First thoracoscopic repair of tracheoesophageal fistula in the UAE: a case report and a review of the literature

Mohamed E. Hassan[a,b] and Khalid Al Ali[a]

Repair of esophageal atresia/tracheoesophageal fistula (EA/TEF) with open thoracotomy is associated with significant chest wall deformity. However, with the advancement made in minimally invasive instruments, thoracoscopic repair of this anomaly is achievable. We report our first successful case of thoracoscopic repair of EA/TEF. The surgical steps followed have been enumerated, as well as the postoperative management protocol. Thoracoscopic repair of EA/TEF is a real advantage for affected babies. ***Ann Pediatr Surg*** **10:46–49 © 2014 Annals of Pediatric Surgery.**

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[a]Department of Pediatric Surgery, Al Qassimi Hospital, Sharjah, UAE and [b]Department of Pediatric Surgery, Zagazig University, Zagazig, Egypt

Correspondence to Mohamed E. Hassan, Department of Pediatric Surgery, PO Box 441103, Dubai, UAE
Tel: +971 502 459 456; fax: +971 042 515 232;
e-mail: dmia88@hotmail.com

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Introduction

Traditionally, tracheoesophageal fistula (TEF) repair involved the isolation and division of the fistula, mobilization of the proximal pouch, and completion of an end-to-end anastomosis, all through a right posterolateral thoracotomy. However, significant complications, such as rib fusion, scoliosis, chest wall deformity, and thoracic nerve damage, have been associated with this approach [1–3].

As a result of the advancements made in minimally invasive instruments and techniques in the pediatric age group, the first successful thoracoscopic repair of a TEF was reported in 1999 [4–6].

Thoracoscopic repair of congenital esophageal anomalies remains a novel concept for many surgeons. It is considered by many to be one of the most technically challenging operations performed in neonatal noninvasive surgery [7].

Here, we report our first successful thoracoscopic repair of TEF in the UAE in a government tertiary hospital for pediatric surgery.

Case report

We report the case of a 2-day-old baby girl born by cesarean section due to obstetric reasons at 39 weeks. During hospital admission the mother's antenatal ultrasound showed polyhydraminios, but a tracheoesophageal fistula was not recognized.

The birth weight of the baby was 2.9 kg; Apgar score at 1 min was 8 and at 5 min was 11. Examination showed no dysmorphic features; the general examination was normal. The nasogastric (NG) tube failed to pass into the stomach. Plain radiograph of the chest showed a typical blind esophageal pouch with coiling of the NG tube in the upper pouch. The abdomen was full of gas. The distance between the upper blind pouch and the Carina was one vertebra in length. A provisional diagnosis of esophageal atresia (EA)/TEF was made.

Echocardiography was performed, which showed only small PDA and left-sided aortic arch. There was no respiratory distress, and there was good peripheral perfusion.

A decision was made for thoracoscopic repair of the anomaly on the third day after delivery and informed consent was obtained from the parents.

Surgical technique

The baby was intubated without single-lung ventilation and positioned in a semiprone position with the right side of the chest a little elevated. The surgeon (standing) and assistant (sitting) faced the baby's face.

Three trocars measuring 3 mm initially were used, one in the anterior axillary line in the fourth intercostal space for the telescope (3 mm, 30°) and the other two working ports inserted in the third and fifth intercostal space in the midaxillary line.

Insufflation was achieved with a veress needle with a pressure of 6 mmHg. During insertion of the veress needle and insulation, the anesthetist discontinued ventilation. Ventilation was continued with a very low tidal volume that kept O_2 saturation above 90%.

Coagulation of the azygos vein was achieved with monopolar diathermy after it was completely separated from the underlying tissues. Dissection with right-angled Maryland was done to delineate the TEF, which was separated easily (Fig. 1). A Polyglactin (Vicryl) stitch 5/0 with a 3/8 needle was introduced through the 3 mm trocar for transfixation of the fistula (the same suture material was used for the entire surgery).

