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QATAR MEDICAL JOURNAL

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DOI: http://dx.doi.org/10.5339/qmj.2013.9
Article type: Research Paper
Submitted: 17 June 2013
Accepted: 19th June 2013

Cite this article as: Almudhafer MM, Al-Hassani FAA, Benyan AZ, Surgical management of benign tracheal stenosis in Basrah. *Qatar Medical Journal* 2013:**9** http://dx.doi.org/10.5339/qmj.2013.9

Surgical management of benign tracheal stenosis in Basrah

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Abstract:

Background: Tracheal stenosis is more frequent as a result of wide-spread use of endotracheal intubation and tracheostomy. Resection and tracheal reconstruction remain the treatment of choice in benign tracheal stenosis.

Objectives: To report our experience in Basra and to identify the result of anastomosis after tracheal resection and management of those patients preoperatively and postoperatively.

Methodology: A descriptive study of sixteen patients (aged 11-28 years, 10 male and 6 female) with tracheal stenosis who underwent tracheal resection and reconstruction in Basrah thoracic unit (Basra teaching hospital) from January 2008 to January 2011.

Results: The result was excellent in 62.5%, good in 25%, and satisfactory in 12.5%. Postoperative complication occurred in 25% and treated successfully with no mortality. Follow-up was every 3 months for an average of 3.6 years.

Conclusion: Resection and tracheal reconstruction is the treatment of choice in benign tracheal stenosis and achieved excellent results in management of the patients.

Introduction:

Tracheal stenosis is still observed due to increasing number of patients having tracheostomy and prolonged endotracheal intubation [1-3] for respiratory support which are the main causes of stenosis (up to 67%) [1,2,5]. Other causes of tracheal stenosis are less common; they may result from laryngeal or tracheal trauma, chemical burn and radiotherapy.

Many procedures have been devoted in recent years to solve this problem and to repair tracheal stenosis like airway transplantation, allograft with temporary or permanent stent, balloon dilatation and stent [6, 7].

Despite the different approaches developed recently, tracheal resection and end-to-end anastomosis of the trachea is an effective treatment for stenosis with high success rates [3,8,9]. The aim of this article is to report our experience of tracheal stenosis treatment in 16 patients in the period from January 2008 to January 2011 with an average follow-up period of 3.6 years.

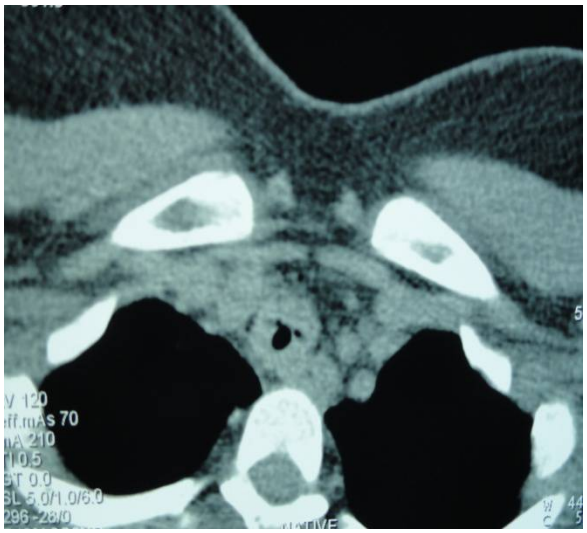
Methodology:

Sixteen patients with progressive dyspnoea were reported during the period from January 2008 to January 2011, their ages ranged from 11 years to 28 years. There were 10 male and 6 female patients. The cause of dyspnoea was tracheal stenosis in all of them who had undergone endotracheal intubation or tracheostomy for respiratory resuscitation following trauma.

Full history was taken and complete physical examination was performed. The investigations requested were chest x-rays, C-T scan (sagital and coronal sections) for both the neck and the chest to reveal the length, severity of stenosis and the status of the vocal cords (Figure 1 a, b, c), delineates the airway below the stenosis which cannot be assessed by bronchoscopy and gives an idea on the cartilagenous support and the surrounding structures. Sputum was sent for bacteriological examination with culture and sensitivity test.

