

AFRICAN JOURNAL OF MEDICINE and medical sciences

VOLUME 36 NUMBER 2

JUNE 2007



Editor-in-Chief
YETUNDE A. AKEN'OVA

Assistant Editors-in-Chief
A. O. OGUNNIYI
O. D. OLALEYE

ISSN 1116—4077

Improvised laryngeal cautery forcep in microsurgical treatment of laryngotracheal stenosis - experience in Nigeria, Sub-Saharan Africa

AO Lasisi and A Adeyemo

Department of Otorhinolaryngology, College of Medicine,
University of Ibadan, Ibadan, Nigeria

Summary

Traumatic laryngotracheal stenosis is uncommon, however it seems to be increasing due to improvement in survival after trauma and detection of injury. Surgical options include dilatation and intralesional steroid, endolaryngeal microsurgery and laryngotracheal resection and anastomosis. We report our experience with management of traumatic laryngotracheal stenosis using improvised cauterization forcep in endolaryngeal microsurgery, in the absence of supportive facility for open laryngeal surgery in resource – poor sub-Saharan Africa. This is a retrospective analysis of the outcome of endolaryngeal microsurgery in patient with laryngotracheal stenosis using our improvised laryngeal cautery forceps. Traumatic A Lindholm laryngoscope suspended by a Riecher-Kleinsasser laryngoscope holder and chest support; and Carl-Zeiss operating microscope (Op Mi 1) was used for surgery. We improvised a laryngeal cauterization forcep by using an oesophageal foreign body forcep inserted in the measured length of fluid – giving set, exposing about 1cm of the cutting end would insulate the forcep against the laryngotracheal wall. The diathermy handle is applied to the exposed end of the forceps. All the patients had endolaryngeal microsurgery and intralesional steroid. Thirteen endolaryngeal microsurgical procedures were done on 5 patients, 4 males and 1 female. The age ranged between 19 and 62 years. Functional voice and decannulation was achieved in 2/5 patients after each had had between 2 – 3 procedures. The indications in all was hoarseness while there was in addition, upper airway obstruction and dependence on tracheostomy in 3. The stenosis was supraglottic in 2, combined glottic and subglottic in 1 and laryngotracheal involvement in 2. Using the circumference of the laryngeal lumen as reference

for severity of stenosis, 2 patients had a 50-70% lumen obstruction while 2 had a 71-99% and 1 had 100% lumen obstruction. We found the improvisation of the laryngeal cautery forcep useful for procedures in the larynx and recommend it to resource – poor centres where appropriate facilities are yet available. However this further shows that the role of endolaryngeal microsurgery is limited in laryngotracheal stenosis. The availability of other therapeutic modalities and training of personnel will give us the opportunity of a randomized treatment comparison in future.

Keywords: *Laryngotracheal stenosis, improvised laryngeal cautery forcep, microsurgery, sub-Saharan Africa.*

Résumé

Le traumatisme de la sténose laryngotrachéale reste moins commun, cependant augmenter la survie après le traumatisme et la détection des blessures est capable par différentes options de chirurgie. Nous rapportons nos expériences dans le ménagement du traumatisme de la sténose laryngotrachéale en absence des facilités de support pour la chirurgie laryngale ouverture dans les pays développés de l'Afrique Sud du Sahara. Des résultats de cette analyse rétrospective de la microchirurgie endolaryngeal du patient ayant la sténose laryngotrachéale. Le laryngoscope de traumatisme de A Lindholm suspendue au support par la poitrine et le laryngoscope de Reicher-Kleissasser, et microscope de Carl Zeiss était utilisé pour la chirurgie. Tous les patients avaient eu une microchirurgie endolaryngeale et une sternite intralesionale. Treize procédures microchirurgicale endolaryngeale étaient faite sur cinq patients, 4 males et 1 femelle, age variant entre 19 à 62 ans. La voie fonctionnelle et décannulation étaient achevé chez 2/5 patients après chacun avait eu 2-3 procédures. Les indications sur tous les cas

difficile et il y avait une obstruction respiratoire dépendant de la trachéostomie chez 3 patients. La sténose était supra glottique chez 2 patients, une combine subglottique et glottique, et deux patients avaient un développement laryngotracheal. Utilisant la circonférence du lumen comme référence de la sévérité de la sténose, 2 patients avaient une obstruction du lumen de 50-70%, de 71-99% chez 2 et un patient seulement avait une obstruction complète du lumen. Nous trouvons nécessaire l'emploi de forces dans les procédures dans le larynx et le recommande dans les centres de santé à ressources limitées, démontrant le rôle de la microchirurgie endolaryngéale limitée à la sténose laryngotracheal. L'accessibilité à d'autres modes de thérapeutique et la formation du personnels offriront l'opportunité à des traitements comparatif dans le proche future.

