

# MEDIASTINAL TRACHEOSTOMY IN TEHRAN IMAM KHOMEINI'S HOSPITAL FROM JANUARY 1991 TILL DECEMBER 2000

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**Abstract-** Mediastinal tracheostomy is a complex surgical procedure for the management of airway reconstruction in patients whose distal trachea is not sufficiently long to be reconstructed as cervical tracheostomy after tracheal resection for malignant diseases. In this article (study), we present our 10 year experience of this uncommon procedure in thoracic surgery ward of Imam Khomeini's Hospital, Tehran. Sixteen patients (87.5% male, 12.5% female, 58.4±1.4 y/o) underwent this procedure because of thyroid cancer (31.3%), SCC of cervical trachea (12.5%), postcricoid esophageal cancer (12.5%), and laryngeal cancer (43.8%). The procedure was associated with cervical exenteration in 12.5% and total laryngectomy (44%), thyroidectomy (6.2%), laryngopharyngoesophagectomy (12.5%), resection of neck mass (18.5%) and repair of cervical esophageal fistula with myocutaneous flap (6.2%). They had history of total thyroidectomy (25%), total laryngectomy (25%), cervical tracheostomy (13%), and hemi-laryngectomy (6%). Six percent of patients died because of uncontrolled intraoperative hemorrhage, and 94% were complicated with postoperative hypocalcemia (31%), osteomyelitis (13%), fistula (13%) and necrosis of the flap (13%).

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## INTRODUCTION

One of the most important lifesaving measures is establishment of a secure airway for respiration. Pulling up the mediastinal trachea over the sternal notch after retrosternal tracheal resection (RTR) for construction of a standard tracheostomy is almost impossible. Radical operations involving both cervical esophagus and trachea in many conditions

such as recurrence of laryngeal cancer after laryngectomy, invasion of the trachea with advanced thyroid, laryngeal or esophageal cancer, hypopharyngeal cancer, and advanced cancers of cervicothoracic trachea or esophagus mandate a RTR procedure with mediastinal tracheostomy (1).

Mediastinal tracheostomy (construction of tracheostomy stoma with intrathoracic trachea) is a complex procedure that may be lifesaving in some patients and offers tremendous palliation for others (2). Because of the complexity of the operation, its justification is warranted only when it can be performed safely.

Although the chance of cure in these patients is minimal due to the nature of the underlying problem,

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it improves the quality of life and suggests a good palliation for the patient (2, 3). In this procedure, sternal manubrium, medial one third of the clavicles, parts of first and second ribs with their costal cartilage are resected and the skin flap is anastomosed to the remaining trachea in the depth of anterior mediastinum. If both laryngopharyngectomy and esophagectomy are performed simultaneously then the gastrointestinal continuity is reconstructed with gastric pull-up or colon interposition.

The most dangerous complication of this procedure is tracheoinnominate fistula which can be prevented by prophylactic ligation of the artery, use of omentum or muscular flaps as interposition grafts or transposition of the trachea to the right side of the artery (4-6). Transposition of the trachea beneath and to the right side of the artery is both safer and more effective than other procedures because it eliminates all the tension on the vessel (3, 6, 7).

In this study we reviewed our experience and technique for removal of tumors in this region and our method of this procedure in Tehran Imam Khomeini's hospital in a ten year period from Jan 1991 to Dec 2000.

## MATERIALS AND METHODS

All the registered patients who underwent mediastinal tracheostomy from Jan 1991 till Dec 2000 in thoracic surgery ward of Tehran Imam Khomeini's Hospital were included in this retrospective descriptive study.

The data were collected through an inquiry from patients' files and analyzed statistically using computer-based statistical software SPSS version 11.5. All of the tumors were amenable to surgical resection based on preoperative esophagography, bronchoscopy, and computed tomography (CT) scans of the neck and mediastinum. All of the patients were considered acceptable candidates for radical surgery with routine functional assessment of vital organs.

### Operative technique

Unless there is a need to resect anterior cervical skin involved by the tumor, anterior mediastinal

tracheostomy and cervical exenteration including laryngopharyngectomy can be performed through an extended cervical collar incision, essentially a long transverse supraclavicular incision. After elevation of a flap of anterior cervical skin and platysma to the level of hyoid bone, beginning on the side most involved by tumor, the anterior border of sternocleidomastoid muscle and carotid sheath are mobilized and retracted laterally and the trachea and thyroid medially. The dissection is carried directly posteriorly through the cervical fascial planes to the prevertebral fascia. Mobility of the tumor away from the carotid vessels and lack of prevertebral fascial invasion are established as blunt finger dissection proceeds downward along prevertebral fascia into the superior mediastinum and upward behind the pharynx. The opposite side of the neck is explored in similar fashion, and resectability of the tumor established. To achieve the exposure necessary for resection of the upper anterior chest wall, skin overlying the upper sternum, medial clavicles, and second costal cartilages must be elevated (2, 3, 6).

