

## RESEARCH ARTICLE

# Blocked Voice Prosthesis: A Common Complication Reducing the Prosthesis Longevity

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## ABSTRACT

**Background/Objectives:** Mechanical prosthetic valve rehabilitation after total laryngectomy have a success rates of 90% in restoring voice. The effective speech is achieved better with mechanical voice prosthesis when compared to esophageal speech and electrolarynx. Candidal growth and tubal blockage are the commonest cause of peri and endotubal leakage causing prosthesis failure.

**Case report:** A 50-year-old male who had undergone wide field laryngectomy with primary tracheoesophageal puncture (TEP) with voice prosthesis 18 months back complained of blocked voice prosthesis and peritubal leakage. The tip of the cleaning brush which had blocked the opening was removed in the outpatients under topical anesthesia and the peritubal block reduced.

**Conclusion:** Mechanical valve prosthesis rehabilitation after primary tracheoesophageal puncture is the standard voice rehabilitation of laryngectomized patients. Patient education regarding maintenance of the prosthesis and the care for the tracheostoma is important in reducing the complications.

**Keywords:** Voice prosthesis, Tracheoesophageal puncture (TEP), Prosthesis brush, Peritubal leak.

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## INTRODUCTION

Surgical procedures for obtaining pulmonary voice came to the rescue of total laryngectomy patients who had complete voice loss.<sup>1</sup> These procedures had high complication rates with aspirations of pharyngeal contents into the airways.<sup>1</sup>

To overcome these complications mechanical valve devices inserted into the tracheoesophageal mucosa began to be used with the aim of obtaining an acceptable voice and also to prevent to prevent aspiration of saliva and food particles.<sup>2-4</sup> Mechanical prosthetic voice rehabilitation after total laryngectomy has proven to be successful in restoring proper speech function in over 90% of patients and is nowadays the method of choice in most developed countries.<sup>5,6</sup>

Mechanical voice prosthesis is a silicone device placed in a fistula created through the tracheoesophageal wall either at the time of the primary operation or later as a second stage independent procedure.<sup>7</sup> Effective speech production using the voice prosthesis is superior to the esophageal speech and electrolarynx.<sup>8,9</sup>

The average life of the prosthesis is 3 to 14 months and the common problems recommending a prosthesis replacement are incompetence of the prosthesis or tracheoesophageal puncture, the deterioration of the prosthesis due to fungal colonization, the emergence of mucoid crusts that impede a correct functioning and granulomas in the fistular path or tracheal mucosa.<sup>1,10</sup> Also noted are persistent fistula inadequate to prosthesis diameter, cervical cellulitis, necrosis of the tracheoesophageal mucosa, stomal stenosis and dysphagia and granulomas in the orifice of the fistulas are seen in 5 to 10%.<sup>1</sup>

Prosthesis speech is rated to be of enhanced quality with better intelligibility, higher restoration and longer phonatory time which seem to be unaffected by age or radiotherapy.<sup>11</sup> These factors make TEP with prosthesis speech superior over the mechanical intonation of electrolarynx speech and the simplicity of training is preferred over the largely complex rehabilitation using esophageal speech.<sup>11</sup> TEP prosthesis speech was initially advocated for esophageal or electrolaryngeal speech failed patients.<sup>11</sup>

Later it has evolved as a current standard in voice rehabilitation of alaryngeal patients performed at the time of total laryngectomy.<sup>11</sup> Primary TEP introduction is more widely preferred over secondary as the provision of voice much earlier after the laryngectomy whereas reacquisition in secondary TEP is delayed after completion of subsequent adjuvant treatment like radiotherapy or chemoradiotherapy.<sup>11</sup> We report a case of blockage of the prosthesis by the broken

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impacted cleaning brush used to clean it which was successfully removed at the outpatients.

## CASE REPORT

A 50-year-old male who had undergone wide field laryngectomy with primary TEP and prosthesis implantation 18 months back came for follow-up with history of blocked prosthesis. Earlier he had come with 3 months history of difficulty in swallowing and change in voice where he was diagnosed as tumor in the left pyriform fossa under mirror examination.

