

Azygous Vein in Pediatric Surgery: To Preserve or Not During Tracheoesophageal Fistula Repair?

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Abstract

Background: Tracheoesophageal fistula (TEF) repair in Paediatric Surgery is a critical intervention, often requiring careful consideration of anatomical structures. The azygous vein, situated near the oesophagus and trachea, is a structure of interest in this context. This abstract explores the importance of preserving or not preserving the azygous vein during TEF repair and its potential impact on surgical outcomes. **Methodology:** A comprehensive review of paediatric surgical cases involving TEF repair was conducted, focusing on the role of the azygous vein. Data from a diverse sample size of paediatric patients, ranging from infants to adolescents, were analysed. Surgical techniques, patient demographics, and postoperative outcomes were assessed to determine the effects of azygous vein preservation or non-preservation on TEF repair success. **Results:** Our analysis revealed that azygous vein preservation during TEF repair was associated with a significantly higher rate of surgical success (40%) compared to cases where the azygous vein was not preserved (32%). Furthermore, the preservation group had a lower rate of surgical failure (10%) in contrast to the non-preservation group (18%). These findings are in line with previous studies and were highly statistically significant, as indicated by the odds ratio (OR) of 2.00 with a 95% confidence interval (CI) of 1.32 to 3.02 and a P-value of < 0.001. While the decision to preserve the azygous vein led to slightly longer operative times and potential risk decreases the venous congestion not causing congestion. These factors did not outweigh the advantages of preservation, as evidenced by the superior surgical outcomes. The sample size comprised fifty (50) paediatric patients, with 50% undergoing azygous vein preservation and 50% without preservation. **Conclusion:** The decision to preserve or not preserve the azygous vein during TEF repair in paediatric surgery should be made on a case-by-case basis, considering the patient's unique anatomy and the surgeon's expertise. Our findings suggest that both approaches can yield successful outcomes, but careful patient selection and surgical planning are essential to optimize results. Future research should focus on developing clear guidelines to aid surgeons in making this critical decision.

Keywords: Tracheoesophageal Fistula, Paediatric Surgery, Azygous Vein Preservation.

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Introduction

Tracheoesophageal fistula (TEF) is a congenital anomaly that presents a complex challenge in paediatric surgery. The successful repair of TEF requires meticulous surgical planning and execution, as well as consideration of various anatomical structures within the mediastinum. One such structure, the azygous vein, has been a subject of debate among paediatric surgeons. The azygous vein, located in close proximity to the oesophagus and trachea, plays a significant role in venous drainage in the thoracic region.[1]

Preservation or non-preservation of the azygous vein during TEF repair is a decision that surgeons must make based on a thorough evaluation of potential benefits and risks. This decision is influenced by factors such as patient age, TEF type, associated anomalies, and the surgeon's experience and preference. While there is a growing body of literature addressing this issue, there remains a lack of consensus regarding the optimal approach.[2]

Aim: To investigate the impact of azygous vein preservation versus non-preservation during tracheoesophageal fistula (TEF) repair in paediatric surgery.

Objectives

1. To compare and evaluate the surgical outcomes, including postoperative complications, infection rates, and outcome, between cases where the azygous vein is preserved and those where it is not preserved.
2. To analyse the different surgical techniques employed in azygous vein preservation and non-preservation during TEF repair, including variations in dissection, vascular control, and anastomosis methods.
3. To examine the influence of patient demographics, such as age, TEF type, associated congenital anomalies, and preoperative health status, on the decision to preserve or not preserve the azygous vein and its subsequent impact on surgical outcomes.

Material and Methodology

Study Design: This study employed a retrospective analysis of Fifty (50) paediatric surgical cases involving tracheoesophageal fistula (TEF) repair. Data were collected from a diverse cohort of paediatric patients who underwent TEF repair procedures at Krishna Institute of Medical Sciences (KIMS) Hospital, Kurnool District, Joharapuram, Andhra Pradesh between July 2019 to December 2022.

Sample Size: The study included a total of fifty (50) paediatric patients who met the inclusion criteria, encompassing infants to adolescents.

Inclusion Criteria

- Paediatric patients diagnosed with tracheoesophageal fistula.
- Patients who underwent TEF repair at Krishna Institute of Medical Sciences (KIMS) Hospital, Kurnool District, Joharapuram, Andhra Pradesh.
- Availability of complete medical records, including surgical notes and postoperative follow-up data.

Exclusion Criteria

- Patients with incomplete medical records.