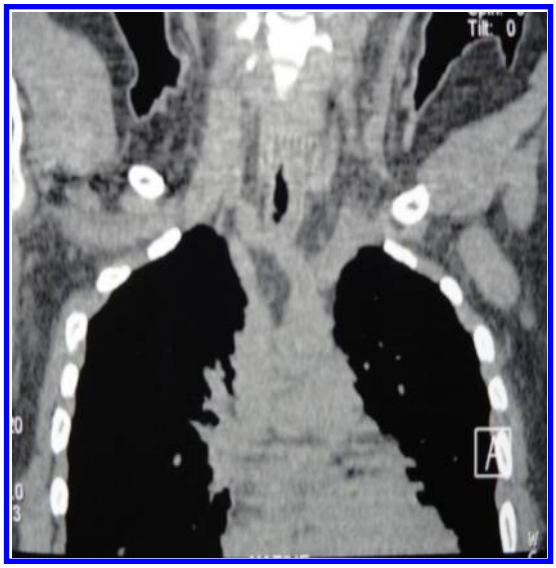
Pre-operative bronchoscopic examination of the larynx and the trachea was performed in all patients to determine the state of the tracheal mucosa, the vocal cords status and the distance up to the stenosis, and for the assessment of the location and the length of the stenosis.

Cervical tracheal stenosis was in 12 patients (75%), and intrathoracic lesions were in 4 patients 25% (Figure 2). One of the cervical tracheal lesions was subglottic stenosis (7.2%) (Figure 3). Four patients received preoperative tracheostomies performed in other hospitals.



A

B



C

Figure 1. Computed tomography shows post-intubational cervical tracheal stenosis in 28 years old female A: saggital section. B: transverse section. C: coronal section.

We used the grading system proposed by Ghorbani A. *et al* [10] , which depends on three factors (diameter of stricture, type of stenosis and clinical symptoms) (Table 1); and we classified the patients according to that system and giving a score to each patient.

All patients received antibiotic and steroid inhalational therapy preoperatively for temporary palliative airways opening and preoperative bronchoscopic dilatations were attempted in some patients.

Figure 2. C-T scan shows post-intubational intrathoracic Tracheal stenosis in 11 years old boy.

Figure 3. C-T scan for 24 years male with post-intubational subglottic tracheal stenosis.

Table (1) A proposed grading system for post-intubation tracheal stenosis by Ghorbani A. *et al*[10]

Factor	Description	Score
Diameter of stricture	Stenosis rate between 0-25% Stenosis rate between 26-50% Stenosis rate between 51-75% Stenosis rate between 76-90% Stenosis rate over 91%	**0** **1** **2** **3** **4**
Type of stenosis: was determined based on the type of tissue of the lesion	Granulation tissue Granulation tissue, fibrosis and inflammation Fibrosis Malacia	**1** **2** **3** **4**
Clinical symptoms:	Dyspnea only during intense activity Dyspnea during normal activity but physical examination was normal Long inhalation and exhalation but with no stridor or retraction Presence of stridor and retraction	**1** **2** **3** **4**

Surgical treatment

Complete excision of the stenotic lesion was performed; the operative approach was by cervical collar incision with sternal split in 11 patients and cervical collar incision with median sternotomy in the other 5 patients (Figure 4). The anterior and lateral surfaces of the trachea was exposed and carefully dissected close to the walls of the trachea to avoid injuries to the recurrent laryngeal nerves and blood supply. The dissection was extended up to the cricoid cartilage above and down to the carina below for better mobilization of the trachea. The resection was performed between the cartilaginous rings to allow anastomosis in a healthy area (Figure 5). End-to-end anastomosis was done using 4 interrupted sutures of 2-0 or 3-0 Vicryle for membranous part and 12-14 interrupted sutures for the cartilaginous part (Figure 6).