X-ray soft-tissue neck revealed irregular soft-tissue opacity seen in the pyriform fossa extending into the aryepiglottic fold and epiglottis. Rest of the soft-tissues were normal and anterior osteophytes were seen (Figs 1 and 2). 2D echocardiography and color Doppler study were normal with normal LV function and wall motion.

On contrast enhanced CT neck a large well-defined homogenous enhancing soft-tissue attenuating mass lesion was seen in the left pyriform fossa with pre-epiglottic space extension, thyroid cartilage infiltration with extension to the strap muscles. The lateral wall of the fossa was spared with no subglottic extension. Left sided level II, III lymphadenopathy were seen. Ultrasound guided translaryngeal fine needle aspiration biopsy revealed squamous cell carcinoma with spindle cell morphology.

Direct laryngoscopic evaluation and frozen section analysis showed poorly differentiated squamous cell carcinoma in the left pyriform fossa, later proceeded with tracheostomy and wide field laryngectomy. Intraoperatively interjugular clearance was done with preservation of the right thyroid. Primary TEP was done after cricopharyngeal myotomy.

Voice prosthesis was placed and the neopharynx created with three layers T closure.

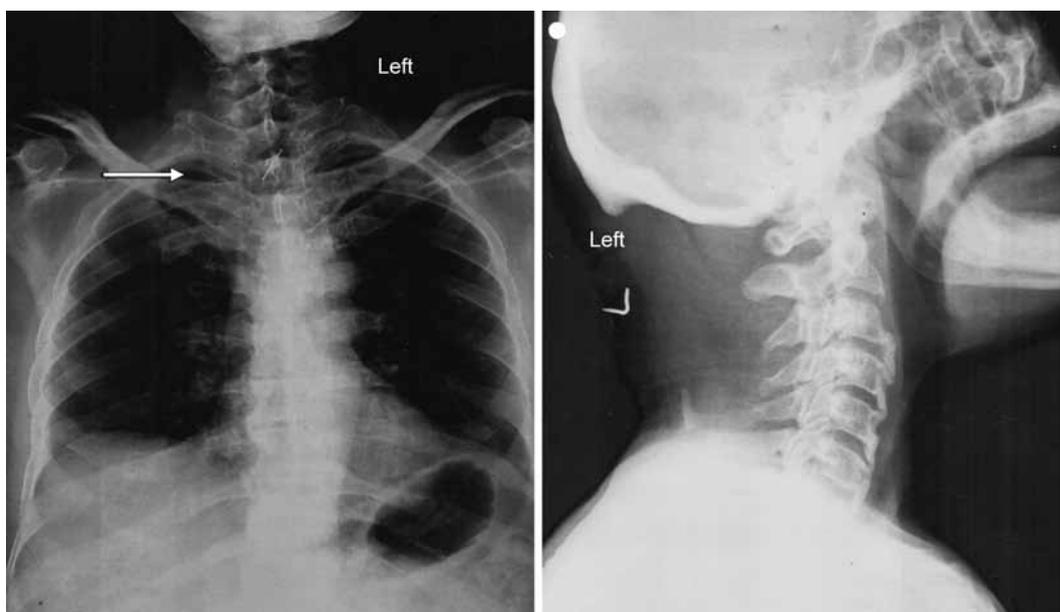
Histomicroscopic examination reported squamous cell carcinoma Grade I of the left pyriform fossa. All the cut margins were free of the tumor. Left paraglottic space was involved, epiglottic and pre-epiglottic adipose tissue was free of tumor. Thyroid and cricoids cartilages and the thyroid glands were free of tumor. All the level II and III and the para and pretracheal lymph nodes were not involved by tumor. The patient was advised postoperative radiotherapy with intensity modulated radiotherapy 66 gy over 33 fractions with five cycles of chemotherapy. Five cycles of intravenous carboplatin 150 mg weekly were given.

