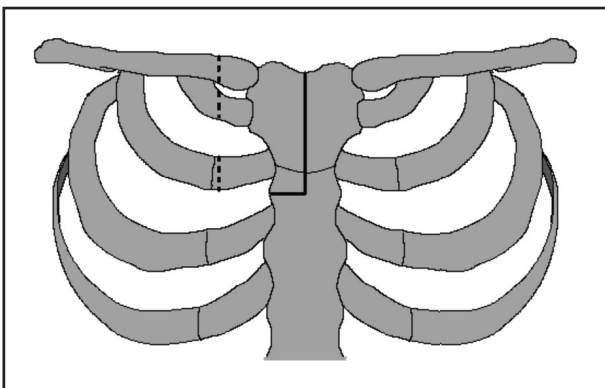


FIG. 2

The median sternotomy is performed following the continuous line. A bivalve retractor then allows the mediastinal dissection. The resection of the anterior chest wall is performed following the dotted lines.



FIG. 3

A tunnel is created in the middle of the flap and the trachea is pulled through the opening.

lungs. The right half of the manubrium, the right medial clavicular head and the right first and second costal cartilages are then resected (Figure 3). The trachea is mobilized and transposed below the innominate artery. With this transposition, the remaining part of the trachea is placed in the middle of the right chest wall resection. Reconstruction is performed with a pectoralis major flap. The muscular part of the flap must fill the dead space between the trachea and the innominate artery to prevent any friction. A site for the proposed tracheal stoma is chosen in the middle of the flap, a tunnel is created and the trachea pulled through the opening of the flap as described by Gomes<sup>3</sup> (Figure 3), to be anastomosed to the skin using interrupted sutures to avoid any tension.

### Discussion

In the 1960s the mortality rate of mediastinal tracheostomy, caused by rupture of the innominate artery, was dramatically high. This rupture was due to necrosis of the vessel caused by local infection, by friction of the trachea against the vessel during respiratory movements, or by tracheal necrosis due to devascularization or disruption of the tracheocutaneous anastomosis. To avoid these problems, Grillo described a technique with a large, well-vascularized bipediced skin flap dropped into a mediastinal valley created by the removal of the sternum, the clavicular heads and the first and second costal cartilages. With this large resection, the trachea could be sutured to the skin without tension.

In 1970, Stell described a technique using unilateral resection of the anterior thoracic wall,

giving a more stable shoulder joint and a better cosmetic appearance. Surprisingly, and despite excellent results, this procedure has never been reproduced, probably because of the high risk of disruption of the tracheocutaneous sutures. Indeed, with this limited resection the skin flap cannot fall down into the mediastinal valley. The sutures between the residual trachea and the thoracic skin are then under tension, particularly if the tracheal remnant is short.

Despite Grillo's procedure, the post-operative mortality of this extensive surgery remained high. From the 1980s the use of myocutaneous pedicled flaps, especially the pectoralis major flap, has enabled us to reduce the mortality after mediastinal tracheostomy, yet the thoracic resection is still as extensive as that described by Grillo. Because the use of a pedicled flap also prevents tension on the tracheocutaneous sutures, we think that a large bilateral resection is no longer necessary. Therefore, we suggest that Stell's procedure with the use of a pedicled flap can replace Grillo's procedure in most cases. Nevertheless, this procedure must begin with a restricted medial sternotomy (Figure 2) and a mediastinal dissection through a bivalve retractor. This dissection is difficult to perform after resection of the right part of the mediastinal wall, because the bivalve retractor is then difficult to put in place.

This unilateral resection solves part of the problems posed by Grillo's procedure. Indeed, the left part of the thoracic cage remains intact. Therefore, the left shoulder remains fully functional

and the ventilation is more efficient owing to the elimination of the flail chest effect on the left side.

## Conclusion

Historically, the bilateral resection of the anterior chest wall was performed to allow the skin to fall down to the trachea so as to avoid tension on the anastomosis. Currently, with the use of myocutaneous flaps, bilateral resection seems no longer necessary. A unilateral resection can reduce post-operative sequelae, enable a more stable shoulder joint and a more stable anterior chest wall with more efficient pulmonary function, and give a better cosmetic appearance.

## References

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