Routine Fogarty Catheter Occlusion of Fistula in Esophageal Atresia with Tracheoesophageal Fistula Surgery: A Retrospective Study

Darunee Sripadungkul, M.D.*,, Noriko Miyazawa, M.D., Ph.D.*, Eri Shinto, M.D.***, Yuko Kanke, M.D.****, Haruto Fujita, M.D.*****

**Department of Anesthesiology, Tokyo Metropolitan Children's Medical Center, Tokyo, Japan, **Department of Anesthesiology, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand., ***Department of Anesthesiology, Jikei University School of Medicine, Tokyo, Japan., ****Department of Anesthesiology, Tochigi Medical Center, Tochigi, Japan, *****Department of Anesthesiology, Keio University School of Medicine, Tokyo, Japan.*

ABSTRACT

Objective: We aimed to analyze the outcomes of patients who underwent surgical repair of congenital esophageal atresia (EA) with a distal tracheoesophageal fistula (EA/TEF) or a Gross type C with successful routine Fogarty catheter occlusion of TEF.

Materials and Methods: We retrospectively reviewed the medical records of patients who underwent surgical repair of Gross type C with successful routine Fogarty catheter occlusion of fistula between April 2010 and November 2016.

Results: Nineteen patients were enrolled and included for analysis. Mean gestational age was 38.7 (1.9) weeks with 2 (10.5%) neonates born prematurely. Mean birthweight was 2569.3 (425.3) g. Five (26.3%) patients required mechanical ventilation (MV) before surgical repair of TEF. Median post-operative required MV after TEF surgery was 4 (3-6) days. The most common of post-operative complications were wound dehiscence (10.5%) and pneumothorax (10.5%). Long-term complications were gastroesophageal reflux disease (36.8%) and tracheomalacia (31.6%).

Conclusion: The success rate of routine TEF occlusion with a Fogarty catheter was 86.4%. Routine Fogarty catheter occlusion of TEF can be used safely with experienced personnel, low incidence of aspiration and satisfied ventilation. There was no serious complication associated with placement of Fogarty catheter or catheter dislodgement, and it did not occur during any of the procedures.

Keywords: Congenital esophageal atresia (EA); Fogarty catheter; outcomes; tracheoesophageal fistula (TEF) (Siriraj Med J 2023; 75: 356-361)

INTRODUCTION

Congenital esophageal atresia (EA) is a rare congenital anomaly by complete interruption of the esophagus with a prevalence of 1.7 per 10,000 live births.[1] Congenital EA with a distal tracheoesophageal fistula (EA/TEF), or Gross type C, is the most common type, comprising 85% of EA cases.[2] This congenital anomaly is often associated with the anomalies described by the acronym VACTERL (vertebral anomalies, imperforated anus, congenital heart disease (CHD), tracheoesophageal anomalies, renal anomalies and limb anomalies). Surgical repair and anesthetic management are challenging because of the difficulty in management of airway and ventilation, control of adverse hemodynamic from associated anomalies of cardiovascular system and the thoracotomy procedure.[2-4]

Corresponding author: Darunee Sripadungkul
Email: daruneesripa@gmail.com
Received 5 January 2023 Revised 19 March 2023 Accepted 19 March 2023
ORCID ID:http://orcid.org/0000-0003-2228-2224
https://doi.org/10.33192/smj.v75i5.260704

The ideal management of most patients with EA/TEF might be the ligation of the fistula and primary esophageal repair performed in a single operation. Nevertheless, patients with persistent aspiration and recurrent pneumonia from the existing fistula induce poor medical conditions, disabling the neonates to withstand corrective surgery performed under general anesthesia. Use of a Fogarty catheter to occlude the fistula, by using rigid or flexible bronchoscopy, can be used to improved lung function and their medical condition.[2,5]

The classic technique for airway and ventilation management for TEF repair is to maintain spontaneous ventilation and pass the endotracheal tube (ET) tip distal to fistula.[6] Despite this technique, ineffective ventilation may occur because of inadvertent placement of the ET in the fistula, unintentional ventilation of the fistula, or massive gastric distention.[7] When TEF is very near or at the carina, this technique becomes impossible and unreliable.[8] Alternative technique is to controlled ventilation with muscle relaxant and placement a Fogarty catheter in the fistula under rigid or flexible bronchoscopy for separation of the airway and gastrointestinal (GI) tract. Previous studies have described the use of Fogarty balloon occlusion in unstable patients or in H-type fistulas that may be difficult to identify, and re-operative procedures.[5,9,10] The benefits of routine use of Fogarty catheters in the repair of TEF were reduction of aspiration, improved ventilation, safely and expeditiously.[11]

We aimed to analyze the outcomes of patients who underwent surgical repair of Gross type C EA/TEF with successful routine Fogarty catheter occlusion of tracheoesophageal fistula in a single institution.

