The use of heterologous bovine pericardium in the surgical treatment of large tracheo-oesophageal fistulas and dilaceration of the membranous wall of the trachea.

Case report

Ann Ital Chir, 2018 89, 5: 461-464
pii: S0003469X18026544
Epub Ahead of Print 10 July 2018
free reading: www.annitalchir.com

Bogdan Andrei Suciu*, Ioana Hălmaciu**, Vasile Bud*, Decebal Fodor*, Vlad Vunvule***, Klara Brînzaniuc**, Constantin Copotoiu*, Călin Molnar*

**1st Surgical Clinic, University County Hospital Mureş, University of Medicine and Pharmacy Târgu Mureş, Romania*
***Department of Anatomy, University of Medicine and Pharmacy Târgu Mureş, România*
****Student, University of Medicine and Pharmacy Târgu Mureş, România*

The use of heterologous bovine pericardium in the surgical treatment of large tracheo-oesophageal fistulas and dilaceration of the membranous wall of the trachea. Case report.

The tracheo-oesophageal fistula is a severe condition endangering the patients' live. The main cause of this condition is the prolonged ventilation. The purpose of this paper is to present an innovative technique in treating this affection.
CASE REPORT: *We present the case of a 32 years old female patient with multiple trauma due to traffic accident. The patient was hospitalized with the diagnosis of brain injury, subarachnoid hemorrhage, and fractured femur. After 11 days of mechanical ventilation and intubation via endotracheal route, the patient was diagnosed with a large (7x3 cm) tracheo-oesophageal fistula with dilaceration of the membranous wall of the trachea. A cervical and right thoracic approach was performed to repair the tracheo-oesophageal fistula. The reconstruction of the membranous wall of the trachea was performed by using heterologous bovine pericardium patch, and the of the esophageal defect using single-layer suture protected by a heterologous bovine pericardium patch. The postoperative evolution was favorable, the patient being discharged 22 days postoperatively and in good health after 6 months.*
To our knowledge this is the first reported case regarding the use of two heterologous bovine pericardium in the surgical treatment of large tracheo-oesophageal fistula with dilaceration of the membranous wall of the trachea to reconstruct the membranous wall of the trachea and to protect the esophageal suture.

KEY WORDS: Heterologous bovine pericardium, Trachea-oesophageal fistula

Introduction

The tracheo-oesophageal fistula is a severe condition characterized by a particularly high mortality and morbidity rate, endangering the patients' lives. The main cause of this condition is the oro-tracheal intubation with prolonged ventilation, but also cases due to trauma, foreign bodies, cervical surgery, esophageal neoplasia or congenital etiology were reported [1,2]. In patients on mechanical ventilation with high pressure for long periods of time, the incidence of tracheo-oesophageal fistula can reach up to 0.5% of the cases [3].

Case Report

We present the case of a 32 years old female patient, a victim of multiple trauma by traffic accident, the patient was hospitalized with the diagnosis of brain injury, subarachnoid hemorrhage, and fractured femur. The femur fracture was treated by surgery. The patient was intubated via endotracheal route and mechanically

Pervenuto in Redazione Ottobre 2016. Accettato per la pubblicazione Novembre 2016
Correspondence to: Ioana Hălmaciu,Tg Mures, Str. Aleea Cornişa n. 6 ap. 8, 540102, Târgu Mureş. Mures, Romania (e-mail: anca_halmaciu@yahoo.com)

ventilated since her hospitalization. 11 days after admission the occurrence of digestive secretions throughout the oro-tracheal intubation cannula was observed. The gastroscopy and bronchoscopy examinations revealed a large tracheo-oesophageal fistula of 7x3 cm, with dilaceration of the membranous wall of the trachea. The cervical-thoracic CT examination with contrast substance highlighted a large tracheo-oesophageal fistula, the upper extremity of the injury corresponding to the C7 segment and the lower extremity to the Th2 segment (Figs. 1, 2). After an adequate preoperative preparation was intervened by double surgical approach, namely by left cervical and right thoracic approach (right postero-lateral thoracotomy). Intraoperatively the esophagus and trachea were prepared in the cervical and upper thorax regions. The existence of a large tracheo-oesophageal fistula (7x3 cm) was found, with dilaceration of the membranous wall of the trachea. (Figs. 3, 4)