Introduction

Laryngeal stenosis can be defined as a partial or circumferential narrowing of the endolaryngeal airway and may be congenital or acquired. The incidence of subglottic stenosis after intubation is reported to be 1-10% and accounts for 90% of acquired subglottic stenosis [1]. Laryngotracheal stenosis resulting from head and neck trauma is uncommon, the increase is attributable to improvement in survival after injury and detection of laryngotracheal trauma [1]. Due to the above reason, only few physicians have extensive experience in the management. The goals in management; functional voice and good airway, have been a great challenge. This is due to recurrence of stenosis, which may result from perichondrial injury during surgery leading to persistent inflammation and cicatrization of the cartilaginous framework [2,3]. The extent of this is related to severity of initial injury, delay in initiation of management, biological factors in the patient and technical experience of the surgeon [1,2,3].

The options in management are observation, dilatation and intralesional steroid, endoscopic resection and open surgery. This includes laryngotracheal resection and primary anastomosis, mucosal lining with skin graft, reconstruction with bi-pedicled sternohyoid myofascial flap,

sternocleidomastoid clavicle membrane flap and the use of artificial prosthesis [4,5,6].

All these approaches have encountered limitation in achievement of functional voice. Advances in the use of adjuncts such as laser and electrocautery has improved the outcome of microsurgery. However, most reports conclude in support of LTR as the definitive surgery for laryngotracheal reconstruction; and microsurgery is reserved for isolated stenosis involving the supraglottis, glottis or subglottis.

We present our experience in management of traumatic laryngotracheal stenosis using microsurgery and improvised electrocautery in resource – poor sub-Saharan Africa. The outcome is also compared to previous work.

Materials and method

This is a retrospective analysis of the clinical records of all the patients who had endolaryngeal microsurgery for traumatic laryngotracheal stenosis in our department of otorhinolaryngology. Detailed information were extracted about the operative indications, procedures and outcome. All the patients were evaluated with plain x – ray of the neck, indirect and direct laryngoscopy. Computerized axial tomography scan was done in 1.

All had tracheostomy before microsurgery. A Lindholm laryngoscope suspended by a Riecher-Kleinsasser laryngoscope holder and chest support; and Carl-Zeiss operating microscope (Op Mi 1) was used for surgery. Excision was done using an improvised laryngeal cautery. The procedure was done under general anaesthesia administered through the tracheostomy tube and the first author was the operating surgeon in all the cases. All the patients had intralesional injection of 60mg of Dexamethazone into the laryngeal mucosa immediately after excision and oral maintenance was continued for 2 weeks.

Improvisation

We improvised the laryngeal cautery by using a combination of the oesophageal foreign body forceps and the intravenous fluid - giving set. The length of the oesophageal foreign body forceps and the intravenous fluid - giving set were measured and the intravenous giving set was cut to a length 1- 1.5 cm shorter than the forceps. The forceps was then insulated by inserting it in the measured fluid – giving

set, exposing about 1cm of the cutting end. In this way the cutting end of the forceps is used to cut through the lesion while the diathermy handle was applied through the outer end. Figure 1.

