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Voice changes following cricothyroidotomy

by

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Abstract

Twenty-four patients underwent crico-thyroidotomy at Guy's Hospital between 1977 and 1981. Of these, 13 died during admission or shortly after discharge as a result of their primary disease and three were unsuitable for further examination. The eight remaining patients were examined to assess the effect of cricothyroideotomy on the laryngeal function of voice production. Assessment was made both subjectively and objectively by laryngography. Objective findings were correlated with structural changes seen by indirect laryngoscopy. Six of the eight patients examined had both subjective and objective disturbance of voice production. We report our experience with the surgical procedure of cricothyroidotomy which, in addition to a high incidence of vocal disturbance, includes one case of subglottic stenosis secondary to granulation tissue.

Introduction

Cricothyroidotomy, being a high tracheostomy, was condemned by Chevalier Jackson (1921). He stated that its use was associated with an increased incidence of subglottic stenosis. His teaching, which had revolutionized the management of airway intubation, influenced subsequent surgical practice for 50 years. Brantigan and Grow (1976), with a series of 655 patients, disputed this outright condemnation of cricothyroidotomy and, as thoracic surgeons, they advocated its use in patients requiring prolonged endotracheal intubation who had undergone median sternotomies. The higher site of access to the airway facilitated isolation of the stoma from the sternotomy wound, thereby eliminating secondary chest infection. These authors suggested that the procedure was safer and quicker than tracheostomy and not attended by a significant incidence of subglottic stenosis. They concluded that stenosis of the airway was precipitated by a combination of factors, viz. infection, poor surgical technique and damage produced by cuffed endotracheal tubes. Eight of their patients developed airway obstruction following extubation. Five of these were tracheal stenoses at the cuff site and required resection. Two developed granulation tissue in the subglottic region which was removed successfully endoscopically; one of them had not been intubated prior to cricothyroidotomy. Only seven of their patients reported a voice change characterized as either a transient hoarseness or permanent decrease in pitch and staying power.

Morain (1980) presented a series of 16 cases and confirmed Brantigan and Grow's (1976) findings. He suggested that cricothyroidotomy, used in connection with composite resections of the head and neck, prevented the complication of subcutaneous sinus formation between a radical neck dissection and tracheostomy. He also recom-

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mended its use in patients with limited neck mobility. Subglottic stenosis was not encountered, but no attempt was made to document vocal abnormalities.

Two cases of subglottic stenosis and two of transient hoarseness following cricothyroidotomy were reported by Romita (1981). He attributed the stenoses to previous per-oral intubation in excess of one week, and voice changes to incorrect technique.

As a result of the study by Brantigan and Grow, the policy of the Cardiothoracic Unit of Guy's Hospital was changed in 1977 so that any patient requiring prolonged ventilation underwent cricothyroidotomy instead of tracheostomy.

We report our experience with cricothyroidotomy and in particular its subsequent effect on the laryngeal function of voice production.

Materials and Methods

The hospital records of 24 patients requiring a prolonged period of mechanical ventilation between November 1977 and June 1981 were reviewed (Table I). All patients had cricothyroidotomy performed for the purpose of respiratory management. No laryngeal neoplasms or infections were included and no patient required a second cricothyroidotomy. Of the 24 patients who underwent cricothyroidotomy, 12 died in hospital of causes related to their primary disease. One of the survivors has since died at home of myocardial infarction and another was lost to recall. One patient who was unable to phonate clearly before operation did not attend for assessment and another refused. Eight patients were assessed at intervals of between three months and four years following cricothyroidotomy.

The mean age of patients in the assessed group at the time of operation was 39.6 years. The mean period of per-oral intubation prior to cricothyroidotomy was 5.1 days for the assessed group. The mean dura-

TABLE I

DETAILS OF OPERATIVE PROCEDURE AND OUTCOME OF PATIENTS

	Patient	Age	Operation/injury	Intubation period		Disposal	Complication
				Oral	Crico		
1	M.B.	50	Decortication Empyema	1	12	Home	ESN
2	J.B.	37	MVR/TA	1	7	Home	Voice disturbance
3	G.A.	42	MVR	3	8	Home	Died MI
4	C.C.	55	MVR	2	12	Died	
5	S.C.	64	Revision CABG	3	16	Died	
6	S.I.	76	AVR. CABG	2	20	Died	CVA
7	C.H.	71	Coronary Art. Fistula. MVR	4	4	Died	
8	A.R.	45	MVR	3	12	Home	Lost to recall
9	G.S.	51	CABG	2	7	Died	CVA
10	E.W.	44	MVR	3	38	Home	Voice disturbance
11	A.M.	60	CABG	3	30	Home	Refused recall
12	H.M.	72	Diverticular Abscess	4	1	Died	
13	J.W.	59	Right lobectomy, laparotomy	2	94	Died	
14	A.H.	42	AVR Revision	3	8	Home	Delayed healing Voice disturbance
15	A.G.	56	CABG. Excision Aneurysm	3	21	Died	
16	G.L.	55	Lobectomy	1	10	Died	
17	P.B.	26	Coarctation + CABG	1	26	Died	
18	W.D.	48	Excision Aneurysm + CABG	4	12	Died	
19	L.B.	59	CABG	2	2	Died	
20	M.W.	22	Guillain-Barre	3	99	Home	Voice disturbance
21	E.R.	63	CABG	8	41	Home	Voice disturbance
22	D.C.	58	CABG	3	7	Home	Voice disturbance
23	D.G.	17	Multiple injuries	13	15	Home	Subglottic stenosis
24	D.L.	34	Cervical spine fracture	7	24	Inpatient	

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tion of intubation by cricothyroidotomy for the assessed group was 29.8 days.