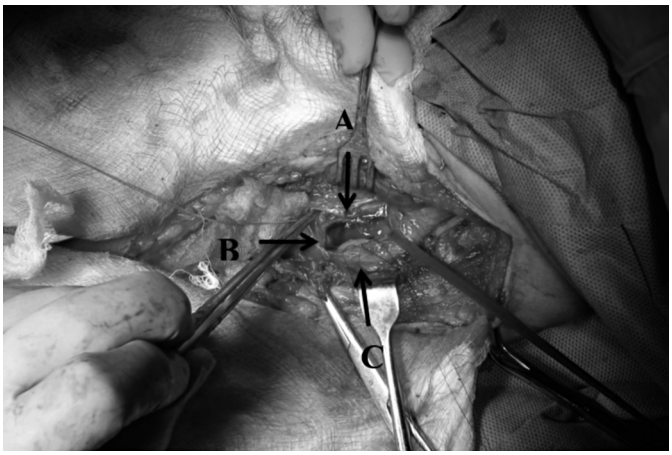

Fig. 3: Left cervical approach. Highlighting the tracheo-oesophageal fistula: (A) the tracheal wall, (B) the oro-tracheal intubation tube, (C) the esophageal wall.

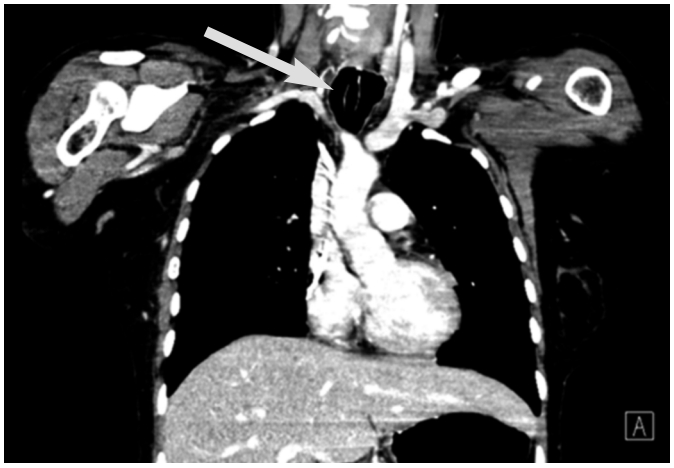

Fig. 1: Angio-CT thoracic scan, coronal section, before the surgical intervention: Highlighting the tracheo-oesophageal fistula.

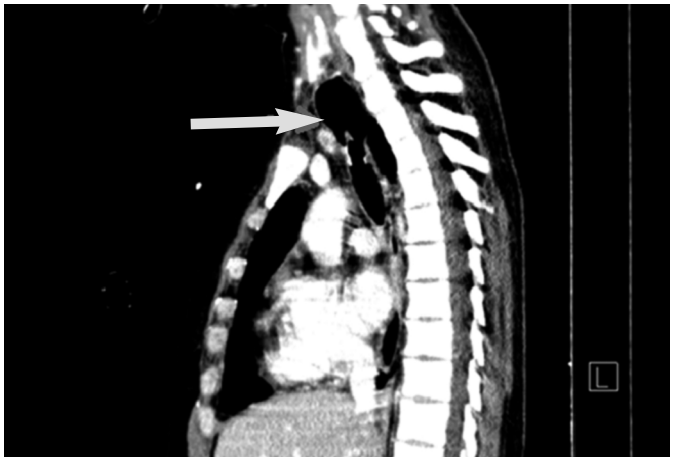

Fig. 2: Angio-CT thoracic scan, sagital section, before the surgical intervention: Highlighting the tracheo-oesophageal fistula.