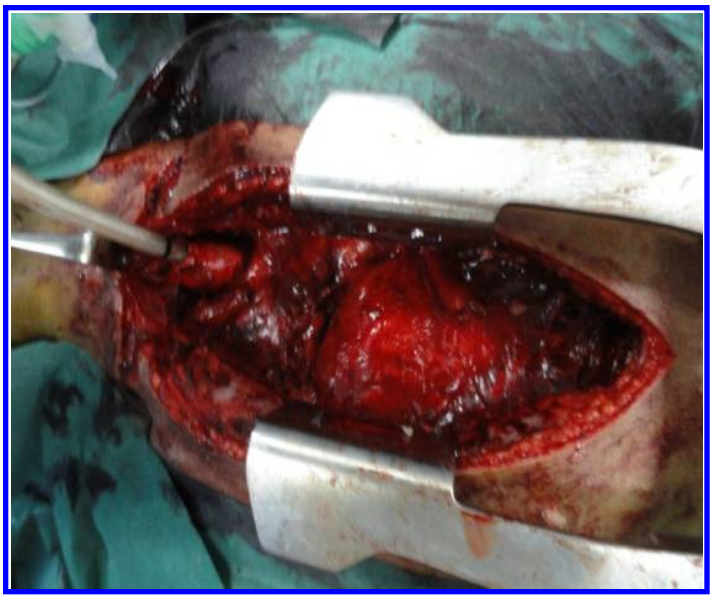


Figure 4. Photography shows collar incision and median sternotomy with armored endotracheal tube through tracheostomy opening.

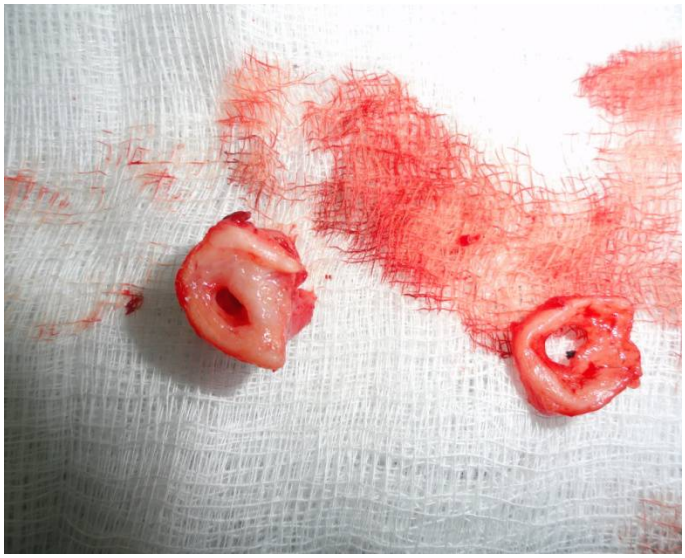


Figure 5. Stenosed segment of the trachea resected in two pieces

Figure 6. Photography shows several 2-0 Vicryle stay sutures between the proximal and distal part of the trachea after resection of stenotic part with rhinotracheal intubation through the anastomosis).

Ventilation was initially maintained by oro-pharangeal endotracheal tube above the stenotic site. Ventilation was later maintained by cross-field endotracheal tube placed in the distal tracheal tract when resection of stenotic segment of the trachea was done and the tube was withdrawn. The tube was removed when the anastomosis completed and rhino-tracheal tube was placed in through the anastomosis and the suture knots were tied outside. In patients with pre-existing tracheostomies, the stoma was resected with the stenotic tract.

The neck is flexed during tracheal anastomosis and heavy sutures were used post-operatively to tie the chin to the chest skin with neck in hyperflexion.

Results:

The mean score obtained for all patients was 9.44 (range 9-11) (Table 2) and the surgical reconstruction performed in all 16 patients. The outcome of the patients and the state of their respiration were analyzed at discharge time from the hospital and at 3 months intervals. The result was classified as excellent, good, satisfactory and failure according to patient usual activities and phonation with bronchoscopic assessment of the size of the anastomosis site. The average length of follow-up in our patients was 3.6 years. The result was excellent in 10 patients (62.5%) as they were able to perform normal daily activities, and endoscopically the patency of airway was of 90-100%; in 4 patients (25%), the result was good as they did the usual daily activities normally with airway patency of 70-80%. Tow patients (12.5%) had satisfactory result as they were able to perform daily activities but had dyspnoea on stress and exertion. No failures were in our series.