The fistula was not cut after its ligation. Orientation was directed to the upper pouch in which the anesthetist pushed the NG tube into the upper pouch. Dissection of the upper pouch was done using sharp and blunt dissection with the monopolar hook in a judicious way to avoid injuring the membranous trachea or the vagus nerve (Fig. 2).

An extraluminal 5/0 polyglactin stitch was used to approximate the upper and lower pouches together (which was easily accomplished because of adequate mobilization of the upper pouch). Then, the upper pouch was opened (Fig. 3).

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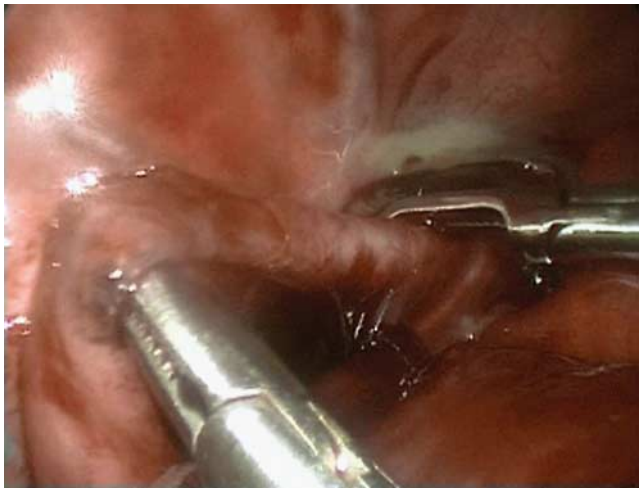
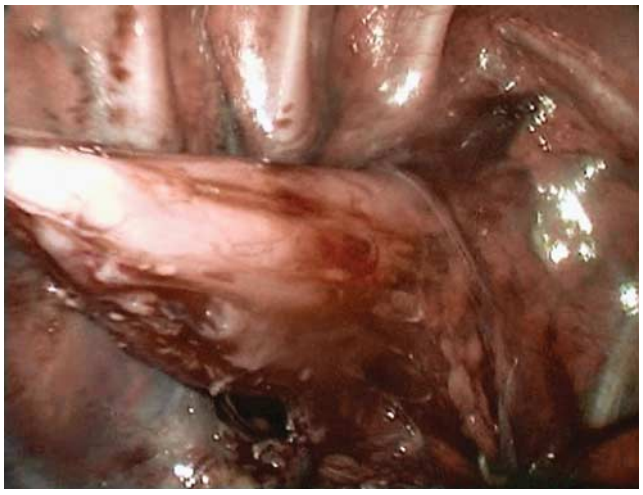
Fig. 1



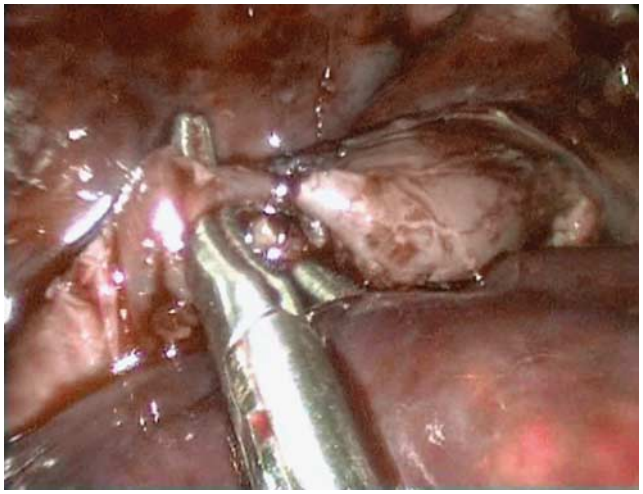
Separation of the esophageal fistula from the trachea.

Fig. 2



Dissection of the upper pouch.

Fig. 3



Extraluminal sutures to approximate the upper and lower pouch.

The posterior wall of the upper and lower pouches was approximated together with an interrupted intracorporeal 5/0 polyglactin suture, taking care to approximate the mucosa. The NG tube 8F was introduced and passed down to the stomach, and the anastomosis of the anterior wall was completed using the same technique as that of the posterior wall. There was moderate tension on the anastomotic site (Fig. 4).

