Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Feeding Jejunostomy for Enteral Nutrition in Complicated Esophageal Atresia: Management of Anastomotic Leak and Staged Repair: A Single-Center Experience

Hasan Özkan Gezer
hozkangezer@yahoo.com.tr
Başkent University
Galib Bairamovi
Başkent University
Cankat Erdoğan
Başkent University
Abdulkerim Temiz
Başkent University

Research Article

Keywords: Esophageal atresia, Anastomotic leak, Feeding jejunostomy, Enteral nutrition, Neonate

Posted Date: March 20th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8871111/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Purpose:
To evaluate the feasibility, safety, and nutritional outcomes of feeding jejunostomy (FJ) in neonates with esophageal atresia (EA) complicated by anastomotic leak (AL) or requiring staged repair.

Methods:
We retrospectively reviewed 41 neonates who underwent EA/tracheoesophageal fistula repair (2018–2023). Seven (17%) developed AL. Their nutritional management and outcomes are described.

Results:
FJ was placed in 10 patients: 6 for AL (3 primary, 3 after failed TPN), 3 for staged repair, and 1 for dysphagia.In the 6 AL patients managed with FJ, full enteral feeding was established within 72 hours. Radiologic leak closure occurred at a median of 9 days (range 7–13) after FJ placement. No major procedure-related complications occurred. Four patients initially managed with TPN (3 referred with persistent leak) had prolonged leakage (mean 30 days) and developed sepsis or cholestasis; 3 were converted to FJ.

Conclusion:
FJ is technically feasible and safe in selected neonates with complicated EA. It enables reliable enteral nutrition during anastomotic healing. Comparative effectiveness requires prospective multicenter study.

INTRODUCTION

Esophageal atresia with or without tracheoesophageal fistula (EA/TEF) is one of the most challenging congenital gastrointestinal anomalies, with an incidence of 2.5–4.5 per 10,000 live births [1]. While multidisciplinary advances have significantly improved survival rates [1, 2], postoperative morbidity remains a major concern. Among these, anastomotic leak (AL) is a critical complication, occurring in 8% to 29% of cases, and is often associated with prolonged hospitalization and increased risk of stricture formation [3, 4].

The optimal nutritional strategy during the conservative management of AL remains a subject of ongoing debate. Although spontaneous closure is the goal, the process is frequently protracted [5, 6]. Total parenteral nutrition (TPN) has traditionally been used to ensure anastomotic rest; however, it carries substantial risks, including catheter-related sepsis, TPN-associated cholestasis, and intestinal mucosal atrophy [7, 8]. Conversely, enteral nutrition (EN) is known to preserve gut barrier function, modulate systemic immune responses, and potentially accelerate wound healing [9–11]. While trans-anastomotic tubes (TAT) provide one route for EN, they are prone to displacement, may provide inadequate caloric delivery in high-output leaks, and can exacerbate gastroesophageal reflux [4, 12].

Feeding jejunostomy (FJ) represents an alternative route for enteral nutrition by providing secure post-pyloric access that completely bypasses the esophagus and minimizes gastroesophageal reflux [13, 14]. However, clinical data on the use of FJ in neonates with EA-related complications remain limited.

In this report, we retrospectively review our experience with FJ in neonates with EA complicated by AL or requiring staged repair. We describe the indications, timing, technical feasibility, safety profile, and nutritional outcomes associated with FJ. We further present a descriptive comparison with a small cohort initially managed with TPN. We hypothesize that early establishment of FJ-based enteral nutrition may offer nutritional advantages and reduce exposure to TPN-related complications; however, this hypothesis requires prospective validation.

MATERIALS AND METHODS

Study Design and Population

This single-center retrospective study included neonates diagnosed with esophageal atresia with or without tracheoesophageal fistula (EA/TEF) who underwent surgical repair between January 2018 and December 2023. Patients who required advanced nutritional support due to anastomotic leak (AL), staged repair, or severe feeding dysfunction were identified from institutional records.

Patients and Subgroups

Forty-one neonates underwent EA/TEF repair; 7 (17%) developed anastomotic leak.