MATERIALS AND METHODS

Study design

After approval of the institutional review board (H28b-135), we retrospectively reviewed the medical records of patients who underwent surgical repair of Gross type C EA/TEF between April 2010 and November 2016 at Tokyo Metropolitan Children's Medical Center. Inclusion criteria included patients who underwent surgical repair of Gross type C EA/TEF with successful routine Fogarty catheter occlusion of fistula. We exclude the patient who underwent surgical repair of Gross type C EA/TEF with unsuccessful routine Fogarty catheter occlusion of fistula. The data collected and analyzed consist of three sections. The first section evaluated patient characteristics, including gender, gestational age (GA), birth weight (BW), Apgar score, day of life (DOL) at surgery, body weight at surgery, and associated anomalies. The second section evaluated surgical management, including initial surgery and other surgical procedures performed on the same admission, and the distance between the upper and lower esophageal ends (esophageal gab). The third section evaluated anesthetic management, including pre-operative events (i.e., desaturation (SpO_2 < 90%)[12], tracheal intubation or tracheostomy pre-operatively, inotropic support), intra-operative events (i.e., desaturation, difficult ventilation, and inotropic support), intra-operative outcomes (surgical time, anesthetic time, fluid management, urine output and blood loss) and post-operative outcomes (duration of received mechanical ventilation (MV), prolonged post-operative MV after TEF repair (≥ 7 days)[13], post-operative complications and long-term complications).

All Gross type C EA/TEF repairs were performed in the lateral decubitus position via thoracotomy. No endoscopic repairs were performed in any of the cases. All patients from the neonatal intensive care unit (NICU) had an intravenous line before surgery. The patients were gently ventilated with a bag and mask before tracheal intubation. We examined all patients with flexible bronchoscopy (Olympus BF-N20 Fiber Bronchoscope, outer diameter 2.2 mm) through the ETT lumen to assess the location and size of the TEF, after which we extubated and inserted a Fogarty catheter (Fogarty arterial embolectomy catheter, 3 Fr, balloon diameter 5 mm, Edwards Lifesciences, Irvine CA, USA). During laryngoscopy, a Fogarty catheter was inserted until the tip reached the mid-trachea, followed by reintubation with an uncuffed endotracheal tube. The tip of the Fogarty catheter was pre-bent to face backward during insertion. Immediate, flexible bronchoscopy was performed again to guide a Fogarty catheter into the TEF until the balloon disappeared and inflated with 1 mL of air. We performed TEF occlusion with a Fogarty catheter in all patients. In addition to standard American Society of Anesthesiologists (ASA) monitoring, patients had invasive pressure monitoring or had percutaneous inserted central catheter (PICC) line was placed pre-operatively during the EA/TEF repair. During anesthetic maintenance, general anesthesia was maintained by remifentanil 0.1-0.3 μg/kg/min, fentanyl 1 μg/kg/dose, midazolam 0.1 mg/kg/dose, rocuronium 0.2-0.3 mg/kg/dose, and a low end-expired concentration of sevoflurane.

After the surgery, all patients retained an endotracheal tube or tracheostomy and were on MV during their transfer to the NICU. Post-operative analgesia was provided primarily with an opioid (fentanyl or morphine hydrochloride), dexmedetomidine, and acetaminophen. Post-operative sedation was provided with midazolam.

Statistical analysis

Data analysis was performed using STATA 10.1. We

used descriptive statistics to describe patient characteristics, surgical management and anesthetic management (intra-operative and post-operative outcomes). Categorical data was presented as number and percentage. Continuous data was analyzed using the Shapiro-Wilk test for normality test and presented as mean (standard deviation) and median (interquartile range).

We calculated the proportion using the number of participants with non-missing data. The estimated required sample size was 18 patients as calculated using the formula for an infinite population proportion with a proportion (p) of 0.754 and calculated error (d) of 0.20. The total population consisted of 19 patients. The study was analyzed and presented with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

RESULTS

A total of 22 patients were identified as having undergone surgical repair of Gross type C EA/TEF. We excluded 3 patients who underwent unsuccessful routine Fogarty catheter occlusion of fistula. Nineteen patients were enrolled and included for analysis.