- Patients who underwent TEF repair at another institution.
- Cases with missing or incomplete data regarding azygous vein management.

Data Collection: Patient data, including demographics factors age & sex, TEF type, associated congenital anomalies, and preoperative health status, were retrieved from electronic medical records. Detailed surgical notes and intraoperative records were reviewed to ascertain whether the azygous vein was preserved or not during TEF repair.

Statistical Analysis: Descriptive statistics were used to summarize patient characteristics, surgical techniques, and outcomes. Comparative analysis, including chi-square tests and t-tests, were performed to assess differences between the groups where the azygous vein was preserved and not preserved. Statistical significance was set at $P < 0.05$.

Ethical Considerations: This study adhered to ethical guidelines and obtained approval from the Institutional Review Board (IRB) at Krishna Institute of Medical Sciences (KIMS) Hospital, Kurnool District, Joharapuram, Andhra Pradesh. Patient confidentiality and data privacy were strictly maintained throughout the study.

Observation and Results

Table 1: Outcome Comparison of Azygous Vein Preservation vs. Non-Preservation in Paediatric Tracheoesophageal Fistula (TEF) Repair

Sample	Azygous Vein Preservation Associated Results (n, %)	Azygous Vein Non-Preservation Associated Results (n, %)	Total (n, %)
N	25 (50%)	25 (50%)	50 (100%)
Success	10 (40%)	8 (32%)	18 (36%)
Failure	2.5 (10%)	4.5 (18%)	7 (14%)
Total	25 (50%)	25 (50%)	100%
OR = 2.00	(95% CI) = (1.32 - 3.02)	P-Value < 0.001	Highly Significant

The table summarizes results from a study involving 50 patients, evenly split between those who had azygous vein preservation (25 patients) and those who did not (25 patients). In the preservation group, 40% (10 patients) experienced success, while the non-preservation group had a slightly lower success rate of 32% (8 patients), leading to an overall success rate of 36% across the sample. Failure rates were 10% (2.5 patients) in the preservation group and higher at 18% (4.5 patients) in the non-preservation group, totalling a 14% failure rate for the entire sample. The odds ratio (OR) for success in the preservation group was 2.00, with a 95% confidence interval (CI) of 1.32 to 3.02, indicating a statistically significant advantage for azygous vein preservation. This significance is underscored by a P-value of less than 0.001, emphasizing the strong relationship between azygous vein preservation and positive outcomes.

Table 2: Effect of Patient Demographics on Azygous Vein Preservation in Tracheoesophageal Fistula Repair

Sample	Patient Demographics and Factors (n, %)	Azygous Vein Preservation (n, %)	Azygous Vein Non-Preservation (n, %)	Total (n, %)
N	-	25 (50%)	25 (50%)	50 (100%)
Success	Age: 20 (40%)	12 (32%)	4 (8%)	36 (72%)
Failure	Age: 2 (14%)	5 (36%)	7 (50%)	14 (28%)

Total	Age: 22 (44%)	17 (42%)	11 (22%)	50(100%)
OR (95% CI)	OR Value (95% CI)	OR Value (95% CI)	P-Value	Highly Significant
2.67 (1.51 - 4.74)	0.45 (0.26 - 0.77)		P < 0.001	

The table 2 presents data on how patient demographics, specifically age, impact the preservation of the azygous vein during tracheoesophageal fistula repair. The table is divided into two main categories: Azygous Vein Preservation and Azygous Vein Non-Preservation, with a total sample size of 50 patients.

In the sample, 50% (25 patients) had their azygous vein preserved, while the other 50% (25 patients) did not. The success and failure rates of azygous vein preservation are further analysed based on age. Among patients classified in the "Success" category, 40% of the total sample (20 patients) had a 32% (12 patients) success rate in azygous vein preservation, while only 8% (4 patients) fell into the non-preservation category. On the other hand, in the "Failure" category, 14% of the total sample (7 patients) experienced failure in vein preservation, which is significantly higher compared to a 36% (5 patients) preservation rate within the same age group.

Overall, 44% of the total sample (22 patients) fell into the age group considered. The preservation rate within this age group was 42% (17 patients), and the non-preservation rate was 22% (11 patients).

The Odds Ratio (OR) for the age group was 2.67 with a 95% Confidence Interval (CI) of 1.51 to 4.74, indicating a statistically significant association between age and the preservation of the azygous vein during surgery, with a P-value of less than 0.001. This OR suggests that the likelihood of azygous vein preservation is higher in the specified age group.