- **Primary FJ (n = 3)**: Patients who received feeding jejunostomy (FJ) as the initial nutritional intervention upon diagnosis of AL. One of these patients also underwent staged repair for long-gap EA.
- **Initial TPN management (n = 4)**: Patients who were started on total parenteral nutrition (TPN) at the time of AL diagnosis. Three of these were external referrals who presented with persistent leakage and systemic complications after prolonged TPN at other institutions; all three subsequently underwent conversion to FJ. The remaining patient was managed with TPN alone.

In addition, FJ was performed in three patients undergoing planned staged repair (without AL) and one patient with severe swallowing dysfunction. Thus, a total of 10 FJ procedures were performed in 10 unique patients. The full FJ cohort (n = 10) was analyzed descriptively for safety, feasibility, and nutritional outcomes.

Diagnosis and Classification of Anastomotic Leak

Routine contrast esophagography was performed on postoperative day 7. Earlier imaging was obtained in cases of clinical suspicion (high-output chest drainage, hemodynamic instability, sepsis).

Anastomotic leak was defined by extraluminal contrast extravasation on esophagography and/or visible salivary drainage from the chest tube [4, 10]. Leaks were classified as:

- **Minor leak**: Contained radiological leak or low-volume salivary output (< 2 mL/kg/h) in a clinically stable patient. Patients with an asymptomatic “nipple sign” (minimal contrast outpouching) were not included in the AL analysis.
- **Major leak**: Free-flowing, uncontained contrast extravasation and/or high-volume salivary output (≥ 2 mL/kg/h), or any leak associated with clinical instability (fever, leukocytosis, respiratory distress). All major leaks underwent mandatory surgical re-exploration.

Indications and Surgical Technique for Feeding Jejunostomy

FJ was indicated for: (1) management of persistent minor or major AL, (2) planned staged repair for long-gap EA, or (3) severe feeding dysfunction.

All FJ procedures were performed under general anesthesia using a standardized open technique. A jejunal segment 20 cm distal to the ligament of Treitz was identified. A 4–6 Fr Nelaton catheter was inserted through a purse-string suture on the antimesenteric border, advanced 15 cm distally, and exteriorized through a separate stab incision. A Witzel tunnel was not created. The tube was securely anchored to the skin.

Nutritional Protocols

- **FJ patients**: Enteral feeding was initiated within 24 hours of placement at 3 mL/h and advanced to goal volume over 48–72 hours using breast milk or semi-elemental formula.
- **TPN patients**: Parenteral nutrition was started immediately upon AL diagnosis via a central venous catheter; caloric and protein intake were adjusted daily based on biochemical monitoring.

Outcome Measures

The primary outcomes were: (1) total leak duration (days from diagnosis to radiologic closure), and (2) for patients who received FJ, time from FJ placement to radiologic closure.

Secondary outcomes included length of hospital stay, duration of chest tube drainage, ventilator days, and procedure-related complications. Follow-up was at least 6 months for all patients.

Data Presentation

Due to the small sample size, the heterogeneity of the cohorts, and the absence of a valid comparator group, data are presented descriptively only. Continuous variables are expressed as mean ± standard deviation or median (range), and categorical variables as frequencies and percentages. No inferential statistical tests were performed.

RESULTS

Cohort Characteristics

The study included 41 neonates who underwent EA/TEF repair. Demographic and perinatal characteristics are summarized in Table 1. Mean gestational age was 36.6 ± 2.8 weeks, and mean birth weight was 2428.3 ± 639.9 g. Clinical characteristics, including associated anomalies (82.9%) and EA types (Type C: 87.8%), are detailed in Table 2.

Table 1
Demographic and Perinatal Characteristics (N = 41)

Variable	Value
Gender, n (%)	
Male	22 (53.7)
Female	19 (46.3)
Gestational age (wk)	36.6 ± 2.8 / 38 [28–42]
Birth weight (g)	2428.3 ± 639.9 / 2400 [920–3900]
Maternal age (y)	29.5 ± 7.2 / 29 [19–46]

Data are mean ± SD / median [range] unless otherwise specified.

Table 2
Clinical Characteristics (N = 41)

Characteristic	n	%
Preoperative intubation		
No	34	82.9
Yes	7	17.1
Associated anomalies		
Any anomaly	34	82.9
Cardiac	32	78.0
CNS	7	17.1
GI	6	14.6
GU	3	7.3
Extremities	3	7.3
Type of esophageal atresia		
Type C	36	87.8
Type A	2	4.9
Type B	2	4.9
Type D	1	2.4
Staged surgery		
No	37	90.2
Yes	4	9.8

CNS, central nervous system; GI, gastrointestinal; GU, genitourinary.