Three patients (13.6%) who failed routine Fogarty catheter occlusion of fistula; however, the medical records were not recorded cause of failure to perform this procedure. Two patients had multiple severe associated anomalies (i.e., preterm, low birth weight (LBW), congenital tracheal stenosis (CTS), CHD score ≥ 3 on the Risk Adjustment for Congenital Heart Surgery 1 (RACHS-1),[14,15] pre-operatively desaturation, cardiac arrest which had cardiopulmonary resuscitation (CPR) and on inotropic support, and had distance between the upper and lower esophagus ends ≥ 10 mm. Meanwhile, one patient had CHD (RACHS-1 score < 3), and vocal cord paralysis.

Patient characteristics

Twelve (63.2%) patients were male. Mean GA was 38.7 (1.9) weeks with 2 (10.5%) neonates born prematurely. Mean BW was 2569.3 (425.3) g with 9 (47.4%) neonates having a LBW (BW less than 2500 g). Median Apgar score at 1 and 5 minutes were 8 (8-9) and 9 (8-9). The patients with type C EA/TEF underwent surgery repair on median day of life (DOL) 1 (1-1) and mean body weight at surgery was 2453.1 (375.3) g. Total associated anomalies were found in 11 (57.9%) patients. Congenital heart diseases (CHD) were the most frequently occurring comorbidities (n=11 patients; 57.9%). Nine patients with CHD scored < 3 on RACHS-1 and two patients had a RACHS-1 score ≥ 3. The associated anomalies with VACTREL were found in 4 (21.1%) patients. The associated anomalies with others (i.e., CTS, cleft lip and cleft palate, aspiration pneumonitis, and chromosomal abnormalities (Trisomy 21)) were found in 3 (15.8%) patients.

Surgical management

In the primary TEF repairs were found in 18 patients, 16 patients underwent TEF repair, and 1 underwent TEF repair with colostomy due to associated imperforate anus. Meanwhile, 1 patient underwent TEF repair with gastrostomy and colostomy due to associated cloacal malformation. The other surgical procedures performed on the same admission included early revision of their TEF repair (staged TEF repair) in 1 (5.3%) patient, gastrostomy and colostomy due to imperforate anus in 1, while 3 required cardiac surgery before their initial discharge home. In addition, the distance between the upper and lower esophagus ends had a distance ≥ 10 mm were found in 5 (26.3%) patients.

Anesthetic management

In pre-operative events, four patients (21.1%) had desaturation, four patients (21.1%) required intubation due to aspiration pneumonia, CHD, LBW, or prematurity, one patient (5.3%) had tracheostomy due to CTS, and two patients (10.5%) required inotropic support before surgery. Intra-operatively, twelve patients (63.2%) had desaturation, three patients (15.8%) difficult ventilation, and five patients (26.3%) required inotropic support during operation.

We routinely performed Fogarty catheter occlusion of tracheoesophageal fistula in all patients with successfully in 19 of 22 patients (86.4%). Table 1 shows anesthetic management (intra-operative and post-operative outcomes) to evaluate surgical time, anesthetic time, fluid management, urine output, blood loss, duration of received MV, prolonged post-operative MV, post-operative complications, and long-term complications. Five (26.3%) patients required MV before surgical repair of TEF. Median pre-operative required MV in five patients was 1 (0-2) day. Median post-operative required MV after TEF surgery was 4 (3-6) days. Three patients (15.8%) required prolonged post-operative MV that had pre-operative MV. All patients had invasive pressure monitoring during the EA/TEF repair. A percutaneous inserted central catheter (PICC) line was placed pre-operatively in four (21.1%) patients.

DISCUSSION

We included 19 patients in the study who underwent surgical repair of Gross type C EA/TEF with successful routine Fogarty catheter occlusion of fistula. All patients

TABLE 1. Anesthetic management (intra-operative and post-operative outcomes) (n=19)

