



Case Report

3D Silicone Prosthesis in the Management of a Large and Late Tracheoesophageal Fistula Following Primary Puncture in a Laryngectomee

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Abstract

We are describing a case of a large tracheoesophageal fistula that occurred six years following primary tracheoesophageal puncture and total laryngectomy. The patient has been admitted many times to ICU due to aspiration pneumonia. He was managed by 3D printed silicone prosthesis. The prosthesis did not allow him to eat through the mouth, however it decreased the frequency of ICU admissions.

Keywords: Tracheoesophageal; 3D Printed Silicone Prosthesis; laryngectomy; Hyperbaric Oxygen Therapy; Fistula.

Introduction

Voice restoration following total laryngectomy with tracheoesophageal puncture and voice prosthesis is the procedure of choice since it's simple, cost-effective, and easy to learn good quality voice. Several studies have demonstrated its superiority to alternative methods of voice restoration, such as esophageal speech and electrolarynx [1, 2]. However, it is not free of problems which are reported by various authors including leakage around or through the prosthesis, prosthesis displacement, intractable aspiration of secretions or oral intake, bronchial aspiration of the prosthesis, granulation tissue formation, tracheostomal stenosis and widening of the tracheoesophageal fistula [3]. Speech and language specialists are well trained to take care of most of these complications with surgical referral for intractable cases mostly widened TEF after the failure of conservative measures.

Case Report

A 65-year-old male patient, who underwent total laryngectomy and bilateral neck dissection for T4aN1M0 squamous cell carcinoma of supraglottis with adjuvant radiotherapy, also had neck radiotherapy as part of treatment of lymphoma 16 years prior to the diagnosis of laryngeal cancer. The patient was exhibiting swallowing and was able to produce voice very efficiently for about five years post total laryngectomy, then a leak around the voice prosthesis started which was managed by increasing the size of the voice prosthesis, then by using an extra flange then NG tube was inserted and workup to rule out recurrence was done including neck MRI, PET CT scan, which showed no cancer recurrence. The patient ended with a huge tracheoesophageal fistula (Figure 1). The patient was admitted 5 times to ICU with aspiration pneumonia. A gastrostomy tube was inserted, hyperbaric oxygen therapy (HBO) was given and this resulted in stopping the enlargement of the fistula. A Delto pectoral flap was used to close the fistula but unfortunately failed. Thus, a silicone prosthesis was constructed to maintain the natural separation between trachea and the oesophagus.



Figure 1: Left cross-sectional radiological view of the fistula (A) and top view (B).

The patient CT scan of Tracheo-Oesophageal area was processed using specialized biomedical software (CMF Pro Plan, Materialise, Leuven, Belgium) to produce a three-dimensional (3D) virtual model of the patient's trachea and then was cut into two parts. The two parts were exported as standard triangular language files (STL) and were 3D printed using a 3D printer. The 3D models were marked with the design of the medical device (Figure 2).

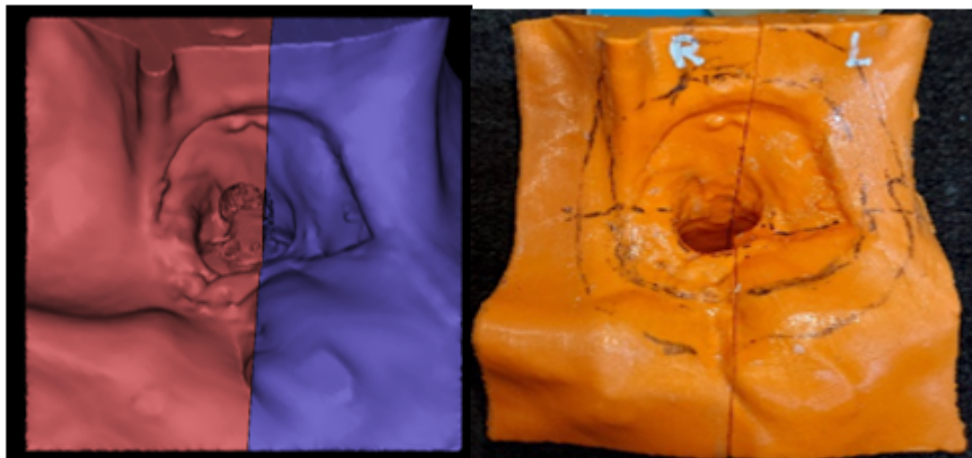


Figure 2: Virtual and 3D models of the defect area respectively (A & B).

