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The use of pyriform sinus mucosa for reconstruction after vertical partial laryngectomy

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Abstract

This prospective study included 30 patients with glottic carcinoma of the larynx who were treated primarily by vertical partial laryngectomy. The pyriform sinus mucosa was used to reconstruct the new laryngeal wall and to form a pseudo-vocal fold at the side of resection. Our results showed that 90 per cent of patients were decannulated, 80 per cent were able to eat a normal diet, 70 per cent developed excellent voice quality after surgery and a 97 per cent three-year survival was achieved. The pyriform sinus mucosa proved to be a reliable material for reconstruction after vertical partial laryngectomy.

Introduction

The primary oncological goal of laryngeal cancer surgery is extirpation of all disease. Other important goals should be the preservation of voice and the maintenance of respiratory and sphincteric functions of the larynx (Maceri *et al.*, 1985). Conservation laryngeal surgery should not compromise the principles of adequate oncological surgery and its results should be comparable to those obtained by treatment of the same lesion with total laryngectomy (Silver, 1981). Krajina (1985) showed that a resection of 5 mm of healthy tissue around the tumour was in most cases a sufficient guarantee for radical excision in laryngeal carcinoma.

Partial resections of the larynx are either vertical or horizontal depending on the site of the tumour. The extent of resection should always take place within healthy tissue and histological examination of the surrounding tissue must confirm that the excision is complete.

Reconstruction of the larynx after vertical partial laryngectomy aims at restoration of both laryngeal lumen and glottic competence to obtain adequate airway, good voice and avoid aspiration. Goodyear (1949) used hypopharyngeal mucosa to partially resurface the lumen after hemilaryngectomy and inserted a solid acrylic tube to maintain the lumen in expectation of re-epithelialization. Figi (1950) used free skin grafts placed over a stent for laryngeal resurfacing. Som (1951) used hypopharyngeal and pyriform sinus mucosa on the side of resection for relining the defect after partial resection. Pressman (1954) described this technique for glottic reconstruction using perichondrial and strap muscle flap after partial laryngectomy. Conley (1961) used pedicled skin flaps for reconstruction of the glottis after partial laryngectomy. Ogura and Dedo (1965) used the infractured border of thyroid cartilage covered by pharyngeal mucosa to form a pseudo cord. Quinn (1975) used free transplants of muscle while Dedo (1975) used free transplants of fat and fascia for glottic reconstruction. Blaugrund and Kurland (1975) used thyroid cartilage flaps pedicled on the inferior constrictor muscle for reconstruction after partial laryngectomy. All these techniques were used with varying results and complications.

In our study the pyriform sinus mucosa was used to reconstruct the new laryngeal wall and to form a pseudo-vocal fold at the side of resection after vertical partial laryngectomy.

Patients and methods

Thirty-three consecutive patients with glottic carcinoma of the larynx were entered in this prospective study. Three patients were excluded, two with extensive tumours and one with poor pulmonary function tests and all three were treated with total laryngectomy. The rest (30 patients) were included in the study and had vertical partial laryngectomy as a primary treatment. The pyriform sinus mucosa on the side of resection was used for reconstruction of the laryngeal lumen and glottic region. These patients had normal pre-operative pulmonary function tests and their tumours were classified as $T_2N_0M_0$ (24 patients) and $T_3N_0M_0$ (6 patients) and had satisfied the following criteria:

(1) The tumour had less than 10 mm of subglottic extension in the anterior or the mid-portion of the vocal fold and less than 4 mm posteriorly where the cricoid lamina is immediately below the arytenoid and likely to be invaded.
(2) The tumour was restricted to the vocal fold at the anterior commissure. Upward or downward extension at this level is often associated with thyroid cartilage involvement or extension beyond the larynx.
(3) The tumour did not extend beyond the anterior third of the opposite side of the larynx.
(4) The pyriform sinus mucosa was not involved by tumour.

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Surgical technique

A low tracheostomy is first performed under local anaesthesia then general anaesthesia is given through the tracheostomy. A collar incision is made at the level of mid-thyroid cartilage and the skin flaps are raised including the platysma. On the side of the tumour, the sternomastoid muscle is retracted laterally, the omohyoid tendon cut and the carotid sheath examined thoroughly for any lymph nodes. The superior laryngeal neurovascular bundle is identified and preserved. A longitudinal cut is made through the thyropharyngeus muscle in line with the posterior edge of the thyroid lamina and continued through its perichondrium. This myotomy is continued down the cervical oesophagus allowing the mucosa of the pyriform sinus to be adequately dissected and pedicled on the superior laryngeal neurovascular bundle. The initial pharyngotomy incision is made tranversely in the suprahyoid area where the exact extension of the tumour is assessed and the margin of resection is determined using the operating microscope if necessary. The tumour and the corresponding part of the thyroid cartilage are resected and the margins are checked by frozen sections in doubtful cases.

Reconstruction

The apex of the pyriform sinus 'folded mucosal flap' is sutured to the anterior end of the contralateral vocal fold. The posterior end of the medial flap is sutured to the ipsilateral arytenoid or its vacant site if resected and other sutures are taken between the remaining part of the thyroid lamina and the medial wall of the pyriform sinus mucosal flap. To create a horizontal fold opposite the intact vocal fold, two sutures are placed anteriorly and posteriorly into the outer surface of the medial wall of the flap. By now, the new lateral wall of the larynx is reconstructed by the medial wall of the flap while the lateral wall of the flap constitutes the lateral pharyngeal wall. The prelaryngeal muscles are sutured. The nasogastric tube is removed seven to ten days after operation.