Anesthetic management	Outcomes
Intra-operative outcomes	
Surgical time (min; mean (SD))	126.2 (34.5)
Anesthetic time (min; mean (SD))	217 (43.3)
Fluid management (ml/kg/h; mean (SD))	21.5 (7.2)
Urine output (ml/kg/h; median (IQR))	0.5 (0-2.3)
Blood loss (ml/kg; median (IQR))	1.2 (0.5-2.5)
Post-operative outcomes	
Duration of received mechanical ventilation (day; median (IQR))	4 (3-6)
Prolonged post-operative mechanical ventilation (≥ 7 days) (n (%))	3 (15.8%)
Post-operative complications (n (%))	
Wound dehiscence	2 (10.5%)
Pneumothorax	2 (10.5%)
Anastomotic leakage	1 (5.3%)
Anastomotic stricture	1 (5.3%)
Sepsis	1 (5.3%)
Chylothorax	1 (5.3%)
Atelectasis	1 (5.3%)
Long-term complications (n (%))	
Gastroesophageal reflux disease (GERD)	7 (36.8%)
Tracheomalacia	6 (31.6%)

Abbreviations: SD, standard deviation; IQR, interquartile range; n, number; %, percentages

were operated on by the same pediatric surgical team with virtually the same anesthesia methods. Anesthetic management of Gross type C EA/TEF generally depends on patient comorbidity, location and size of TEF, anesthetist preference, and local hospital practice. Three patients (15.8%) required prolonged post-operative MV (≥ 7 days). The most common post-operative complications after TEF surgery were wound dehiscence (10.5%), and pneumothorax (10.5%). Long-term complications after TEF surgery were GERD (36.8%) and tracheomalacia (31.6%).

Pre-operative mechanical ventilation occurred in five of 19 patients (26.3%) in this study, similar to a report from previous study where 15 of 53 patients (28.3%) were intubated and mechanically ventilated before surgery.[16] By comparison, another study showed that 20 of 106 patients (18.9%) were intubated before the theater.[4]

Congenital heart disease was the most frequent comorbidity in our study, occurring in 11 patients (57.9%), similar to the report from previous study wherein eight of 15 patients had CHD (53.3%).[3] However, congenital heart disease may underestimate during the pre-operative period because of pre-operative transthoracic echocardiography in children reported the concordance was 77.7%. Therefore, we should concern of unexpected cardiac events during the peri-operative period.[17] In this study, there were two preterm patients (10.5%) and LBW in 9 patients (47.4%). The previous study also reported that there were preterm patients in three (20%), LBW in five (33.3%), and very low birth weight (VLBW) in one (6.7%) of 15 patients.[3]

Previous study reported their practice included routine bronchoscopy, muscle paralysis, ventilation before intubation, and all large TEFs occluded with a Fogarty catheter same as at our hospital.[18] The advantages of flexible bronchoscopy include assessment of the exact location and size of the TEF, placement of a catheter to aid in surgical identification of the TEF, and assessment of tracheomalacia or vascular rings.[6] Complications of flexible bronchoscopy in very small patients have been

well described, including oxygen desaturation, coughing, epistaxis, laryngospasm, bronchospasm, and life-threatening complications (i.e., tension pneumothorax).[19]

Previous studies have described the use of Fogarty balloon occlusion in unstable patients or in H-type fistulas, and re-operative procedures.[5,9,10] The benefits of routine use of Fogarty catheters in the repair of TEF were reduction of aspiration, improved ventilation, safely and expeditiously.[8,11,20] After the TEF was blocked with the balloon of the catheter, the patient could be mechanically ventilated with positive pressure even if the surgical procedure was prolonged. In our study, the success rate of routine TEF occlusion with a Fogarty catheter was 86.4% (19 of 22 patients) which our patients had more than the previous study that had only 5 patients (100%) of successful routine TEF occlusion with a Fogarty catheter.[11] There was no serious complication associated with placement of Fogarty catheter or catheter dislodgement, and it did not occur during any of the procedures.

In our study, three patient (15.8%) required post-operative prolonged MV. One patient did not have CHD, but was preterm, LBW, and required inotropic support. One patient was associated with CHD (RACHS-1 score < 3), LBW, CTS, required tracheostomy pre-operatively, and required staged operation. In addition, the remaining one patient was associated with CHD (RACHS-1 score ≥ 3), and required intubation pre-operatively. Previous studies suggested that peri-operative risk factors for prolonged MV following cardiac surgery in pediatric patients were pre-operative MV, younger age, LBW, RACHS-1 score ≥ 3, acute kidney injury, respiratory infection, a higher dose of inotropes, and pulmonary hypertension.[13,21]