He received speech therapy and voice rehabilitation and was going well till recently he had blocking of the voice prosthesis while cleaning and later developed a peritubal leak. Plain X-ray chest revealed the piece of the brush used for cleaning to be lodged in the prosthesis and blocking it. Also, the metal wire of the brush to be visible in the stomal opening.

After applying topical anesthesia the tip of the metal wire brush was removed using a curved artery forceps (Fig. 3). The patient was advised cleaning of the prosthesis by a new brush and advised nystatin mouth gargles for a week. Follow-up with regular cleaning of the prosthesis with the antifungal gargles reduced the peritubal leaks and made the prosthesis functioning.

## DISCUSSION

Voice and communication skills rehabilitation after total laryngectomy has been revolutionized by the widespread use of mechanical voice prostheses.<sup>2-4</sup>



**Fig. 1:** Foreign body seen in the mechanical prosthesis in the tracheoesophageal puncture area



Fig. 2: Foreign body, the broken cleaning brush seen



Fig. 3: Removal under topical anesthesia in the outpatients

Total laryngectomy represents a significant burden on patients function and cosmesis but the greatest concern is the profound impact on phonation.<sup>10</sup>

Rehabilitation is aimed at diminishing psychological and social distress with ensuring improvement of quality of life.<sup>12-14</sup>

The results obtained through the use of these voice prostheses have been increasing steadily and currently reach over 70% effectiveness.<sup>15,16</sup> Alaryngeal patients are rehabilitated by electrolaryngeal speech, esophageal speech and tracheoesophageal speech via TEP and mechanical voice prosthesis.<sup>10</sup> Electrolarynx needs lesser expertise but gives a mechanical tone to the voice produced.<sup>10</sup> Esophageal

speech requires great patient motivation in mastering the technique.<sup>10</sup> Mechanical voice prosthesis introduced after TEP is a silicon based semipermanent implant requiring occasional replacement.<sup>10</sup>

The new generation prosthesis with an average lifespan of several months only can be replaced at the outpatients and less than 3% of patients require general anesthesia for this change.<sup>1,17</sup> Complications are minimal which include colonization of the pharynx with *Candida* causing leakage around the prosthesis, displacement, intractable aspiration of secretions, granulation tissue, tracheostomal stenosis and widening of the tracheoesophageal fistula.<sup>18</sup>

Periprostheses leakage is reported to the extent of 73% and seen in both primary and secondary may be due to tracheoesophageal wall thinning or fistula widening.<sup>10</sup> Also increased diameter of the fistuloplasty compared to that of the prosthesis is reason behind periprosthetic leaks.<sup>19,20</sup> Periprosthetic leak can be managed surgically but endoprosthetic leaks needs a change of prosthesis.<sup>21</sup>

Periprosthetic granulation tissue is also a common complication seen in 7 to 17.4% of voice prostheses carriers which can be corrected with resection or vaporization of hypertrophic tissue by silver nitrate application or KTP or CO<sub>2</sub> laser.<sup>22</sup> Cheng et al did not find any significant difference with respect to complications between primary and secondary TEPs prosthesis in their 68 cases retrospective study.<sup>23</sup> They noted prosthesis failure when a leakage through it was seen and fistula widening or thinning when leak around it was seen.<sup>24,25</sup> Candidal biofilms on the esophageal surface of the prosthesis is the main cause of valve loosening and leakage requiring replacement.<sup>26</sup> Nystatin suspension cleaning of the prosthesis to limit *Candida* colonization which cause blockage and leaks, purse string suturing around the fistula are also advised however their efficacy are doubtful.<sup>26</sup>

Tracheostomal stenosis seen in 28% causing difficulty in prosthesis cleaning warrant stomal revision.<sup>10</sup> Stenosis are more seen in females with small diameter trachea, also depend on technique of tracheal resection, infection at the mucocutaneous junction scarring.<sup>10</sup> Prosthesis aspiration in the tracheobronchial tree is seen in 0.75 to 13%.<sup>10</sup>