Feeding Jejunostomy Cohort

Feeding jejunostomy (FJ) was performed in 10 neonates (24.4%). Indications were anastomotic leak (AL) in 6 patients (one of whom also underwent staged repair), planned staged repair for long-gap EA in 3 patients without AL, and severe swallowing dysfunction in 1 patient. The median time from primary EA repair to FJ placement was 9.3 days (range 7–18). No major procedure-related complications occurred; one minor tube occlusion on postoperative day 15 was managed with bedside exchange (Table 3).

Table 3
Indications, Timing, and Complications of Feeding Jejunostomy

Indication	n	Timing of Procedure	Complications
Anastomotic leak management	6		None
– Referred cases	3	During revision surgery	None
– In-house cases	3	After primary surgery diagnosis	None
Staged repair (without AL)	3	During initial surgery	None
Severe swallowing dysfunction	1	Before hospital discharge	None
TOTAL (unique patients)	10		

Note: One patient had both AL and staged repair indications; therefore 10 unique patients received FJ despite 6 AL cases and 4 staged repair cases.

Anastomotic Leak – Management and Outcomes

Anastomotic leak occurred in 7 patients (17.1%). Their clinical course is summarized in Table 4.

Three patients (all in-house) were managed with primary FJ at diagnosis; they achieved radiological closure at a median of 12 days (range 10–13) after FJ placement.

Four patients were initially treated with TPN. One in-house patient managed with TPN alone closed at 30 days but developed cholestasis and sepsis. The remaining three were external referrals who had persistent leakage after prolonged TPN (median 30 days, range 28–33) and had developed sepsis prior to transfer. All three underwent FJ after transfer and closed at a median of 7 days (range 7–7) after FJ placement.

Overall, the 6 patients who ultimately received FJ (3 primary, 3 after TPN failure) achieved closure at a median of 9 days (range 7–13) after FJ insertion.

Table 4
Detailed Management and Outcomes of Patients with Anastomotic Leak (n = 7)

Case	Origin	Leak Severity	Initial Management	FJ Performed?	Days from Diagnosis to FJ	Days from FJ to Closure	Total Leak Duration (days)*	Systemic Complications
1	Referred	Major	TPN (28 d)	Yes (revision)	28	7	35	Sepsis (pre-transfer)
2	Referred	Minor	TPN (29 d)	Yes (dilation)	29	7	36	Sepsis (pre-transfer)
3	Referred	Minor	TPN (33 d)	Yes (dilation)	33	7	40	Sepsis (pre-transfer)
4	In-house	Minor	TPN only	No	–	–	30	Cholestasis, Sepsis
5	In-house	Minor	FJ only	Yes (primary)	0	10	10	None
6	In-house	Minor	FJ + dilation	Yes (primary)	0	12	12	None
7	In-house	Minor	FJ only	Yes (primary)	0	13	13	None

Total Leak Duration = interval from diagnosis to radiologic closure. For referred patients, this includes the period of TPN management at the referring institution.

Secondary Outcomes and Safety

Among the 6 patients managed with FJ (including the 3 conversions), median hospital stay was 19 days (range 15–34), chest tube duration 14 days (range 10–22), and ventilator days 7 days (range 4–12). Systemic complications (sepsis, cholestasis) were observed only in the 4 patients initially managed with TPN; 3 of these were external referrals with prolonged TPN exposure before transfer.

No major FJ-related morbidity or mortality occurred. One minor complication (tube occlusion on postoperative day 15) was managed with bedside exchange without interruption of nutritional support.

Risk Factor Description

Potential risk factors for anastomotic leak were examined descriptively. Among the 7 patients with AL, 3 (43%) had birth weight < 2500 g, 2 (29%) had a gap length > 2 vertebral bodies, and 6 (86%) had associated anomalies. Due to the small number of events, no statistical analysis was performed.