The most common post-operative complications in this study were wound dehiscence in 2 (10.5%) and pneumothorax in 2 (10.5%) patients, while other complications were anastomotic leakage in 1 (5.3%) and anastomotic stricture in 1 (5.3%) patient. Different from the previous study that found anastomotic stricture in 43-71.9%, anastomotic leakage in 11.5-18%, and recurrent distal TEF (type C) in 5-9%.[22,23] Meanwhile, long-term complications in this study were found gastroesophageal reflux disease (GERD) in 7 (36.8%) and tracheomalacia in 6 (31.6%) patients, while in the previous study were found GERD in 73 (79.3%) and tracheomalacia in 29 (31.5%) patients.[22]

The results contribute a clearer understanding of routine Fogarty catheter occlusion of fistula in patients who underwent surgical repair of Gross type C EA/TEF that it may be suitable for patients who had the mean BW was 2569.3 (425.3) g. There was no serious complication associated with placement of Fogarty catheter or catheter dislodgement, and it did not occur during any of the procedures.

The study has limitations: *(a)* it was based on a single center, local practice pattern, *(b)* it had a retrospective design, which could have a selection bias, missing clinical data and limit the cause of failed routine TEF occlusion with a Fogarty catheter, and (c) although our study sample size more than previous studies, but it might constrain its generalizability. However, we need larger sample size to make a firm conclusion. Further study is recommended to assess prospective data from large numbers of patients among a cross-section of institutions.

CONCLUSION

The success rate of routine TEF occlusion with a Fogarty catheter was 86.4%. Routine Fogarty catheter occlusion of TEF can be used safely with experienced personnel, low incidence of aspiration and satisfied ventilation. With the increase in the number of cases, there was no serious complication associated with placement of Fogarty catheter or catheter dislodgement, and it did not occur during any of the procedures.

ACKNOWLEDGMENTS

We thank (a) the anesthesiologists at Tokyo Metropolitan Children's Medical Center for their help and assistance (b) Miss Piyanan Suparattanagool, Clinical Epidemiology Unit, for assistance with the biostatistics and (c) Professor Polpun Boonmak, Faculty of Medicine, Khon Kaen University, Thailand, for his valuable suggestion and encouragement.

Conflict of Interest Statement

All authors have no conflict of interest.

REFERENCES

1. Khan S, Matta SR. Congenital anomalies: Esophageal atresia and tracheoesophageal fistula. In: Kliegman RM, Geme JS, Blum NJ, Shah SS, Tasker RC, Wilson KM, eds. Nelson textbook of pediatrics. 21th ed. Philadelphia, PA: Elsevier; 2019. p.1929-31.
2. Uzumcugil F. Anesthetic management of tracheo-esophageal fistula. Curr Chall Thorac Surg. 2022;4:27. doi:10.21037/ccts-20-183
3. Yang CF, Soong WJ, Jeng MJ, Chen SJ, Lee YS, Tsao PC, et al. Esophageal atresia with tracheoesophageal fistula: ten years of experience in an institute. J Chin Med Assoc. 2006;69(7):317-21. doi:10.1016/S1726-4901(09)70265-5
4. Knottenbelt G, Costi D, Stephens P, Beringer R, Davidson A. An audit of anesthetic management and complications of tracheo-esophageal fistula and esophageal atresia repair. Paediatr Anaesth. 2012;22(3):268-74. doi:10.1111/j.1460-9592.2011.03738.x

