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Research Article

Feasibility of Oesophageal Atresia and Distal Tracheoesophageal Fistula Repair by Thoracoscopic Method

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Abstract

Introduction: In neonatal population, esophageal atresia with or without fistula is a rarer congenital anomaly having an incidence of 1/3000-5000 live births [1]. Traditionally it was repaired by posterolateral thoracotomy but this approach is associated with musculoskeletal morbidity. Since the first repair, made the paediatric surgeons confident then they started to bring refinements in their techniques, and led to adoption of this technique in many institutions worldwide.

Material and Methods: This is retrospective study conducted from June 2015 to June 2021 in pediatric surgery department at Peoples University of medical and health sciences Nawabshah Sind, Pakistan. We reviewed the medical records of 85 patients who underwent thoracoscopic esophageal atresia. Data collected included newborn age and weight at the time of surgery, operative time, days of hospitalization, time to start first feed and post-op complications.

Results: Total 85 patients were operated thoracoscopically having mean age at the time of surgery was 3 days because most of patients coming late in our hospital and mostly they are diagnosed postnatally. Weight of patients at the time of surgery ranges between 1.5-3.5kg. Contrast swallow post operatively done in all case on day 5 out of which in 15 (18%) cases leak was confirmed and majority heal spontaneously in 10 -15 days.

Conclusion: Thoracoscopic primary repair of esophageal atresia with distal fistula is feasible then open thoracotomy in terms of visualization of structures, advancement in instruments and refinements in technique to prevent high rate of complications.

Keywords: Oesophageal; Tracheoesophageal; Fistula; Thoracoscopic

Introduction

In neonatal population, oesophageal atresia with or without fistula is a rarer congenital anomaly having an incidence of 1/3000-5000 live births [1]. In open method, postero-lateral thoracotomy approach is used to repair oesophageal atresia with distal tracheaesophageal fistula. This approach has been associated with severe morbidities especially musculoskeletal deformities in the growing age [2-4]. Advancements in endoscopic instrumentation, techniques and high-definition technology now it become possible to perform technically demanding and complex procedures thoracoscopically even in pediatric population. In 1999, Rothenberg first time performed the repair of isolated esophageal atresia thoracoscopically in a 2 month male infant of 2 month [5].

Since the first repair, made the paediatric surgeons confident then they started to bring refinements in their techniques, and led to adoption of this technique in many institutions worldwide [1]. The aim of our study is to determine the feasibility of oesophageal atresia and distal tracheoesophageal fistula repair by thoracoscopic method.

Material and Methods

This is retrospective descriptive case series study conducted from June 2015 to June 2021 in pediatric surgery department at Peoples University of medical and health sciences Nawabshah Sind, Pakistan. We reviewed the medical records of 85 patients who underwent primary esophageal atresia repair (Type-C) thoracoscopically, after taking consent from IRB of our institute. The inclusion criteria were that only neonates with type-C oesophageal atresia, full-term, weight greater than 1.5 kg were included in study. In all neonates, preoperatively extensive workup done to exclude any major cardiac anomalies, renal problems and gastro-intestinal anomalies like imperforate anus and atresia's. Pre-operatively x-ray chest lateral view (cervical and thoracic) done with tube in upper oesophageal pouch to have rough assessment of the distance between two gaps. If the distance is greater than two vertebrae, then the gap is considered larger as shown in figure 1. Variables included were age, weight, operative time, hospitalization period, feeding and post-op complications.

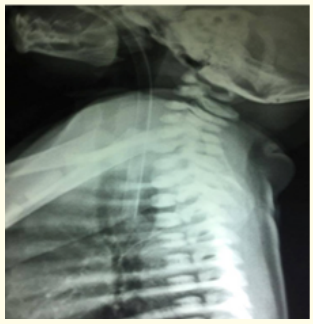

Figure 1: Pre-operative x-ray chest for distance assessment between two blind ends.

Technique

Baby placed in modified prone position with right side elevated at 45 degree with tracheal intubation in all cases and no attempt was done for single lung ventilation. Pre op bronchoscopy was done in selected stable patients to identify the fistula and t roughly assess the gap between the two pouches. We used 5mm port for camera just below tip of scapula, right port of 5mm in mid axillary line two space above camera port and the last 3mm port placed two space below in 6th or 7th intercostal space behind posterior axillary line (Figure 2-4).

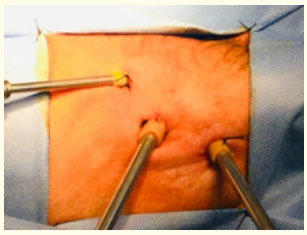

Figure 2: Port position.

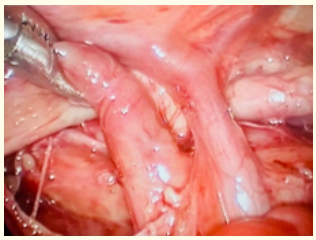

Figure 3: Fistula identification.

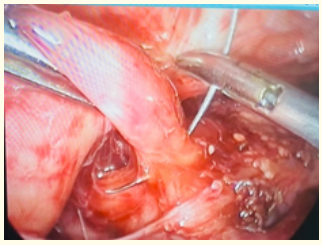

Figure 4: Fistula ligation with clip.