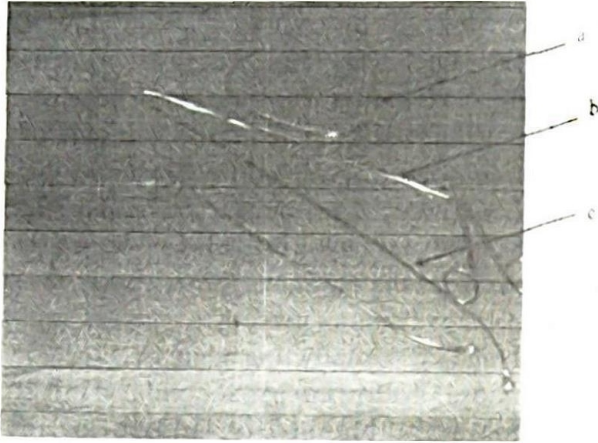


Fig. 1: Picture showing (a) measured length of fluid-giving set, (b) oesophageal foreign body forcep inserted (insulated) in the fluid-giving set (the improvised laryngeal cautery forcep), (c) oesophageal suction nozzle inserted (insulated) in the fluid-giving set

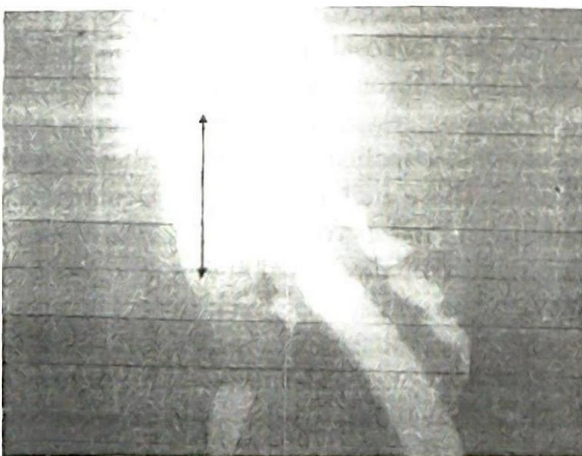


Fig. 2: CT scan of the neck with the arrow showing extensive stenosis involving the larynx and trachea with grade IV, complete (100%) obstruction of the airway.

Results

Thirteen endolaryngeal microsurgical procedures were done on 5 patients, 4 males and 1 female. The age ranged between 19 and 62 years. Each of the patients had at least 2 procedures. The indications in all was hoarseness while there was in addition, upper airway obstruction and dependence on tracheostomy in 3.

The anatomic pathology showed supraglottic stenosis in 2, combined glottic and subglottic in 1 and laryngotracheal involvement in 2. (Figure 2).

Using the circumference of the laryngeal lumen as reference for severity of stenosis, subjective estimation of the laryngeal lumen revealed that 2 patients had a 50-70% lumen obstruction while 3 had a 71-99% lumen obstruction.

The injury followed road traffic accident in 2, industrial accident 2 and domestic injury 1. Presentation in our hospital was immediate postinjury in 1 while the 4 others had had tracheostomy in peripheral hospitals, presenting to our centre between 3 and 6 month postinjury. Isolated neck injury was found in 4 while one had associated multiple long bone fractures. The histology of the tissue removed confirmed fibrous tissues.

Outcome

After surgery, 2/5 patients regained normal functional voice and successful decannulation was achieved. In 3 others there was significant improvement in voice but were still dependent on the tracheostomy. Hence they were discharged home on permanent tracheostomy with a speaking valve.

Discussion

The successful management of laryngotracheal stenosis is still a major challenge in contemporary laryngologic practice. This is particularly relevant to developing countries where there is marginal improvement in survival after trauma leading to increase in number of patients requiring functional surgery [1,2]. The other reason is the taboo and cosmetic dysfunction associated with permanent tracheostomy [1-4,7]. Prevention of stenosis has been reported to depend on re-epithelialization before scar formation [3,8]. This is related to proper preoperative assessment which is required for adequate selection of patients into different surgical options. Plain radiograph of the neck and direct laryngoscopy has been the traditional modalities. In recent times CT Scan of the neck

