

# The sternocleidomastoid myoperiosteal flap for the reconstruction of a tracheal defect

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## Summary

The sternocleidomastoid (SCM) myoperiosteal flap offers a relatively simple, single-stage reconstruction of a tracheal defect after conservative resection of an invasive papillary cancer of the thyroid with intraluminal involvement. Vascularised clavicular periosteum provides a viable, pliant, airtight, composite autologous graft with minimal vocal disturbance and a low risk to the parathyroid glands. The operation is not difficult to perform and has an acceptable long-term result even for the occasional operator in the specialised field of tracheal surgery.

Thyroid carcinoma with laryngotracheal invasion is a rare event. Over a 60-year period (1913 - 1973) involving 2 000 cases of thyroid carcinoma at the Mayo Clinic in the USA, only 18 patients required surgical intervention for intraluminal involvement.<sup>1</sup>

Although the regional lymph nodes are involved in over 50% of patients with papillary cancer of the thyroid, the ultimate prognosis for those who eventually die of cancer is dependent on the local extent of the disease rather than lymphatic spread. Asphyxia due to local recurrence with infiltration of vital structures has been shown to be by far the most common cause of death. Conversely, in patients with medullary cancer, lymph node involvement constitutes the cardinal prognostic factor.<sup>1</sup>

Tracheal invasion by thyroid cancer may be treated by partial tracheal resection, circumferential resection followed by end-to-end anastomosis, cartilage shaving or palliative tracheostomy with adjuvant <sup>131</sup>I or radiotherapy. The extent of resection should obviously be decided on the basis of the morbidity of the procedure, the extent of the disease, patient preference and the availability of the required expertise.<sup>2</sup> Circumferential tracheal resection with end-to-end anastomosis requires extensive dissection with a high risk of complications. Recurrent cancer is common after cartilage shave and should not be considered in cases of thyroid cancer with intraluminal involvement.

The observations of Cody and Shah<sup>3</sup> at the Memorial Sloan-Kettering Center in New York have shown that the majority of patients with tracheal involvement may undergo conservative resection which removes all gross disease with preservation of all the subglottic structures.

Various applications of the sternocleidomastoid (SCM) muscle as a vascular pedicle in reconstructive surgery of the head and neck have been described.<sup>3,4</sup>

In 1978 Siemssen *et al.*<sup>5</sup> described a method whereby immediate reconstruction of the mandible is brought about by using a composite flap of the clavicle and the SCM muscle to close the defect. In 1981 Eliachar and Moscona<sup>6</sup> devised a SCM flap for the laryngotracheal complex in children, a method that was also applied by Tovi and Gittot<sup>7</sup> in 3 patients for the repair of laryngeal and tracheal wall defects (1983).<sup>7</sup> In 1986, Friedman<sup>8</sup> reported on his experience with the SCM flap for the reconstruction of subglottic laryngeal and tracheal defects which included the treatment of tracheal stenosis caused by tracheostomy or prolonged tracheal intubation for the treatment of patients in critical care.

On account of its multifocal blood supply and elongated course in the neck, the SCM mastoid muscle serves as an excellent vascular pedicle for the transfer of a flap of clavicular periosteum.<sup>4</sup>

The present study represents our experience with the SCM myoperiosteal flap for the primary closure of a tracheal defect after removal of an infiltrating papillary carcinoma of the thyroid with intraluminal involvement.

## Clinical presentation

A 68-year-old woman presented in October 1996 with slight hoarseness and intermittent bouts of haemoptysis and a painless swelling of the neck to the left of the midline. On examination a nodular enlargement of the left lobe of the thyroid was found. Computed tomography showed a tumour of the left lobe of the thyroid which infiltrated the trachea. Bronchoscopic biopsy of an intraluminal tracheal tumour showed the histological appearance of a differentiated papillary adenocarcinoma of thyroid origin.

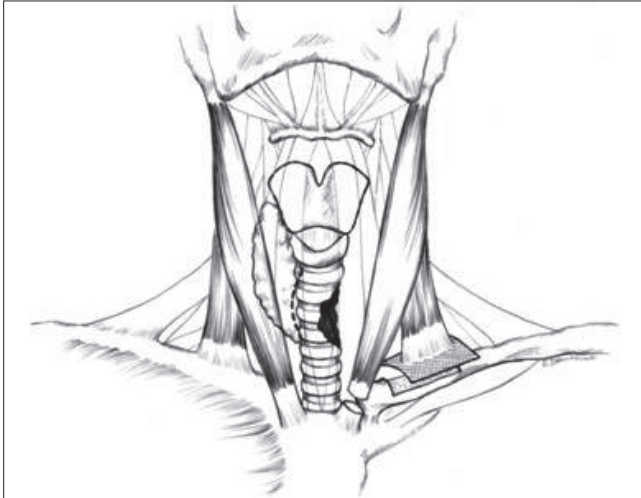
## Operation

Through a transverse cervical (Kocher) incision with transection of the left sternohyoid and sternothyroid muscles, the left recurrent nerve and parathyroid glands were identified. A standard left total lobectomy with isthmusectomy was performed with an *en bloc* hemiresection of the left 2nd - 6th tracheal cartilages from the midline to the thyroid membrane involving about 50% of the tracheal circumference (Fig. 1).