A wax prototype of the medical device was produced by manual wax-up according to the markings made (Figure 3).

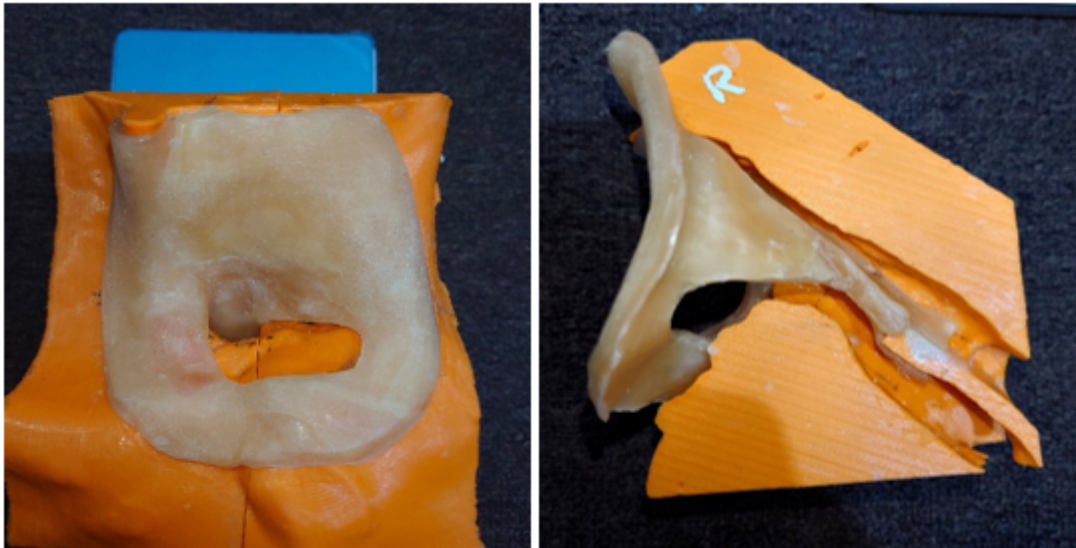


Figure 3: Wax prototype of the medical device; frontal and cross-sectional views (A&B).

Then, it was processed into biomedical silicone elastomer (M511, Technovent, UK) following the lost wax technique which was then fitted in situ without any issue (Figure 4)



Figure 4: Final silicone prosthesis in In-situ.

Discussion

The overall risk of enlarged puncture seems relatively low, less than 10 %, but it remains a rehabilitative challenge [4]. With significant morbidity, pneumonia occurrence at a rate of 4.5 % was reported by Acton, et al. and Bień S, et al. did not find a difference in voice prosthesis related complications between irradiated and non-irradiated patients [5,6]. Hutcheson, et al. in their meta-analysis found the most commonly reported method of management of dilated is conservative with the temporary removal of voice prosthesis with or without catheter insertion to allow for the fistula to narrow, various methods were described in Lettuce in management of this complication including various injection material to narrow the fistula: autologous fat, Hylaform® (Inamed, Santa Barbara, Calif., USA) gel injection, Cymetra TM (Lifecell, Branchburg NJ, USA) [4,7-9]. Silicon button insertion, cautery with silver nitrate, or electrocautery, to various surgical options [10,11].

In our case, all conservative measures failed to help, and due to frequent ICU admissions with pneumonia and due to its relatively huge size we tried HBO with help a lot to stop progressive enlargement, and full nutritional support with surgical correction all failed so we tried the use of 3D silicon prosthesis to prevent aspiration, it helped in decreasing the frequency of aspiration pneumonia.

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