have been added [9,10]. It is reported to be superior to endoscopy for preoperative assessment, however thinner slices seems to be the optimal for the accuracy [9,10,11]. Compared to optical endoscopy, it offers additional information on character of the stenosis (membranous or cartilaginous), shape and size of the stenosis, and the state of the cricoid cartilage (normal or abnormal); this is important for the analysis of the infraglottic and tracheal areas [10,11]. In our report plain radiograph was used in majority of cases, we appreciate the inadequacies in assessment of the definitive extent of the fibrosis arising from this and the limitation in the particular management option to be offered. Laryngotracheal resection appear the definitive surgical management of laryngotracheal stenosis. Younis *et al* [12] reported a decannulation success rate of 83% (38) in 46 patients who had single-stage reconstruction with temporary stenting. Rea *et al* [13] reported 65 patients underwent primary tracheal and laryngotracheal resection and reconstruction for non-neoplastic stenoses, 54 had excellent result. They concluded that LTR is the primary treatment of laryngotracheal stenosis. In the report of Tantinikon *et al* [14], 21 patients were selectedly treated using endoscopic methods in 6 and laryngotracheal reconstruction (LTR) in 15. Decannulations were achieved in 19 patients (90.5%) including all the LTRs. Endoscopic treatment only succeeded within 2-4 procedures in properly selected cases. Decannulation was not achieved in two of the cases, both of whom had all-level laryngeal stenosis. Time to decannulation ranged from 2 to 210 days. The major causes of delayed decannulation were the presence of a large bare area of cartilaginous grafts and restenosis with granulation tissue formation. LTR has also been favoured by many other workers [15,16].

We offered microsurgery because we felt that the supporting facilities for LTR such as laryngotracheal stents are not available and intensive cardiopulmonary devices are not adequate. In order to ensure lysing of the fibrous tissue with minimal injury to the normal mucosa of the laryngotracheal wall, instruments should be long – handled and insulated from the laryngotracheal mucosa. The reason for our improvised laryngeal cautery. We found it useful for procedures in the larynx and recommend it in centres where appropriate facilities are yet available. A success rate of 2/5 after multiple

procedures in each patient is similar to that of Tantinikon *et al* [14] They achieved decannulation in 2 out of 6 patients after each had had between 2 – 4 procedures and subsequently converted the rest to open surgical technique. This seems to confirm the suboptimal outcome of endolaryngeal microsurgery, hence careful selection of patient is required before offering endoscopy. Although the improvised laryngeal cautery has helped improved ligation of laryngotracheal cicatrix. The stenosis in three patients were severe, clinical grade III and IV, with involvement of the larynx and trachea. Many workers would have offered open surgery to this clinical grade from the beginning [1,2,13-17] In addition, imprecision of the laryngeal cautery may result in incomplete excision of fibrous tissue and injury to normal mucosa. Usually this begins as ulceration of the mucosa, followed by secondary infection, perichondritis, chondritis, and formation of granulation tissue, which leads to scar formation and fibrosis.

The use of laser has improved the outcome of endolaryngeal surgery. Fearon and Cinnamound [17] described the use of CO₂ laser to divide laryngeal webs in the glottic and sub-glottic space. Simpson [18] in 1979, reported 2 children with subglottic stenosis that responded to laser excision. Strong *et al* [19] 1979 presented their experience with 18 patients with glottic or subglottic partial or total stenosis. Four of 7 and 8 of 11 subglottic stenosis were treated successfully with the laser.

Success in laser surgery has been reported to be due to delay in formation and maturation of collagen in laser wound, minimal deeper tissue damage and mucosal preservation ability [8]. Agents which delay fibrous tissue formation and maturation have been suggested as adjunct in treatment, although there is no conclusive report on their therapeutic benefit. These include steroids (Dexamethazone), mitomycin and estrogen [20,21,22]. Intralesional Dexamethazone was used in this series but we think that a larger series is needed in order to comment on the benefit or otherwise.

We conclude from this report that endolaryngeal microsurgery is really limited in achieving functional voice and good airway in laryngotracheal stenosis. The availability of other therapeutic modalities and training of personnel, will give us the opportunity of a large random series of patients to compare results and determine the selection criteria for surgical options.