During application of the anastomotic sutures, the lung inflation impaired adequate visualization of the surgical field, and we inserted an extra instrument in the sixth intercostal space in the midaxillary line to retract the lung.

There was no leakage from the fistula. Drain 8F was inserted into the lower port in the sixth intercostal space. The operative time of the procedure was 210 min (Fig. 5).

Postoperative management

The baby was kept intubated with a muscle relaxant for 3 days. Feeding was started on the second postoperative day through the NG tube. A contrast study was performed on the seventh postoperative day, which showed a leak from the anastomosis. The NG tube was left *in situ* for another 5 days; another contrast study was performed and no leak was observed. The chest tube was then removed.

The baby was discharged after surgery on the 14th postoperative day on demand breastfeeding, with a proton pump inhibitor once a day.

At the follow-up visit 2 weeks after discharge the baby was seen to have gained 500 g; there were no visible scars of the surgery (Fig. 6). At 2-month follow-up, there were no clinical signs of anastomotic stricture or gastroesophageal reflux disease. The baby was in the 30th percentile of her growth curve and the parents were advised to continue the proton pump inhibitors for another month (according to our department policy).

Discussion

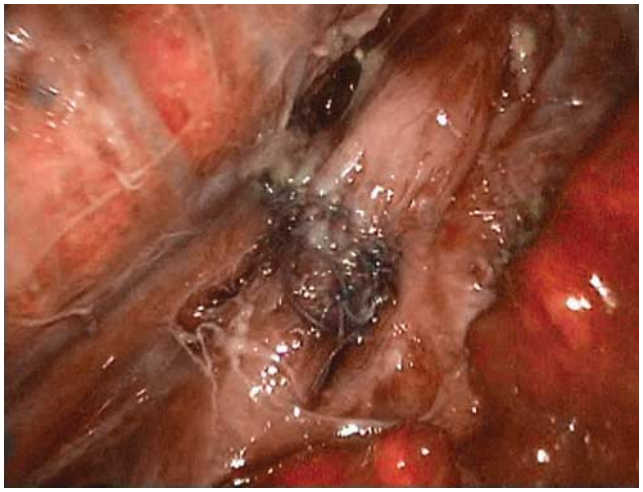
Since the first description of thoracoscopic EA/TEF repair [4–6], debate continues about the ideal surgical technique for repair of EA/TEF. The answer to the question asking whether thoracoscopic EA/TEF repair is only a new technique or a real advantage has not been highlighted yet [8–10].

Worldwide, the prevalence of thoracoscopic repair of EA/TEF is increasing, as evidenced by the study conducted by the International Pediatric Endosurgery Group (IPEG) [11].

The case being reported is our second attempt at thoracoscopic EA/TEF repair, which was successful. Our first case was started thoracoscopically but we converted to open thoracotomy repair because of anesthetic challenges during the procedure, in which we could not visualize the field properly because of excessive lung inflation.

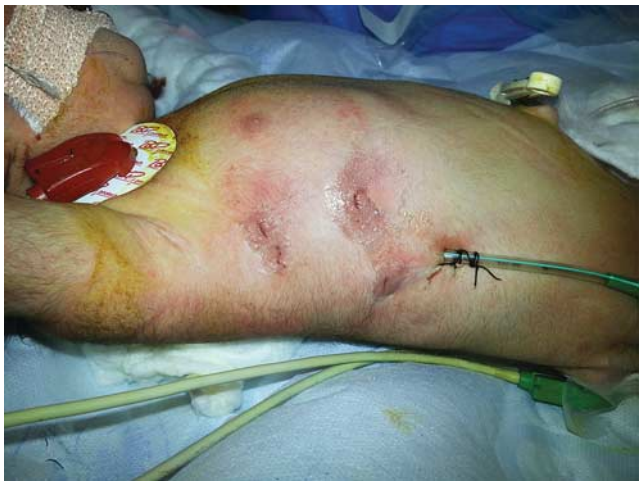
An interdisciplinary team discussion was conducted between the pediatric surgery team and the anesthesia