Five patients had had median sternotomies in the course of their primary operation. The three other patients had undergone cricothyroidotomy for the management of respiratory problems caused by a fractured cervical spine, a Guillain-Barre Syndrome and multiple injuries with shock lung sustained in a road traffic accident.

Cricothyroidotomy was performed by a member of the Cardiothoracic Unit either at the bedside in Intensive Care or in a theatre using the following technique. The neck was prepared and towelled as for a tracheostomy with the head in the midline and the neck extended. The crico-thyroid space was palpated and a 2.5 cm. transverse incision was made in the space through skin and platysma; the sternothyroid muscle was separated with scissors and the crico-thyroid membrane was opened transversely. A Trousseau dilator was then used to facilitate the insertion of the 'tracheostomy' tube on removal of the endotracheal tube. Blue line Portex plastic tracheostomy tubes with high volume low-pressure cuffs were used.

The tubes were changed as necessary or at weekly intervals. Patients were extubated when ventilatory support or direct access for tracheal aspiration was no longer necessary, and coughing and swallowing were normal. Stomata were allowed to heal spontaneously without suture, using dry dressings.

A detailed laryngological history was taken from each patient. Exposure to precipitants of laryngeal inflammation was sought, in particular tobacco, spirits, vocal abuse, nasal and dental sepsis. A thorough examination of the nose, pharynx, larynx and neck was made. Indirect laryngoscopy was successfully performed in all cases allowing structural assessment of the glottis and in most cases the subglottic area. Where an adequate view of the subglottic area was not achieved by mirror examination, xerograms of the neck in two planes were taken. Subjective and objective vocal assessment was undertaken by interview and the laryngographic technique described by Fourcin (1974).

Complications and Results

No significant haemorrhage occurred at operation. One patient who was fully anti-coagulated at the time of operation oozed continuously for six hours; this was stopped by a temporary reduction in anti-coagulation.

Post-operatively there was no evidence of spreading infection, mediastinitis or involvement of the primary incision in any patient. Inflammation was confined locally to the stoma. Following extubation one patient had delayed healing for ten days, but the wound healed completely without interference.

One patient who had been intubated orally for 13 days prior to cricothyroidotomy, developed total occlusion of the subglottic space by granulations on the 15th post-cricothyroidotomy day (Fig. 1). These were removed by microlaryngoscopy and a covering tracheostomy established. Extubation was possible seven days later and no laryngeal deformity developed subsequently.

Six of the eight patients noted voice changes in the immediate post-extubation period which were of a permanent and non-progressive nature. Five patients noted a loss of volume (Nos. 2, 10, 14, 21 and 22), two of whom noted, in addition, that their voices fatigued easily (Nos. 2 and 14). One patient noted that his voice was deeper (No. 14) and another that her voice was husky to a socially unacceptable degree (No. 21). Three patients (Nos. 2, 14 and 20), who had been amateur singers prior to operation, were unable to perform afterwards because their vocal ranges had become limited and they tended to squeak off key when attempting high notes.

Indirect laryngoscopy revealed scarring at the operation site in three patients (Nos. 2, 14 and 21), all of whom had vocal changes, and in these patients distortion of the vocal cords at the anterior commissure was apparent. In four patients the indirect laryngoscopic appearances were normal. Analysis of the laryngographs revealed that all six patients who had subjective vocal changes produced abnormal profiles. Their laryngographs showed a characteristic pathological narrowing of the fundamental vocal range with a