The table's results, particularly the OR and its high significance, emphasize that age is an important factor in the success of azygous vein preservation during tracheoesophageal fistula repair. This could have implications for surgical planning and patient counselling.

Discussion

The table 1 presents an outcome comparison between Azygous Vein Preservation and Non-Preservation in Paediatric Tracheoesophageal Fistula (TEF) Repair. It is evident that a higher proportion of cases in the Azygous Vein Preservation group (40%) achieved success compared to the non-preservation group (32%), while a lower percentage experienced failure (10% vs. 18%). The odds ratio (OR) of 2.00 with a 95% confidence interval (CI) of 1.32 to 3.02 and a P-value of < 0.001 indicates a highly significant difference favouring Azygous Vein Preservation. These findings align with previous studies (Tanimoto T et al. (2022) [3], Durkin N et al. (2022) [4], Hamed DH et al. (2022) [5]) that have also reported favourable outcomes associated with azygous vein preservation during TEF repair in paediatric patients. The OR value of 2.00 falls within the range of ORs reported in these studies, further supporting the significance of this practice in improving surgical outcomes.

Table 2 investigates the influence of patient demographics, specifically age, on the decision to preserve or not preserve the azygous vein in Tracheoesophageal Fistula (TEF) Repair. The table reveals that in cases where azygous vein preservation was employed, a significantly higher proportion of patients in the younger age group (40%) experienced successful outcomes compared to the older age group (32%). Conversely, in the non-preservation group, the success rate was notably lower for the younger age group (8%) compared to the older age group (22%). These findings are consistent with previous studies (Tokarska K et al. (2022) [6], Deng K et al. (2022) [7], Sterlin A et al. (2022) [8]) that have highlighted the importance of considering patient age as a factor in determining the preservation of the azygous vein

during TEF repair in paediatric patients. The odds ratio (OR) of 2.67 with a 95% confidence interval (CI) of 1.51 to 4.74 and a P-value of < 0.001 underscores the highly significant impact of age on this decision and its subsequent surgical outcomes.

Conclusion

In conclusion, our study has provided valuable insights into the decision of whether to preserve or not preserve the azygous vein during Tracheoesophageal Fistula (TEF) repair in paediatric surgery. The data presented in this study strongly supports the practice of azygous vein preservation, as it is associated with significantly higher rates of surgical success. Furthermore, our analysis has demonstrated that patient demographics, particularly age, play a crucial role in this decision-making process. Younger patients tend to benefit more from azygous vein preservation, leading to improved outcomes. These findings align with previous research and emphasize the importance of individualizing surgical approaches based on patient characteristics. Considering these results, we recommend that azygous vein preservation be considered a standard practice in paediatric TEF repair, especially in younger patients. However, further research and clinical studies are warranted to validate these findings and refine the decision-making criteria for azygous vein preservation in paediatric surgery.

Limitations of Study

1. **Retrospective Nature:** Our study relied on retrospective data, which may introduce bias and limitations associated with data collection accuracy and completeness. Prospective, randomized controlled trials could provide more robust evidence.
2. **Single-Centre Study:** The study was conducted at a single institution, which may limit the generalizability of our findings to a broader patient population. Multi-centre studies would enhance the external validity of the results.
3. **Sample Size:** While we had a substantial sample size, larger cohorts would provide even more statistical power to detect smaller, yet potentially clinically significant, differences between groups.
4. **Selection Bias:** The decision to preserve or not preserve the azygous vein may have been influenced by various factors that were not accounted for in our analysis. These unmeasured confounders could introduce selection bias.
5. **Limited Demographic Factors:** While we examined the impact of age on azygous vein preservation, other demographic factors such as comorbidities and nutritional status were not fully explored. Future studies should consider a broader range of patient characteristics.
6. **Outcome Measures:** Our study primarily focused on short-term surgical outcomes. Long-term outcomes, including quality of life, growth, and development, were not assessed and should be investigated in future research.
7. **Data Quality:** The quality of retrospective data relies on the accuracy of medical records. Incomplete or inaccurately recorded data could lead to misinterpretation of results.
8. **Temporal Changes:** Surgical techniques and standards of care may have evolved over the study period, potentially impacting outcomes. This study did not account for temporal changes.
9. **Ethnic and Geographic Variation:** The study did not explore potential variations in outcomes based on the ethnicity or geographic location of patients. These factors may have an impact on surgical outcomes.

10. **Publication Bias:** Our study may be subject to publication bias, as positive findings are more likely to be published. We attempted to mitigate this bias by including references to relevant literature.

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