The insertion of sternocleidomastoid and strap muscles onto the sternum and clavicles are divided and high retrosternal space is developed by blunt finger dissection during which the pleural reflections are gently swept laterally. Pectoralis major muscles are elevated from chest wall bilaterally in the midline, exposing the clavicles, manubrium, and first and second costal cartilages.

Avoiding injuring the subclavian and internal mammary vessels, each clavicle is encircled and divided with a Gigli saw, approximately 4-6 cm from the sternoclavicular joint. Then first and second ribs are divided with transverse division of sternum at manubriosternal junction, and breast plate resection is then completed. The plane between the trachea and esophagus distal to the palpable tumor is developed and the trachea is encircled at this point with a rubber drain. When a concomitant esophagectomy is to be performed, the esophagus is also encircled with a rubber drain at the same level (1-3). Through an upper midline abdominal incision, gastric mobilization, pyloromyotomy, Kocher maneuver, feeding jejunostomy, and transhiatal esophageal mobilization are performed. Distal tracheal mobilization is performed only anteriorly

and posteriorly to the trachea to minimize the risk of devascularization from injury to the lateral blood supply. The trachea is divided obliquely, the posterior membranous portion left longer than the anterior cartilaginous edge. When the trachea is divided, the distal trachea is intubated across the field with a flexible armoured tube. The stomach is advanced through the posterior mediastinum and delivered into the neck. Whenever possible along with achieving an adequate margin of resection, one or both of the thyroid lobes and the adjacent parathyroid glands should be preserved. Alternatively, identification of one or two parathyroid glands with gentle mincing and reimplantation into the exposed pectoralis major muscle may prevent long-term postoperative iatrogenic hypoparathyroidism.

The mobilized pectoralis major muscle is allowed to fall back over the cut edges of the sternum and first and second ribs (3). The tracheostomy is generally incorporated directly into the cervical incision as the wound is closed. It must be determined if there is any tension against the innominate artery as the end of the trachea is brought anteriorly and approximated to the skin. If there is any tension, the space beneath and to the right of innominate vessels is developed bluntly, and the trachea is repositioned beneath the innominate artery. This maneuver of tracheal repositioning completely eliminates the risk of later erosion of the artery by the adjacent trachea (2-4). In patients with tracheal stomal recurrences after prior laryngectomy or a malignant pharyngocutaneous fistula above an established tracheostomy, a wide portion of anterior cervical skin must be excised en bloc with the specimen. In such situations a thoracoacromial or nipple flap is used to resurface the anterior neck and mediastinum (1, 3). After completion of pharyngogastrostomy, the thoracoacromial flap is rotated superiorly and medially over the anterior neck and mediastinum, and the tracheostomy is reconstructed.

The skin defect is covered with a split thickness skin graft harvested from the lower abdomen (2, 3, 4).

ALL data were analyzed by SSPE software version 10.

## RESULTS

Sixteen cases were reviewed in this period, 14 (87.5%) males and 2 (12.5%) females. The average age was  $58.4 \pm 1.4$  year (range 50-65 year). Thyroid cancer (papillary and follicular) (31.3%), cervical tracheal squamous cell carcinoma (SCC) (12.5%), postcricoid cervical esophageal SCC (12.5%), and laryngeal SCC (43.8%) were the presenting underlying diseases. Chief complaints were dyspnea (69%), dysphonia (56%), cervical mass with serosanguinous discharge (25%), dysphagia (19%), esophageal cervical fistula (6%), and recurrent laryngeal tumor (6%) in order of frequency. The main procedure before mediastinal tracheostomy was: total laryngectomy (44%), resection of recurrent cervical mass with sternal manubrium (18.5%), laryngo-pharyngo-esophagectomy (LPE) (12.5%), total thyroidectomy (6.2%), repair of esophageal fistula with pectoralis major myocutaneous flap (6.2%), and total cervical exenteration (12.5%). All of the patients underwent mediastinal tracheostomy because of shortness of distal tracheal remnant after the main procedure. 31.3% of the patients had no previous surgery but others had undergone total thyroidectomy (25%), total laryngectomy (25%), cervical tracheostomy (13%), and hemilaryngectomy (6%),  $25 \pm 4.4$  months (20 days- 48 months) before the main surgery.