References

1. Cotton RT, Myer CM 3rd, Bratcher GO and Fitton CM: Anterior cricoid split, 1977-1987. Evolution of a technique. *Arch Otolaryngol Head Neck Surg* 1988, 114(11): 1300-1302.
2. Berkowitz RG: The management of posterior glottic stenosis following endotracheal intubation. *Aust N Z J Surg* 1994, 64(9): 621-625.
3. Hall RR: The healing of tissues incised by carbon dioxide laser. *Br. J. Surg* 1971, 58: 222 – 225.
4. Lano CF Jr, Duncavage JA, Reinisch L, Ossoff RH, Courey MS and Nettekville JL Laryngotracheal reconstruction in the adult: a ten year experience. *Ann Otol Rhinol Laryngol*. 1998;107(2):92-97.
5. Ashiku SK, Kuzucu A, Grillo HC, Wright CD, Wain JC, Lo B and Mathisen DJ. Idiopathic laryngotracheal stenosis: effective definitive treatment with laryngotracheal resection. *J Thorac Cardiovasc Surg*. 2004;127(1):10-13.
6. Wang H, Luan X and Li Y. Application of epiglottic in reconstruction of traumatic laryngotracheal stenosis : *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*. 2005;19 (2):138-140. Abstract
7. Lasisi OA and Ajuwon A J. Beliefs and perceptions of ear, nose and throat – related conditions among residents of a traditional community in Ibadan, Nigeria. *Afr. J. Med. med sci* 2002, 31: 45 – 48.
8. Dedo HH and Sooy CD. Endoscopic laser repair of posterior glottic, subglottic and tracheal stenosis or microtrap door flap. *Laryngoscope* 1984, 94: 445 – 450
9. Qin Y, Gao WH, Li ZG and Tang GJ. Evaluation of laryngotracheal stenosis with spiral CT three-dimensional images and clinical application *Zhonghua Er Bi Yan Hou Ke Za Zhi*. 2003; 38 (2):147-149.
10. Schultz P, Wiorowski M, Million P, Veillon F and Debry C. Contribution of virtual endoscopy to the investigation of laryngotracheal pathological conditions. *ORL J Otorhinolaryngol Relat Spec*. 2003; 65 (1):33-38.
11. Muller A, Herzau M and Litschko P. How reliable is the measurement of tracheal stenosis by means of computed tomography? *Laryngorhinootologie*. 2000; 79 (10):591-594.
12. Younis RT, Lazar RH and Astor F. Posterior cartilage graft in single-stage laryngotracheal reconstruction. *Otolaryngol Head Neck Surg*. 2003;129(3):168-175.
13. Rea F, Callegaro D, Loy M, Zuin A, Narne S, Gobbi T, Grapeggia M and Sartori F. Benign tracheal and laryngotracheal stenosis: surgical treatment and results. *Eur J Cardiothorac Surg*. 2002; 22 (3): 352-356.
14. Tantnikorn W, Sinratchanant C and Assanasen P. How to overcome laryngotracheal stenosis. *J Med Assoc Thai*. 2004; 87; (7):800-809.
15. Cotton RT and Evans JN: Laryngotracheal reconstruction in children. Five-year follow-up. *Ann Otol Rhinol Laryngol* 1981;90(5 Pt 1): 516-520.
16. McCaffrey TV: Classification of laryngotracheal stenosis. *Laryngoscope* 1992, 102(12 Pt 1): 1335-1340
17. Fearon B and Cinnamon M: Surgical correction of the subglottic stenosis of the larynx. *J. Otolaryngol* 1976, 5: 475 – 478.
18. Simpson GT, McGill T and Healy GB. Benign tumours and lesions of the larynx in children. Surgical excision by CO2 laser. *Ann. Otol*, 1979, 88: 479 – 485.
19. Strong MS Healy GB and Vaughan CW. Endoscopic management of the laryngeal stenosis. *Otolaryngol Clin. North Am*. 1979, 12: 797 – 805.
20. Hartnick CJ, Hartley BE, Lacy PD, Liu J, Bean JA Willging JP, Myer CM 3rd and Cotton RT. Topical mitomycin application after laryngotracheal reconstruction: a randomized, double-blind, placebo-controlled trial. *Arch Otolaryngol Head Neck Surg*. 2001; 127(10):1260-1264.
21. Talas DU, Nayci A, Atis S, Comelekoglu U, Polat A, Bagdatoglu C and Renda N. The effects of corticosteroids and vitamin A on the healing of tracheal anastomoses. *Int J Pediatr Otorhinolaryngol*. 2003; 67(2):109-116.
22. Werner JA. Transoral laryngeal surgery. Brochure of the Department of Otorhinolaryngology – Head and Neck Surgery, Philipps University, Marburg, Germany. 2004, 1 – 25.

Received: 05/09/06

Accepted: 25/05/07