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# COMPLICATIONS OF SURGICAL REPAIR FOR ESOPHAGEAL ATRESIA

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## ABSTRACT

**Background:** Postoperative complications remain common in esophageal atresia repair surgeries. Accurate diagnosis and appropriate treatment of these complications remain a major challenge for pediatric surgeons. **Objective:** To evaluate early and late complications following surgical repair of esophageal atresia. **Materials and Methods:** A retrospective study included all neonates admitted to the Neonatal Intensive Care Unit (NICU) at Tishreen University Hospital between 2017 and 2022 who were diagnosed with esophageal atresia and underwent surgical repair. Detailed information was obtained from neonates' records (gestational age, age at diagnosis, weight, sex, presence of associated anomalies, type of esophageal atresia, age at surgical procedure, type of surgical procedure, presence and duration of postoperative mechanical ventilation), as well as information on early (within the first month after surgery) and late (from 1 month to 5 years after surgery) complications and their management. **Results:** The research sample included 17 neonates, the majority of whom were born at full term (64.7%). The most common type of esophageal atresia was type C (82.4%), followed by type D (11.8%), and type E (5.9%), with associated malformations presenting in (64.7%) of these cases. Surgical repair involved a thoracic access in the majority of cases (94.1%), and most neonates required mechanical ventilation for 1-5 days. Early complications included esophageal stricture (58.8%) and leakage (23.5%). Late complications included gastroesophageal reflux (GER) in (70.6%), recurrent respiratory infections in (64.7%), and dysphagia in (47.1%). **Conclusion:** Emphasize the importance of pre- and postoperative follow-up of neonates with esophageal atresia by parents, pediatricians, and pediatric surgeons to help detect any complications early and manage them in the most appropriate manner.

**KEYWORDS:** Complications - Surgical Repair - Esophageal Atresia.

## INTRODUCTION

Esophageal atresia (EA) and tracheoesophageal fistula (TEF) are rare and relatively complex congenital malformations. Consequently, their surgical management and subsequent follow-up represent a significant challenge for most pediatric surgeons and other involved specialists.[1]

Prematurity, low birth weight, and associated congenital anomalies are correlated with higher mortality rates and complicate the care of these newborns. Survival rates are higher in full-term newborns without other anomalies.[2,3]

Survival rates are also associated with factors including neonatal intensive care, anesthesia, surgical techniques, parenteral nutrition, and antibiotics. Despite good surgical management and care, some post-operative complications often occur in the early or late stages and may be associated with negative outcomes.[4,5]

Early detection and treatment of potential complications are essential to prevent adverse long-term outcomes. Therefore, this study focuses on early and late post-operative complications and their management.

### Importance and objectives of the research

Given the importance of complications following surgical repair of esophageal atresia and their impact on survival and quality of life in these patients, and the absence of a local study to evaluate these complications, this study will classify these complications, both early and late, and their frequency.

## PATIENTS AND METHODS

### Study population

This research included neonates admitted to the neonatal intensive care unit at Tishreen University Hospital between 2017 and 2022 who were diagnosed with esophageal atresia and underwent surgical repair. All post-operative deaths due to associated malformations and cases that could not be followed up were excluded. We collected detailed information from patient files,

including gestational age, age at diagnosis, weight, gender, presence of associated anomalies, type of esophageal atresia, age at surgery, type of surgical procedure, presence and duration of post-operative mechanical ventilation. We also collected information on early complications (within the first month after surgery) and late complications (from 1 month to 5 years after surgery) and their management.

**Statistical analysis**

The statistical analysis was conducted utilizing IBM SPSS version 20. The basic descriptive statistics included means, standard deviations (SD), medians, frequencies, and percentages. To assess the differences between paired groups, the Friedman test was employed. All tests held significance at a type I error rate of 5% ($p<0.05$), with $\beta=20\%$, and 80% power for this study.

## RESULTS

The research sample included 17 neonates, admitted to the Neonatal Intensive Care Unit (NICU) and diagnosed with esophageal atresia at Tishreen University Hospital during the period 2017-2022, who underwent surgical repair and met the inclusion criteria for the study.

**Table 1: Distribution of the study sample by gender and gestational age.**

| The research sample | N | Percentage % |
|---|---|---|
| Male | 11 | 64.7% |
| Female | 6 | 35.3% |
| | | |
| premature | 6 | 35.3% |
| full-term | 11 | 64.7% |

According to Table 1, the study sample consisted of 64.7% males, with a sex ratio (M:F) of 1.8:1. Additionally, 64.7% of the sample were full-term pregnancies.

Neonates were classified according to the type of esophageal atresia and type of surgical procedure, and the results were as the following.

**Table 2: Distribution of the study sample by type of EA and surgical procedure.**

| Type of EA | N | % |
|---|---|---|
| C | 14 | 82.4% |
| D | 2 | 11.8% |
| E | 1 | 5.9% |
| Type of surgical procedure | N | % |
| Open thoracotomy | 16 | 94.1% |
| Cervical approach | 1 | 5.9% |

Based on the previous (Table 2), the majority of cases (82.4%) were type C, followed by type D (11.8%) and type E (5.9%). Open thoracotomy repair was the primary surgical procedure for 94.1% of the sample, while a Cervical approach repair was performed in one case (5.9%).

We also studied the accompanying deformities and the need for mechanical ventilation after surgery, and we found the following.

**Table 3: Distribution of the study sample according to the accompanying deformities and the need for mechanical ventilation**.

| The accompanying deformities | N | % |
|---|---|---|
| present | 11 | 64.7% |
| absent | 6 | 35.3% |
| The need for mechanical ventilation | N | % |
| present | 12 | 70.6% |
| absent | 5 | 29.4% |

We note from the previous (Table 3) that 64.7% presented with concomitant congenital malformations. Additionally, 70.6% required mechanical ventilation, with a duration ranging from 1 to 5 days, averaging 1.1±1.91 days.