Reports of multiple episodes of bronchial aspiration of the prosthesis necessitating bronchoscopic removal of the foreign body have been reported.<sup>10</sup> Poor selection of the size of the prosthesis and fistula widening seen in 20 to 39% were responsible for these aspiration.<sup>25</sup> Replacement should be always done by the surgeon only and never by the patient.<sup>7</sup> The puncture site should be closed in cases of intractable leakage, recurrent prosthesis dislodgement with bronchial aspiration, phonatory failure and persistent severe pain.<sup>10</sup>

Chone, Casso and Boscolo-Rizzo, et al in their independent studies reported no significant influence of radiotherapy on the success rate on primary or secondary TEP.<sup>27-30</sup> Norsuhaznah et al reported postoperative radiotherapy have an increased tendency for developing complications.<sup>10</sup> Primary TEP following salvage laryngectomy is a significant risk factor for pharyngocutaneous fistula in post chemoradiotherapy patients.<sup>10</sup>

A laryngectomized patient with a permanent tracheal stoma should realize that the stoma is now part of their airway and it renders direct and easy access to their lower tracheobronchial tree, and also increases the risk of aspiration.<sup>31</sup>

Patients should also know that the negative intrapleural pressure gradient that is generated during deep breathing or paroxysms of coughing may cause aspiration of an object held loosely around the stoma.<sup>32</sup> Careful handling of objects around the stoma after laryngectomy is important in preventing complications.<sup>31</sup> Xerostomia induced by radiotherapy reduce prosthesis lifespan as it decreases antibacterial and antifungal salivary peptides, which increases the chance of biofilm formation.<sup>26</sup>

Trudeau et al, Artázkoz del Toro and López Martínez found no difference in lifespan of prosthesis in patients with radiotherapy or those without.<sup>33,34</sup> Pattani et al found existence of gastroesophageal reflux and the development of granulation tissue leading to leaks.<sup>35</sup> Good results were obtained with aggressive antireflux therapy.<sup>35</sup>

TEP with prosthesis can be done primarily at time of total laryngectomy or later as a secondary procedure.<sup>27</sup> Primary has a better success rate with immediate reacquisition of speech.<sup>27-30</sup> Success rates on a long-term basis is defined as use of TEP speech consistently for the majority of verbal communication and literature is 78 to 96% in primary and 70 to 75% in secondary.<sup>27-30</sup> Short-term success rates defined as the immediate acquisition of intelligible speech is 67 to 100% in primary TEP and 50 to 100% in secondary TEP.<sup>27-30</sup>

The patients with secondary TEP use the prosthesis for longer duration compared to primary as the earlier have completed treatment and are observed for longer time with more motivation and lower expectations of normal voice acquisition.<sup>36</sup> Foreign bodies can be aspirated like nuts, vegetable matter, bones, metal and plastic objects, pills, safety pins, turban scarf pins, plastic spoons, fishing weight, cockroaches, straight pin and small plastic objects.<sup>31</sup>

Removal of these aspirated foreign bodies are usually done by rigid bronchoscopy and sometimes removal may be difficult in permanent stoma, with a high percentage of these requiring a thoracotomy, especially for the removal of sharp objects such as pins, wild barley, coarse cloth or a fractured tracheostomy tube.<sup>37</sup>

Initial flexible bronchoscopy may be tried if the FB is higher and sometimes even rigid bronchoscopy may be risky officiating the need for open surgery.<sup>31</sup>

Flexible bronchoscopic removal can be done easily under local anesthesia with 86 to 90% success rates.<sup>38,39</sup> Technical improvement with videobronchoendoscopy, a broad variety of forceps and safer anesthesia has reduced the post bronchoscopic removal complication to less than 5%.<sup>31</sup> The aspiration of the prosthesis to the bronchial tree and its intake into the digestive system have also been described, along with the emergence of local abscesses or infectious mediastinitis associated with TEP.<sup>5,40</sup>

## CONCLUSION

Mechanical valve prosthesis rehabilitation after primary TEP is the standard voice rehabilitation of laryngectomized patients. Patient education regarding maintenance of the prosthesis and the care for the tracheostoma is important in reducing the complications. The fistula arising from prosthesis dislodgement should be managed promptly to reduce subsequent morbidity.

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