All patients had a regular post-operative follow up for three years. Microlaryngoscopy was done routinely in all patients after six months and repeated when required.

Results

This study included 30 patients with glottic carcinoma of the larynx treated primarily by vertical partial laryngectomy. The pyriform sinus mucosa was used for reconstruction of the laryngeal wall and glottic region after resection of the tumour. There were 29 males and one female. Their age ranged between 35 and 72 with average 53 years. Twenty-eight patients were smokers for more than 15 years. Three patients received post-operative radiotherapy, two with histology report of poorly differentiated squamous cell carcinoma and one with narrow margin of healthy tissue after resection. Table I represents the early post-operative complications within two weeks of surgery. Two patients had wound infection and three had a salivary fistula which responded to conservative treatment. Four patients had problem with aspiration and one developed pneumonia treated medically.

TABLE I

EARLY POST-OPERATIVE COMPLICATIONS AFTER VERTICAL PARTIAL LARYNGECTOMY (N = 30)

Wound infection	2	Haemorrhage	0
Salivary fistula	3	Pneumonia	1
Aspiration	4		

Table II represents the long-term post-operative results in terms of decannulation, swallowing and quality of voice. Twenty-seven patients (90 per cent) were decannulated and were able to breathe normally through their reconstructed larynx. The period lapsed before decannulation ranged between three weeks and four months after surgery. Three patients (10 per cent) developed laryngeal stenosis and their tracheostomy had to be permanent. Twenty-four patients (80 per cent) were able to eat normal diet while the rest could manage a soft diet only. Twenty-one patients (70 per cent) had good/excellent voice, five patients (17 per cent) had a weak but serviceable voice and four patients (13 per cent) had a poor voice and this group included patients with permanent tracheostomy who use expiratory check valve to speak.

Table III shows the late complications three years after the vertical partial laryngectomy. There were four tumour recurrences (13 per cent) in this series: one after six months with unilateral neck metastasis and recurrence in the larynx which was treated by total laryngectomy and radical neck dissection. This patient died a few months later with further recurrence in the neck. The other three tumour recurrences were local in the larynx nine to twelve months after surgery and were treated by total laryngectomy. These patients were still alive with no further recurrences after total laryngectomy. A total of 29 patients were still alive, with no tumour recurrence three years after their vertical partial laryngectomy.

Discussion

In our surgical technique, the following two procedures are of prime importance:

(1) The extended myotomy down to the cervical oesophagus allows adequate mobilization of the pyriform sinus mucosa and facilitates its use not only for reconstruction of the new laryngeal wall but also for making a pseudo-vocal fold at the side of resection. This myotomy keeps the pharynx widely opened and makes swallowing easier through the permanently patent pharyngo-oesophageal segment.

(2) Preserving the superior neurovascular bundle during dissection keeps the sensory innervation of the pharyngeal and oesophageal mucosa intact allowing initiation of the reflex inhibition of respiration and closure of the larynx during swallowing.

In this study, 90 per cent of patients were decannulated and 10 per cent had permanent tracheostomy because of post-operative stenosis of the larynx. Krajina (1990) reported failure of decannulation in three patients (excluding relapses) in his 64 patient series when he used sterno-

TABLE II

LONG-TERM RESULTS AFTER VERTICAL PARTIAL LARYNGECTOMY (N = 30)

Airway		
Decannulation	27 (90%)	Permanent tracheostomy 3 (10%)
Swallowing		
Normal diet	24 (80%)	Soft food only 6 (20%)
Voice quality		
Good/excellent	21 (70%) Weak 5 (17%)	Poor 4 (13%)

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TABLE III
LATE COMPLICATIONS AFTER VERTICAL PARTIAL LARYNGECTOMY (N = 30)

Unilateral metastasis + tumour recurrence in larynx	1 (3%)
Tumour recurrence in the larynx	3 (9%)
Mortality	1 (3%)

hyoid fascia for reconstruction after vertical partial laryngectomy. In our study, the quality of voice was good/excellent in 70 per cent of patients proving that the double layered mucosal fold acting as a pseudo-vocal fold is very reliable. Regarding swallowing, 80 per cent of patients were able to eat a normal diet while 20 per cent can manage soft diet only with no long-term aspiration problems. Maceri *et al.* (1985) showed that 65 per cent of their patients were able to eat normally following vertical partial surgery while 20 per cent had a spill-over for a long period of time. Rothfield *et al.* (1989) reported voice preservation in 98 per cent of patients and ultimate control of disease with cure in 95 per cent in their series of 54 patients who underwent vertical partial laryngectomy for T_1 glottic tumours. Burgess (1988) used the thyroid cartilage flap for laryngeal reconstruction following vertical partial laryngectomy in seven patients with local control of disease in six and all patients were decannulated after one to four weeks with natural deglutition. In our series there were four patients (13 per cent) with recurrent tumours, one of whom developed a unilateral neck metastasis and died later with a further recurrence. In Krajina's 1990 series of 64 patients treated by vertical partial laryngectomy with reconstruction using sternohyoid fascia there were 17 tumour recurrences (26.5 per cent), eight patients (12.5 per cent) with local recurrence of the tumour and nine patients (14 per cent) with local recurrence and unilateral metastasis. Four of these patients (6 per cent) died of further recurrences. Maceri *et al.* (1985) reported 80 per cent disease-free survival rate at two years after vertical partial laryngectomy.

Conclusion

This study demonstrated that vertical partial laryngectomy was effective in control of laryngeal cancer in properly selected patients. The pyriform sinus mucosa proved to be a reliable material for reconstruction of the larynx with maintenance of its respiratory, sphincteric and phonatory functions.

Key words: Laryngectomy, vertical partial.

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