The study investigated the occurrence of both early and late complications, including their respective incidence rates as the following table.

**Table 4: Distribution of the study sample according to both early and late complications.**

| Early complications | N | % |
|---|---|---|
| Anastomotic strictures | 10 | 58.8% |
| Anastomotic leakages | 4 | 23.5% |
| Recurrent TEFs | 0 | 0% |
| Late complications | N | % |
| Gastroesophageal reflux | 12 | 70.6% |
| Recurrent respiratory infections | 11 | 64.7% |
| Dysphagia | 8 | 47.1% |

Based on the previous (Table 4)

- Esophageal stricture was observed in 58.8% of the study sample and treated with balloon dilatation via upper gastrointestinal endoscopy, requiring an average of 3.10 ± 1.4 sessions (range: 1-6 sessions).
- Anastomosis leakage occurred in 23.5% of cases and was managed with observation.
- No patients experienced tracheoesophageal fistula recurrence.
- Gastroesophageal reflux disease (GERD) was present in 70.6% of the sample and managed with anti-reflux therapy.
- Recurrent respiratory infections occurred in 64.7% and were managed with supportive therapy.
- 47.1% experienced dysphagia, which was managed with observation.

We later studied the relation between the occurrence of complications (early and late) and demographic variables and found the following.

**Table 5: The relation between the occurrence of complications (early and late) and demographic variables.**

| Demographic variables | | Early complications | | P-value | Late complications | | P-value |
|---|---|---|---|---|---|---|---|
| | | present | absent | | present | absent | |
| Gender | Male | 7 (70%) | 4 (57.1%) | 0.5 | 8 (61.5%) | 3 (75%) | 0.6 |
| | Female | 3 (30%) | 3 (42.9%) | | 5 (38.5%) | 1 (25%) | |
| Gestational age (week) | | 37.80±1.8 | 37±2 | 0.4 | 37.15±2.07 | 38.50±0.5 | 0.2 |
| Birth weight (gram) | | 2513±308.8 | 2684±538.4 | 0.4 | 2431.15±314.2 | 3078.75±289.1 | 0.002 |
| Age at surgery (day) | | 2±0.6 | 4.71±3.6 | 0.03 | 2±0.5 | 6.75±3.7 | 0.0001 |

The study examined the relation between demographic variables and the incidence of both early and late complications according to the previous (Table 5). A statistically significant difference was found, with the group experiencing early complications being younger at the time of surgery. Similarly, for late complications, statistically significant differences were observed in both birth weight (the group with complications had a lower birth weight) and age at surgery (the group with complications was younger).

## DISCUSSION

Postoperative complications following EA repair remain a significant concern. The study's findings, based on a sample of 17 neonates, highlight the prevalence of specific complications and underscore the need for vigilant follow-up care.

The demographic characteristics of the study population, with a majority born at full term (64.7%), and the distribution of EA types, with type C being the most common (82.4%), are consistent with established literature on EA. The high rate of associated malformations (64.7%) reflects the complexity often associated with EA cases.

The surgical approach, predominantly involving thoracic access (94.1%), and the common need for post-operative mechanical ventilation for 1-5 days, are standard practices in EA repair. The study's findings regarding early complications, notably esophageal stricture (58.8%) and leakage (23.5%), align with previous reports on the common challenges encountered in the immediate post-operative period. Anastomotic stricture is known to be a frequent complication following EA/TEF repair.

The identified late complications, including gastroesophageal reflux (GER) in 70.6%, recurrent respiratory infections in 64.7%, and dysphagia in 47.1%, emphasize the long-term morbidity associated with EA repair. These complications can significantly impact the quality of life of affected individuals and necessitate ongoing management.

In discussing this study in the context of existing literature, it is necessary to explore how these findings correlate with or diverge from other significant research in the field of Pediatric Surgery about post-operative outcomes in EA patients.

The first study by Zhu et al. (2018) a retrospective study reviewed the cases of 172 esophageal atresia (EA) patients, post-operative complications occurred in 41.4%, with anastomotic strictures (23.7%), anastomotic leakages (11.1%), gastroesophageal reflux (5.9%), and recurrent tracheoesophageal fistulas (5.2%) being the most frequent. These complications were managed with various treatments such as esophageal dilatation, conservative treatments, anti-reflux medications, and re-operations.[6]

The second study by Al-Naimi et al. (2022) This retrospective review examined the medical records of 35 patients with tracheoesophageal fistula (TEF), showed that immediate post-operative complications occurred in 33% of patients, including anastomosis leak (12%), air leak (6%), and sepsis (6%). Long-term complications included gastroesophageal reflux (GERD) in 63%, dysphagia in 31%, and anastomotic stricture in 34%.[7]

Similarly, a study by Chiang et al. (2023) of 65 patients who underwent EA with/without TEF repair, found that significant gastro-esophageal and respiratory morbidities remained prevalent despite successful surgical repair, highlighting the importance of long-term multi-disciplinary care.[8]

## CONCLUSION

This study reinforces the critical importance of comprehensive pre- and post-operative follow-up for neonates with EA. Collaborative efforts among parents, pediatricians, and pediatric surgeons are crucial for the early detection and appropriate management of potential complications. Early detection of potential complications and appropriate management is key. Further research with larger sample sizes and multi-center collaborations could provide a more comprehensive understanding of the factors influencing post-operative outcomes in EA patients.

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