Fig. 4



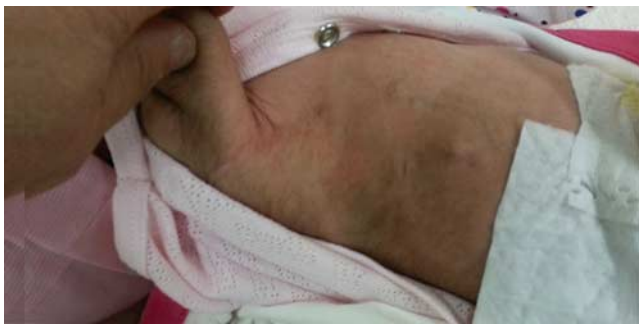
Completed anastomosis.

Fig. 5



Skin incisions at the end of the surgery.

Fig. 6



Surgical incisions 2 weeks postoperatively.

team for the challenges faced in the first case and reasons for conversion, and proper planning was done. Parents were fully explained about the options of treatment, as well as possible complications.

The position of the surgeon and assistant in relation to each other was critical so as not to have any interlacing during the procedure. There were incidents of desaturation during the procedure, which obliged us to discontinue insufflation for 1–2 min.

The procedure requires mastering of intracorporeal laparoscopic suturing skills, as the surgical field is limited, and there is little time available for suturing. This skill should be mastered in other neonatal laparoscopic procedures in advance.

Anatomical landmarks could be visualized clearly and magnification of the field was excellent, enabling the detection of any upper pouch fistula and avoiding injuring the trachea. The same surgical steps as those employed for the open technique were completely followed during the entire procedure.

Another excellent advantage of the procedure is that there was no postoperative right lung collapse, as usually encountered, in the open technique.

Holcomb *et al.* [12] conducted an elegant multi-institutional study comparing different surgical techniques and complications for thoracoscopic repair of EA/TEF. The study compared the suture materials used for ligation of the fistula (whether clips, absorbable or nonabsorbable) and for the anastomosis. There were no statistically significant differences between any of the suture materials regarding the incidence of recurrent fistula and/or anastomotic leak. Similarly, the study reported no statistically significant differences in the postoperative complication rates from other studies using open techniques.

Van der Zee *et al.* [13] highlighted several technical points that can help perform thoracoscopic repair of EA/TEF more efficiently. They used absorbable sutures for ligation of the fistula as well as for the anastomosis, traction suture to aid in approximating the upper and lower pouches during the anastomosis, and continuous sutures for both the posterior and anterior walls.

We have some concerns about the use of continuous suturing for esophageal anastomosis. Although it will decrease the operative time required for esophageal anastomosis, we think it may impair the blood supply for the suture line, which is a critical factor in anastomotic stricture. In concordance with published studies by Holcomb *et al.* [12] and Van der Zee *et al.* [13], we have been using absorbable sutures for ligating the fistula in the open technique since the last 5 years and we have not observed an increasing incidence of recurrent fistulae.

Hiradfar *et al.* [14] described passing a transesophageal tube before starting to suture to minimize the gap, reduce the tension over primary sutures, and provide better visualization of the posterolateral parts of the anastomosis in thoracoscopic esophageal atresia repair.

High-frequency oscillating ventilation was reported by Mortellaro *et al.* [15] for thoracoscopic repair of EA/TEF and congenital diaphragmatic hernia. They concluded that usage of high-frequency oscillating ventilation allows for good intraoperative exposure with excellent oxygenation

and elimination of carbon dioxide to prevent acidosis. We think this is a valuable alternative that may help decrease the anesthetic obstacles we encountered in our cases.

Conclusion

Thoracoscopic repair of EA/TEF is an anesthetic challenge, which is a major contributing factor for failure of thoracoscopy. Advanced laparoscopic suturing skills should be mastered in other laparoscopic neonatal procedures before performing this procedure. In our preliminary experience, thoracoscopic repair of EA/TEF is a real advantage for surgical repair of these anomalies.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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