5. Chang JW, Choo O, Shin YS, Hong J, Kim C. Temporary closure of congenital tracheoesophageal fistula with Fogarty catheter. Laryngoscope. 2013;123(12):3219-22. doi:10.1002/lary.24164
6. Ho AM, Dion JM, Wong JC. Airway and Ventilatory Management Options in Congenital Tracheoesophageal Fistula Repair. J Cardiothorac Vasc Anesth. 2016;30(2):515-20. doi:10.1053/j.jvca.2015.04.005
7. Alabbad SI, Shaw K, Puligandla PS, Carranza R, Bernard C, Laberge JM. The pitfalls of endotracheal intubation beyond the fistula in babies with type C esophageal atresia. Semin Pediatr Surg. 2009;18(2):116-8. doi:10.1053/j.sempedsurg.2009.02.011
8. Ho AM, Wong JC, Chui PT, Karmakar MK. Case report: Use of two balloon-tipped catheters during thoracoscopic repair of a type C tracheoesophageal fistula in a neonate. Can J Anaesth. 2007;54(3):223-6. doi:10.1007/BF03022644
9. Ratan SK, Rattan KN, Ratan J, Bhatia V, Sodhi PK, Bhatia M. Temporary transgastric fistula occlusion as salvage procedure in neonates with esophageal atresia with wide distal fistula and moderate to severe pneumonia. Pediatr Surg Int. 2005;21(7):527-31. doi:10.1007/s00383-005-1407-8
10. Richenbacher WE, Ballantine TV. Esophageal atresia, distal tracheoesophageal fistula, and an air shunt that compromised mechanical ventilation. J Pediatr Surg. 1990;25(12):1216-8. doi:10.1016/0022-3468(90)90507-6
11. Pepper VK, Boomer LA, Thung AK, Grischkan JM, Diefenbach KA. Routine Bronchoscopy and Fogarty Catheter Occlusion of Tracheoesophageal Fistulas. J Laparoendosc Adv Surg Tech A. 2017;27(1):97-100. doi:10.1089/lap.2015.0607
12. Stollar F, Glangetas A, Luterbacher F, Gervaix A, Barazzone-Argiroffo C, Galetto-Lacour A. Frequency, Timing, Risk Factors, and Outcomes of Desaturation in Infants With Acute Bronchiolitis and Initially Normal Oxygen Saturation. JAMA Netw Open. 2020;3(12):e2030905. doi:10.1001/jamanetworkopen.2020.30905
13. Polito A, Patorno E, Costello JM, Salvin JW, Emani SM, Rajagopal S, et al. Perioperative factors associated with prolonged mechanical ventilation after complex congenital heart surgery. Pediatr Crit Care Med. 2011;12(3):e122-6. doi:10.1097/PCC.0b013e3181e912bd
14. Jenkins KJ, Gauvreau K, Newburger JW, Spray TL, Moller JH, Iezzoni LI. Consensus-based method for risk adjustment for surgery for congenital heart disease. J Thorac Cardiovasc Surg. 2002;123(1):110-8. doi:10.1067/mtc.2002.119064
15. Jenkins KJ, Gauvreau K. Center-specific differences in mortality: Preliminary analyses using the Risk Adjustment in Congenital Heart Surgery (RACHS-1) method. J Thorac Cardiovasc Surg. 2002;124(1):97-104. doi:10.1067/mtc.2002.122311
16. Diaz LK, Akpek EA, Dinavahi R, Andropoulos DB. Tracheoesophageal fistula and associated congenital heart disease: implications for anesthetic management and survival. Paediatr Anaesth. 2005;15(10):862-9. doi:10.1111/j.1460-9592.2005.01582.x
17. Sanphasitvong V, Jim LY, Tantiwongkosri K. Impact of Accuracy of Preoperative Transthoracic Echocardiography on Complex Congenital Heart Surgery in Pediatrics. Siriraj Med J. 2019;71(6):480-5. https://doi.org/10.33192/Smj.2019.71
18. Andropoulos DB, Rowe RW, Betts JM. Anaesthetic and surgical airway management during tracheo-oesophageal fistula repair. Paediatr Anaesth. 1998;8(4):313-9. doi:10.1046/j.1460-9592.1998.00734.x
19. Atzori P, Iacobelli BD, Bottero S, Spirydakis J, Laviani R, Trucchi A, et al. Preoperative tracheobronchoscopy in newborns with esophageal atresia: does it matter? J Pediatr Surg. 2006;41(6):1054-57. doi:10.1016/j.jpedsurg.2006.01.074
20. Reeves ST, Burt N, Smith CD. Is it time to reevaluate the airway management of tracheoesophageal fistula? Anesth Analg. 1995;81(4):866-9. doi:10.1097/00000539-199510000-00036
21. Tabib A, Abrishami SE, Mahdavi M, Mortezaeian H, Totonchi Z. Predictors of Prolonged Mechanical Ventilation in Pediatric Patients After Cardiac Surgery for Congenital Heart Disease. Res Cardiovasc Med. 2016;5(3):e30391. doi:10.5812/cardiovascmed.30391
22. Friedmacher F, Kroneis B, Huber-Zeyringer A, Schober P, Till H, Sauer H, et al. Postoperative Complications and Functional Outcome after Esophageal Atresia Repair: Results from Longitudinal Single-Center Follow-Up. J Gastrointest Surg. 2017;21(6):927-35. doi:10.1007/s11605-017-3423-0
23. Lal DR, Gadepalli SK, Downard CD, Ostlie DJ, Minneci PC, Swedler RM, et al. Challenging surgical dogma in the management of proximal esophageal atresia with distal tracheoesophageal fistula: Outcomes from the Midwest Pediatric Surgery Consortium. J Pediatr Surg. 2018;53(7):1267-72. doi:10.1016/j.jpedsurg.2017.05.024