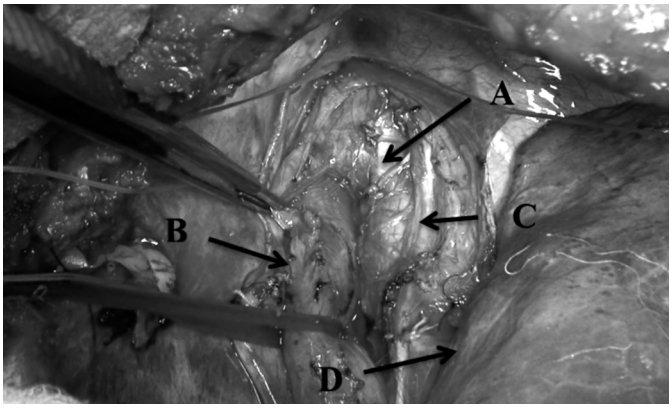

Fig. 4: Right postero-lateral thoracotomy: (A) the inferior margin of the fistula, (B) the esophagus, (C) the trachea, (D) the right lung.

In view of the large size of the fistula, the reconstruction of the membranous wall of the trachea was performed using heterologous bovine pericardial patch (fixed in glutaraldehyde), the pericardium patch being sutured with single layer interrupted non-absorbable 3/0 sutures to the cartilage wall of the trachea. The restoration of the esophageal wall was performed by suturing the wall in a single-layer with interrupted non-absorbable 3/0 sutures, this suture being protected by applying a heterologous bovine pericardial patch over the esophageal suture. (Figs. 5, 6) At the same time, tracheostomy, feeding jejunostomy and pleural bilateral drainage were performed.

The postoperative evolution was favorable, the patient was ventilated by tracheostomy cannula and fed by the jejunostomy tube and parenteral. The oral feeding was resumed on the 16th postoperative day. The bronchoscopy performed 20 days after surgery, revealed the full integration of the heterologous bovine pericardium patch with the absence of any signs of esophageal-tracheal fistula or rejection (Fig. 7).

Fig. 5: The reconstruction of the cervical esophagus and the trachea with heterologous bovine pericardium patches: (A) the tracheal patch, (B) the esophageal patch.

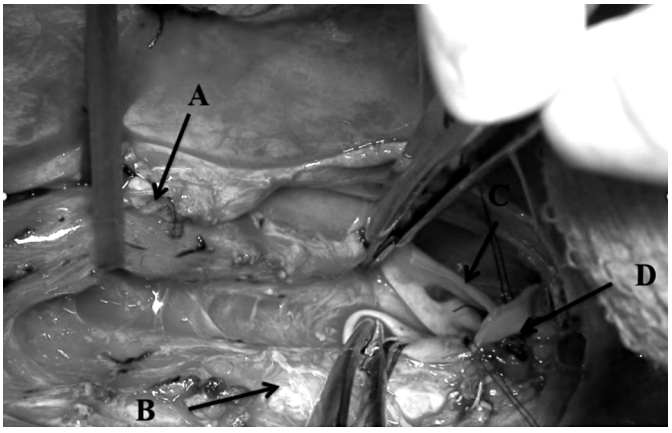

Fig. 6: Right postero-lateral thoracotomy, the reconstruction of the esophagus and the trachea with heterologous bovine pericardium patches: (A) the esophagus, (B) the trachea, (C) the esophageal patch, (D) the tracheal patch.

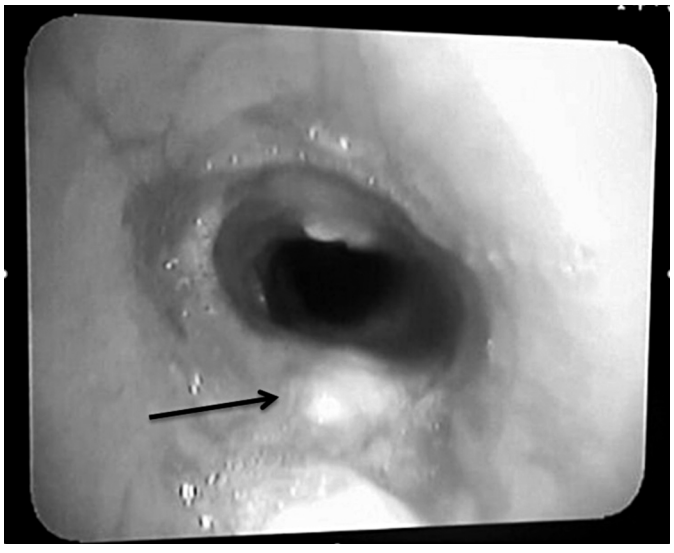

Fig. 7: Bronchoscopy 20 days postoperatively, highlighting the heterologous bovine pericardium patch.