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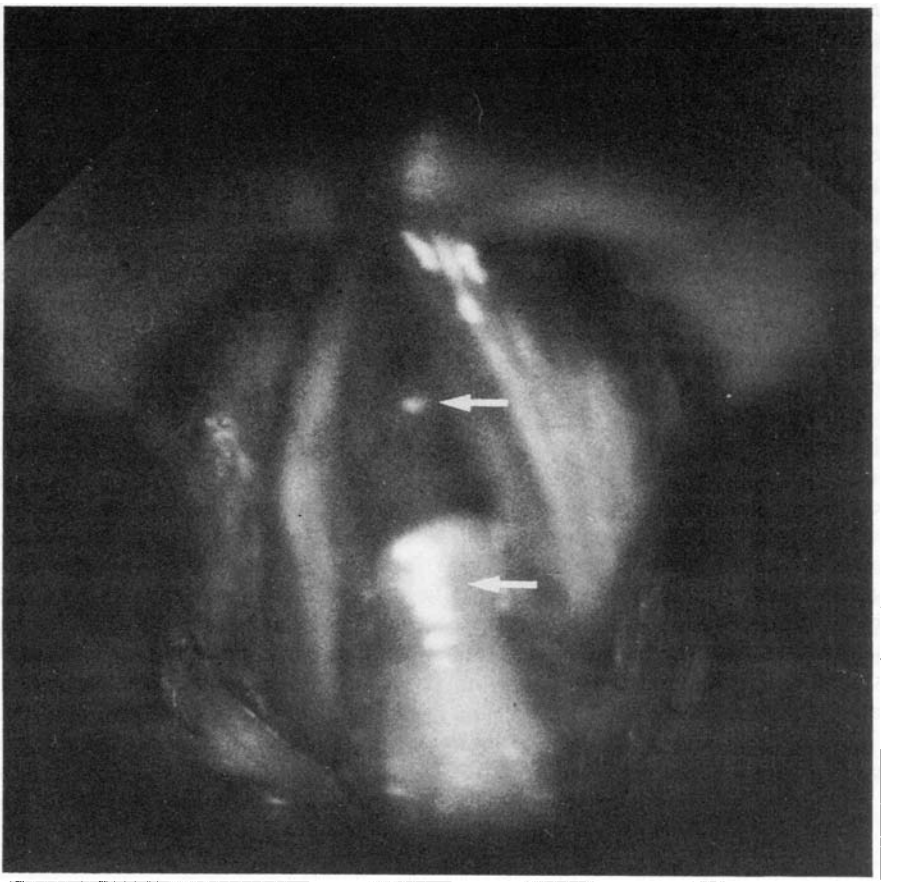


FIG. 1

View of larynx at operation showing exuberant granulations (arrow) arising from subglottis blocking the glottic chink.

lop-sided distribution favouring the lower frequencies. The two patients without subjective vocal changes produced normal laryngographic profiles (Fig. 2).

Discussion

Previous authors have highlighted several advantages of cricothyroidotomy, the ease with which it is performed and the low complication rate in comparison to tracheostomy. In one review (El-Kilany, 1980), the overall complication rate of tracheostomy varied between 9 per cent and 48 per cent. Brantigan and Grow pointed out the desirability of isolating an inevitably contaminated stoma from a median sternotomy incision because of the potentially fatal consequences of mediastinitis. Morain advocated its use for certain head and neck procedures, where it eliminated the formation of a sinus between the stoma and the neck dissection. He also suggested that vocal disturbance and swallowing should be infrequent if Bonanno's (1971) hypothesis of strap muscle fixation secondary to scarring was correct, as cricothyroidotomy was essentially a subcutaneous procedure.

In our small series we found and have demonstrated minor degrees of scarring in the anterior part of the subglottic space producing both anatomical and functional deformities of the larynx. 75 per cent of the patients in this series had both subjective and objective voice changes.

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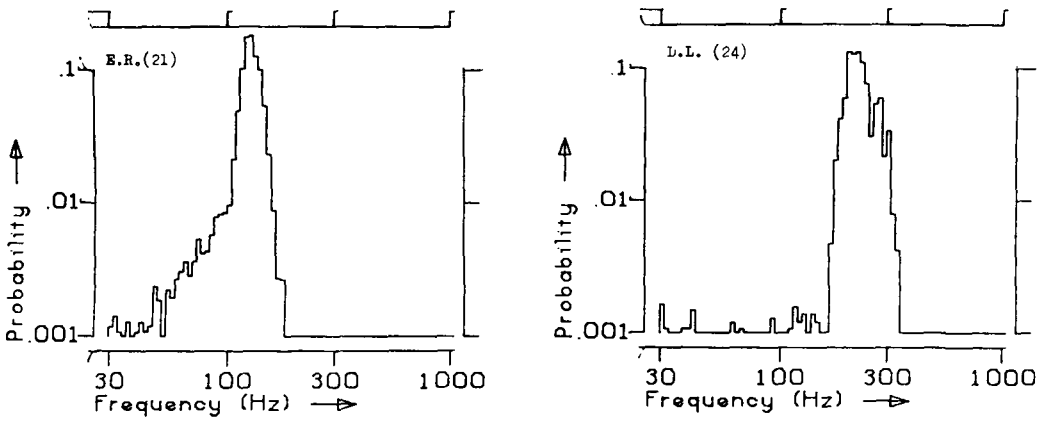


FIG. 2

Laryngographs: Patient ER (21), demonstrating the pathological narrowing of the frequency range with the characteristic low frequency skirt which combines to produce an asymmetrical distribution in a post-crico-thyroidotomy patient. Patient D.L. (24) Normal laryngograph following crico-thyroidotomy.

Conclusion

We conclude that cricothyroidotomy has a place in the surgical management of a very select group of patients namely.:

1. As an emergency and temporary procedure.
2. Where neck mobility is so limited or undesirable that access to a standard tracheostomy site is impossible.
3. In those patients where there is an increased risk of the development of mediastinitis.

We warn against its indescriminate use as the vocal changes, hitherto thought rare, are both common and permanent.

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