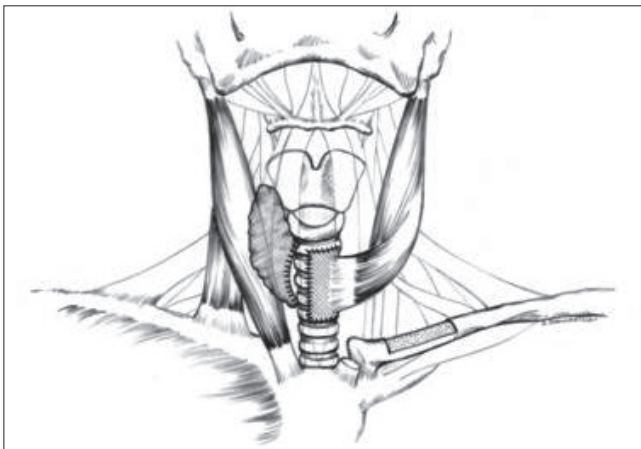
## Preparation of the SCM myoperiosteal flap

After transection of the sternal head of the SCM muscle, the clavicular periosteal flap was prepared at the clavicular origin by raising a flap of periosteum approximately 6 x 3 cm extend-

ing from the antero-inferior to the postero-inferior border of the clavicle. The width of the periosteal flap, which was dissected free with the aid of a periosteum elevator, was fashioned in order to correspond with the length of the tracheal defect. The distal end of the SCM muscle was carefully dissected in order to provide sufficient mobility for the periosteal flap to be sutured to the tracheal defect with an airtight running suture of 4-0 polypropylene (Fig. 2).



**Fig. 1.** Operative field after left total thyroid lobectomy and isthmus resection for an infiltrating papillary carcinoma. Note the tracheal defect after *en bloc* resection of the area of tracheal infiltration. The periosteal flap with the attached clavicular head of the SCM muscle pedicle has been dissected off the medial aspect of the clavicle. The sternal head has been transected.



**Fig. 2.** The periosteal flap is sutured to the margins of the tracheal defect (see text). Note the denuded area at the medial end of the clavicle after removal of the periosteum.

A temporary tracheostomy was fashioned immediately below the autograft. The postoperative course was uneventful. The tracheostomy tube was removed on the 8th postoperative day. Two years after the operation the right lobe of the thyroid was removed in order to facilitate radiopharmaceutical treatment with  $^{131}\text{I}$  and lifelong replacement with

exogenous thyroid hormone. At the latest follow-up 10 years after the operation the patient was well. She had no vocal cord impairment, and her serum calcium level was normal. There was no evidence of local or systemic recurrence.

## Discussion

Reconstruction of laryngeal or tracheal defects with vascularised periosteum consists of a one-stage procedure where the donor site is in the same surgical field as the defect. The operation, which requires minimal dissection, leaves no cosmetic defects or disturbance of vital functions and provides a tension-free airtight closure of the subglottic or tracheal defects with autologous periosteum that conforms to the shape of the trachea and also calcifies,<sup>9</sup> thereby providing long-term airway stability and excellent postoperative quality of life.<sup>7,8</sup>

On the other hand, circumferential tracheal excision with primary anastomosis which requires special technical expertise, involves extensive dissection with a significant risk of recurrent laryngeal nerve injury, hypoparathyroidism, tracheal stenosis and significant peri-operative morbidity.<sup>10</sup>

## Conclusion

From our experience, based on a 10-year follow-up, it would seem that the SCM flap offers a relatively simple, single-stage reconstruction of a tracheal defect after conservative resection of an invasive papillary cancer of the thyroid with intraluminal involvement.

Clavicular periosteum provides a viable, pliant, airtight composite autologous graft with minimal vocal disturbance and a low risk to the parathyroid glands. The operation is not difficult, and has an acceptable long-term result even for the occasional operator in the specialised field of tracheal resection, where circumferential excision of the trachea with primary anastomosis would pose a significantly more demanding technical challenge.

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