The patient was discharged 22 days postoperatively and 6 months after the surgical intervention doesn't have any signs of tracheo-oesophageal fistula.

Discussions

The tracheo-oesophageal fistula is particularly severe affection, which can endanger the patients' lives due to the complications it may produce. The main risk factors for the occurrence of tracheo-oesophageal fistula in patients with prolonged mechanical ventilation are hypotension, diabetes mellitus, the use of a nasal-gastric tube[1,4]. Usually, the penetration of saliva and eso-gastric secretions inside the respiratory system leads to the occurrence of severe respiratory infections, as well as Mendelson's aspiration syndrome which may lead to the patients' death. Therefore, diagnosing and treating these patients as quickly as possible is imperative. Usually, the diagnosis of the tracheo-oesophageal fistula is done using bronchoscopy and upper gastrointestinal endoscopy, which can reveal the existence of the fistula.

The surgical treatment of patients with the tracheo-oesophageal fistula is the only method that can ensure their healing, a spontaneous closure of these fistulas being impossible [5].

Most authors recommend one time surgical treatment [5]. In many cases it is very difficult to choose the best surgical technique for treating this type of fistula. The simple suture of tracheal and esophageal defect can be made only in case of small fistulas [1]. At present, it is considered that the best method for surgical treatment of these fistulas is the trachea separation from the esophagus, the resection of the tracheal affected segment, followed by a tracheal termino-terminal anastomosis and suture of the esophagus defect in a single layer. It is also recommended separating the two suture portions by interposition of a muscle flap, which is especially important in preventing fistulas at this level [6,7].

On the other hand, placing the intercostal muscle flap between the trachea and esophagus may lead in time to the occurrence of esophageal or tracheal stenosis [7]. Other authors have used other types of flaps prepared from the sternohioid muscle, sternocleidomastoid muscle, or pericardium [8,9].

A particularly difficult surgical technique problem, is the treatment of large tracheo-oesophageal fistulas with dilaceration of the membranous wall of the trachea; especially those cases of fistulas over 5 cm in diameter. In these cases, the tracheal resection can not be performed and, therefore, they require tracheal reconstruction techniques. Some authors have used for this purpose in situ esophageal wall, which was sutured on the edges of the tracheal defect or with synthetic grafts (GoreTex)[10-12].

Given the large size of the tracheo-oesophageal fistula for this case we choose to use heterologous bovine pericardium in rebuilding the membranous wall of the tra-

chea and protecting the esophageal suture. Currently, the surgeons' experience in using the heterologous bovine pericardium for tracheal reconstruction is particularly low. Its use allows a timely re-epithelialisation of the tracheal wall [13].

The particularity of this case is due to the large dimensions of the defect of the membranous wall of the trachea, and practically we had to perform a reconstruction of the membranous wall of the trachea with a heterologous bovine pericardial patch. That is why we couldn't use a muscle flap in the reconstruction of the membranous wall of the trachea. To our knowledge this case represents the first case cited in the literature regarding the use of heterologous bovine pericardium in the surgical treatment of tracheo-oesophageal fistula with dilaceration of the membranous wall of the trachea. Another particularly important aspect was that, in addition to using heterologous bovine pericardium patch in the reconstruction of the membranous wall of the trachea, another patch of bovine pericardium was used to protect the esophageal suture.

Riassunto

PREAMBOLO: La fistola esofago-tracheale è una patologia particolarmente grave che costituisce un pericolo per la vita dei pazienti. La sua principale causa è rappresentata dalla ventilazione meccanica prolungata. Lo scopo del presente studio è quello di presentare una tecnica chirurgica innovatrice per trattare questa patologia.