Lung collapse was done with CO2 insufflations with flow of 0.5 lit/min and pressure kept between 5-6 mmhg and even less pressure requires once patient maintains saturation and acclimatized. The first step in all cases was to deal azygos, which was accomplished by hook electrode or by ligation and in recent many cases azygos vein was spared after opening the pleural membrane. Next step was to ligate with fistula (Figure 3) which was done with 5mm of Grena plastic clips passed through right upper port (Figure 4) or by intracorporeal Tran fixation which is easier and more economic. Next was to identity the upper pouch, which was mobilized by hook or Maryland in right hand and grasper in left hand to pull pouch inferiorly to achieve adequate length taking care not to damage the tracheal wall underlying. One good technique is to

mobilize the esophagus from posterior aspect first making way to easier plane behind than adherent combined wall at anterior aspect. (Figure 5) Once the good length is achieved upper pouch is opened and anastomosis of posterior layer of two ends was done intracorporeal by 5/0 non-absorbable suture like vicryl or PDS. After completing posterior layer trans-anastomotic tube placed and anterior layer of esophagus repaired with interrupted stiches. (Figure 6) Chest drain placed in all cases.

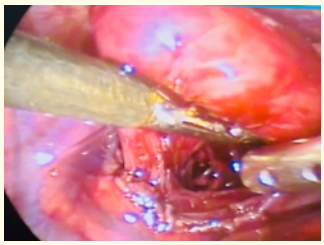

Figure 5: Upper pouch mobilizations.

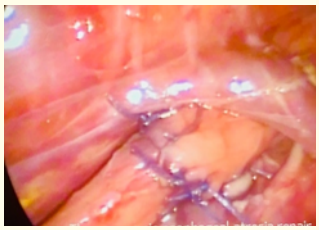

Figure 6: Primary Oesophageal anastomosis.

Results

Thoracoscopic repair done in total 85 neonates, the mean age was 3.5 (range 1-6 days) at the time of presentation. Weight at the time of presentation ranges between 1.5-3.5kg. We started performing thoracoscopic repair since June 2015 so in initial cases the operative time was bit longer between 120 to 150 minutes as it was our early learning curve but with the passage of time more experience gained the operative time reduced to 90-110 minutes.

Contrast swallow post operatively done in all case on day 5 out of which in 15(18%) cases leak was confirmed and majority heal spontaneously in 10 -15 days. No leak require additional interventions. Those neonates who were clinically stable we started nasogastric feeding on 3rd postoperative day by nasogastric tube, except in few cases feed started after contrast swallow on 5th post-operative day and those who were on mechanical ventilation feeding started on 6th post-operative day.

Other complications encountered were stricture in 17(20%) cases of which 15 cases patients recovered by dilatation only and two cases require resection of stricture with fresh anastomosis of esophagus and 7(8.2%) patients had reflux which were treated on medical therapy only. There were 7(8.2%) death in our series out of which 4 were because of sepsis and three died because of cardiac arrest. The total length of hospitalization after surgery was variable from 7 days to 13 days.

Discussion

Thoracoscopic esophageal atresia repair is a worldwide accepted procedure due to its fewer operative morbidities and has been done routinely in developed centers [6,7].

In few Asian countries and Middle East thoracoscopic repair of esophageal atresia has been started but they are at initial learning stage and they have found same results as develop centers [8-10]. In 2017, we reported our 11-case series which was the first ever study from Pakistan in which we shared our early learning curve. In that study, we adopted Uniportal VATS technique, to understand the anatomy videoscope and tried to do initial steps like dealing with azygos vein, fistula clipping [11]. Rothenberg., *et al.* reported in their study that premature, under-weight and major cardiac anomalies are absolute contraindication to thoracoscopic approach [12]. Selection of patient based on age, weight and exclusion of major associated anomaly is a key to successful outcomes and that's what we have observed in our study.

In 2020 a systemic review done by Amyul., *et al*. and he reported that 28.5% surgeons prefer azygos sparing and 70% preferred the sealing or diathermy devices to deal with the azygos vein [13] so in our study we also adopted both techniques of azygos vein dealing. Different surgeons deal with fistula in different ways according to their expertise, some prefer ligation of fistula by suture, some prefer titanium clips or hemolocks [1,13] but we dealt with fistula either by 5mm Grena clip or by intracorporeal trans fixation.

Intracorporeal suturing in such a small cavity is technically difficult, especially the first stitch as two ends are quite apart. In those cases where the gap was long we applied stay sutures, then did the

intracorporeal suturing [8]. Because of small working space, technical difficulty in applying intracorporeal stitching we observed variation in operative time in our study which was more in initial cases but with the passage of time and getting expertise in technique now it is reduced.

After oesophageal atresia repair there is an estimated chance of 12- 22% of anastomosis leak [14,15] but in thoracoscopic repair it is somewhat 10.4% comparable to open repair [13], in our study, we observed 18% leak cases which is slightly high. Many authors considered that azygos vein sacrificing is an important factor for the leakage [15].

Anastomotic stricture is a frequent complication after oesophageal atresia repair estimated to be more than 50% and that may be because of gastro-oesophageal reflux, inappropriate suture material usage and leakage at anastomotic site [16]. In our study, we observed stricture in 20% patients in whom majority responded well to dilatation and only few cases required resection and anastomosis.

Gastro-oesophageal reflux has been observed between 26-70% of post oesophageal atresia repair [17] and in our study, only 8.2% patients developed gastro-oesophageal symptoms and none of them required surgical interventions.

Conclusion

Thoracoscopic primary repair of oesophageal atresia with distal fistula is feasible then open thoracotomy in terms of visualization of structures, advancement in instruments and refinements in technique to prevent high rate of complications.

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