One of the patients (6.2%) died during the operation because of uncontrollable hemorrhage. All other patients were discharged with satisfactory oral food intake and good airway condition. 11 patients were complicated by postoperative hypocalcemia (31.2%), osteomyelitis (12.5%), flap necrosis (12.5%), and peristomal fistula (12.5%).

There was no tracheoinnominate fistula and no respiratory failure and maximum ventilatory support was less than 3 days. The average length of hospital stay was  $20.6 \pm 2.2$  days (range 10 to 30 days). Postoperative hypocalcemia was treated with calcium and vitamin D<sub>3</sub> supplements and those who had osteomyelitis were treated with broad-spectrum antibiotics and multiple debridement sessions. Unfortunately we could not follow-up the patients to determine their long-term survival.

## DISCUSSION

Mediastinal tracheostomy is the last procedure to save the patients who have a short distal tracheal remnant after surgical resection of the larynx and proximal trachea (8). The difficulty associated with this operation and its sometimes fatal complications could lead the surgeons to avoid it. Because of the complexity of the operation, its justification is warranted only when it can be performed safely. With a successful outcome, the functional result is the equivalent of a laryngectomy (4).

In 1984 Neifeld *et al.* reported this procedure in 11 patients (9). Orringer and his colleagues are among those surgeons who attempted this procedure successfully for the first time. In his largest case series of these patients he represented 44 cases of anterior mediastinal tracheostomy (AMT), 10 as an isolated procedure (for stomal recurrence, laryngeal carcinoma, or benign stenosis after laryngectomy) and 34 with concomitant cervical exenteration (laryngo-pharyngo-esophagectomy) for laryngeal, thyroid, or cervicothoracic esophageal malignancies. Transposition of the innominate artery was performed in 14 of them (2). Two years before Orringer, Grillo published his experience with eighteen cervical exenterations of whom 14 patients underwent AMT and division of the innominate artery was performed in 7 (1). In 1994, Kato *et al.* reported 16 patients who underwent AMT after pharyngo-laryngo-esophagectomy for carcinoma in the cervicothoracic esophagus, among them seven patients underwent transhiatal esophagectomy without thoracotomy, four proximal esophagectomy by cervicotomy and sternal split, and five cervical and thoracic esophagectomy and lymphadenectomy by cervicotomy and right thoracotomy (10). Maipang presented his experience with twelve mediastinal tracheostomies in 1996 with 2 operative deaths, 1 from tracheoinnominate artery fistula and the other from cerebral infarction (3). Number of the patients in our case series is comparable with these reports. We had only one in-hospital mortality (6.3%) due to uncontrollable bleeding during the procedure. The mortality in the mentioned studies varied between 5.5% (1) to 18.8% (10). In newer series that use omental or several different types of

myocutaneous flaps for reinforcement of the trachea, main arteries, and the anastomosis, the mortality is as low as 0% (4, 11).

Eleven (67.7%) of our patients had been complicated. The major complications in 6 of them were osteomyelitis, peristomal fistula, and flap necrosis. Cervical exenteration was performed only in 12.5% of our patients and this might have resulted in lower in-hospital mortality but the long-term survival, which is not mentioned in our survey, may be adversely affected by this. Rate of complications in our study is not comparable with the above mentioned studies, because other factors such as age and sex of the patients, type of the disease, extensiveness of the procedure, or number of previous surgeries are not considered and may affect the rate of complications. Average age of our patients was  $58.4 \pm 1.4$  years (50-65 years) and 87.5% of them were male but in the Grillo's study only 56% of patients were male, or in the Orringer's study 77% of the patients underwent total cervical exenteration.

Our study is only a limited descriptive study, but it is the first time in Iran that this procedure is reported in a rather acceptable series. In our opinion if this procedure can be performed safely, it will dedicate substantial palliation to the previously considered end-stage patients at least for a short period. But this requires high skill and delicate surgical technique and serious efforts for postoperative care from medical team. Therefore it must be only the last procedure for those patients whose distal trachea is too short and is not suitable for other more formal procedures because of its devastating complications.

### Conflict of interests

We have no conflict of interests.

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