CASO CLINICO: Si presenta il caso della pazienta di sesso femminile, di età 32 anni, vittima del politrauma subito in seguito ad un incidente stradale, e ricoverata con la diagnosi di emorragia subaracnoidea e frattura del femore. Dopo 11 giorni di ventilazione meccanica ed intubazione orotracheale, la pazienta è stata ricoverata per insorta fistola gigante esofago–tracheale, con la dilacerazione della parete membranosa della trachea delle di dimensioni 7x3 cm. Previa idonea preparazione all'intervento, si è intervenuti chirurgicamente con doppio accesso (cervicale e toracico dx.), per eliminare la fistola esofago-tracheale, mediante l'apposizione alla parete membranosa della trachea con patch di pericardio eterologo bovino, sutura del difetto esofageo in un piano unico, proteggendo la sutura esofagea con altro patch di pericardio eterologo bovino. A seguito di una evoluzione postoperatoria favorevole, la pazienta è stata dimessa in 22° giornata postoperatoria.

Per quanto ci è noto questo caso rappresenta il primo caso affidato alla letteratura per l'uso del pericardio eterologo bovino nella terapia chirurgica delle fistole esofago-tracheali per ovviare ad una dilacerazione della parete membranosa della trachea.

Un aspetto particolarmente importante a nostro giudizio è che, oltre al patch di pericardio eterologo bovino utilizzato per la ricostruzione della parete membranosa della trachea, è stato utilizzato un altro patch anche per proteggere la sutura esofagea.

References

1. Marulli G, Loizzi M, Cardillo G, Brattistella L, De Palma A, Ialongo P, Zampieri D, Rea F: *Early and late outcome after surgical treatment of acquired non-malignant tracheo-oesophageal fistulae*. Eur J Cardiothorac Surg, 2013; J43(6):e155-61.

2. Migliore M, Choong CK: *Management of concomitant congenital tracheo-oesophageal fistula and cancer of the oesophago-gastric junction in an adult.* Eur J Cardiothorac Surg, 2007; 32(1):169-70.

3. Harley HR: *Ulcerative tracheo-oesophageal fistula during treatment by tracheostomy and intermittent positive pressure ventilation*. Thorax, 1972; 27:338-52.

4. Payne DK, Anderson WM, Romero MD, Wissing DR, Fowler M: *Tracheoesophageal fistula formation in intubated patients. Risk factors and treatment with high-frequency jet ventilation*. Chest 1990; 98:161-64.

5. Dartevelle P, Macchiarini P: *Management of acquired tracheoesophageal fistula*. Chest Clin North Am, 1996; 4:819-36.

6. Camargo JJ, Machuca TT, Camargo SM, Lobato VF, Medina CR: *Surgical treatment of benign tracheo-oesophageal fistulas with tracheal resection and oesophageal primary closure: Is the muscle flap really necessary?* Eur J Cardiothorac Surg, 2010; 37(3):576-80.

7. Macchiarini P, Verhoye JP, Chapelier A, Fadel E, Dartevelle P: *Evaluation and outcome of different surgical techniques for postintubation tracheoesophageal fistulas*. J Thorac Cardiovasc Surg, 2000; 119(2):268-76.

8. Oliaro A, Rena O, Papalia E, Filosso PL, Ruffini E, Pischedda F, Cavallo A, Maggi G: *Surgical management of acquired non-malignant tracheo-esophageal fistulas*. J Cardiovasc Surg, 2001; 42(2):257-60.

9. Reed WJ, Doyle SE, Aprahamian C: *Tracheoesophageal fistula after blunt chest trauma.* Ann Thorac Surg, 1995; 59:1251-56.

10. Galàn G, Tarrazona V, Soliveres J, Calvo V, Paris F: *Tracheoplasty in a large tracheoesophageal fistula.* Ann Thorac Surg, 1999; 68:1071-72.

11. Bardini R, Radicchi V, Parimbelli P, Tosato SM, Narne S: *Repair of a reccurent benign tracheoesophageal fistula with a Gore-Tex membrane.* Ann Thorac Surg, 2003; 76:304-6.

12. He J, Chen M, Shao W, Wang D: *Surgical management of huge tracheo-oesophageal fistula with oesophagus segment in situ as replacement of the posterior wall of the trachea.* Eur J Cardiothorac Surg, 2009; 36(3):600-02.

13. Knott PD, Lorenz RR, Eliachar I, Murthy SC: *Reconstruction of a tracheobronchial tree disruption with bovine pericardium*. Interact Cardiovasc Thorac Surg, 2004; 3(4):554-56.