Table 2. Scores of 16 patients

Patients	Diameter of stricture \ score	Type of stenosis \score	Clinical symptoms\ score	Total
1	3	2	4	9
2	2	3	4	9
3	3	3	4	10
4	3	3	4	10
5	2	3	4	9
6	2	3	4	9
7	3	3	4	10
8	3	3	4	10
9	3	2	4	9
10	3	2	4	9
11	4	3	4	11
12	2	3	4	9
13	3	2	4	9
14	3	2	4	9
15	3	3	3	9
16	3	4	3	10

Post-operative complications occurred in 4 patients (25%), restenosis occurred in 1 patient (6.2%) who was treated successfully with bronchoscopy and dilatation using carrot head dilators. Superficial wound infection occurred in 2 patients (12.5%) and was dealt with by drainage, daily dressing and appropriate antibiotics. One patient (6.2%) had temporary vocal cords oedema that mandated reintubation and mechanical ventilation with heavy parentral steroid therapy for 24 hours and extubation was done successfully in the next day.

No mortality in our series; all patients were discharged at 15^{th}- 20^{th} post-operative day. All patients had flexible endoscopic examination before discharge. Rigid bronchoscopic examination under general anesthesia was done on follow-up at 3 months and fiberoptic bronchoscopy was done every three months for two years of follow-up.

Discussion:

The causes of tracheal stenosis in all our patients were post intubation and tracheostomy. This have been well established by many authors as a leading causes of tracheal stenosis [3,4,9,11].

Pre-operative assessment had been done including full history, thorough physical examination, bronchoscopy and C-T scan to find the exact location of the stenosis, its length, the presence or absence of inflammation and oedema at the site of stenosis and its border. Rigid bronchoscopy was performed in all patients; and we agree with others that bronchoscopy is the best pre-operative diagnostic procedure to evaluate the state of tracheal stenosis [3,12]. Pulmonary function tests are usually not necessary in the diagnostic workup of the patient, as they may provide an insight on the functional limitations of the patient[13,14]

Computed tomography with saggital and coronal sections gave useful information about the stenosis. It delineates the airway below the stenosis, which cannot be assessed by bronchoscopy. It also gives an idea of the cartilagenous support and the surrounding structures, in spite that other authors suggest that it does not add further information to rigid bronchoscopy findings [12,16].

The mean score obtained for all patients was 9.44 (range 9-11). This means that they had significant stenosis that requires surgical reconstruction. This is compatible with the grading system proposed by Ghorbani A. *et al*, who suggested that surgical treatments are required for every patient with a score over 8.5 [10].

In the surgical technique, we used the basic principles of the tracheal reconstruction introduced by authors with large experience [3-5,7,12,17]. These principles include avoidance of anastomosis tension, maintenance of tracheal blood supply and preservation of recurrent laryngeal nerve with careful and meticulous dissection and anastomosis. We adopted interrupted Vicryle sutures for anastomosis (2-0 or 3-0) in all patients.

Our results were excellent in 62.5%, good in 25% and satisfactory result in 12.5%, with no failure in our series. This remarkable result is due to the adoption of the suggestions by the expert authors [3,12,17].

No major complication observed with our patients. One patient developed vocal cord oedema that was managed successfully by reintubation for 24 hours. Two patients developed superficial wound infection, which was managed by conservative treatment (wound debridement, daily dressing and antibiotics) and achieved complete healing in both of them. One patient developed restenosis a month after surgery; this was also managed successfully by bronchoscopic dilatation.

No adjuvant therapy (like local injection of mitomycin or other substances) was used post-operatively, because it not found in our locality and we have no experience with it.

In conclusion, laryngotracheal stenosis, despite all measures to avoid its occurrence, remains one of the serious problems following tracheostomies and endotracheal intubations.

According to our results, we confirm that surgery is the best way to treat the benign laryngotracheal stenosis.

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