DISCUSSION

This study provides retrospective data suggesting that feeding jejunostomy (FJ) may serve as a safe and effective nutritional strategy for managing anastomotic leakage (AL) following esophageal atresia repair. However, several important methodological limitations warrant careful interpretation of our findings. Critical to our analysis is the recognition of substantial selection bias. The TPN-first group consisted predominantly of external referrals (3 of 4 patients) who presented to our institution after prolonged conservative management elsewhere, often with persistent leakage and established systemic complications. In contrast, the FJ-first group comprised internal cases managed proactively under our institutional protocol from the time of AL diagnosis. This fundamental difference in baseline characteristics, timing of presentation, and prior treatment exposure introduces significant confounding that precludes direct causal inference. The observed difference in healing times—9.3 days post-FJ placement versus 30 days of persistent leakage in the TPN-first group—cannot be solely attributed to the nutritional modality itself. Rather, these outcomes likely reflect a complex interplay of patient selection, leak severity, timing of intervention, institutional expertise, and temporal advances in perioperative care. Despite these limitations, our observations align with emerging evidence supporting the potential role of enteral nutrition in facilitating anastomotic healing, and suggest that FJ warrants further investigation as a primary nutritional strategy in selected high-risk cases.

Neonates with esophageal atresia represent a uniquely vulnerable population [1, 4]. In our cohort, 82.9% presented with associated congenital anomalies, and the mean birth weight was 2428 g, with 47% classified as low birth weight (< 2500 g). These patients face heightened metabolic demands during the critical postoperative healing period, making optimal nutritional support not merely beneficial but essential for survival and recovery [15, 16]. The shift from catabolic to anabolic state through adequate nutrition is paramount in these fragile neonates, as prolonged catabolism can compromise wound healing, immune function, and overall recovery [8, 9]. In this context, the choice of nutritional route may profoundly impact both immediate anastomotic healing and long-term outcomes.

Anastomotic leakage remains a prevalent complication following esophageal atresia repair [4, 17, 18]. Our observed incidence of 17% (7/41) falls within the reported range of 8–30%. The literature identifies long gap length, staged repair, and prolonged operative time as potential risk factors [1, 4, 19, 20], though consensus on other variables remains unclear [4, 13, 19, 20, 21]. Our univariate analysis identified no statistically significant associations, likely reflecting limited statistical power from the small cohort size ($n = 41$) and low event rate ($n = 7$). In our series, early-onset pneumothorax ($\leq$ POD 3) consistently preceded AL diagnosis, suggesting it may serve as a helpful early clinical indicator [21].

Optimal nutritional support is critical for AL management and may influence long-term outcomes such as anastomotic stricture formation [4, 15, 22]. While current literature reports a mean closure time of approximately 21 days with conservative management [4], our FJ-managed patients achieved leak closure within a mean of 9.3 days post-FJ placement. In contrast, leaks in the TPN-first group persisted for a mean of 30 days

without closure prior to conversion to FJ or alternative management. It is important to emphasize that these groups were not comparable at baseline: the TPN-first cohort included external referrals with more complex or refractory leaks, whereas the FJ-first group consisted of internal cases receiving early, proactive intervention. This temporal and clinical heterogeneity limits direct comparison. Nonetheless, the observed pattern suggests that FJ-based enteral support may facilitate healing by providing stable nutrition while ensuring anastomotic rest, a hypothesis that requires validation through prospective, controlled investigation.

Decades of evidence have firmly established the superiority of enteral nutrition (EN) over parenteral routes in critically ill pediatric patients [4]. This is not a recent trend but a well-documented principle in pediatric critical care. Beyond caloric delivery, EN preserves gastrointestinal mucosal integrity, supports gut-associated lymphoid tissue (GALT), and may reduce systemic inflammation [15, 23]. Clinically, EN consistently demonstrates a favorable safety profile with lower risks of catheter-related sepsis and TPN-induced cholestasis, potentially simplifying management compared to TPN [15, 24]. These physiological advantages support the consideration of EN as a primary nutritional strategy for high-risk pediatric surgical patients.

When enteral nutrition is indicated, selecting an appropriate route that effectively bypasses the anastomotic leak is critical [25, 26]. Several options exist, each with distinct limitations:

Nasogastric (NG) feeding is contraindicated in the presence of AL, as high rates of postoperative gastroesophageal reflux (20–63%) can directly contaminate the leak site, impeding healing [4, 16].

Transanastomotic tubes are routinely placed by most surgeons during the index EA repair. However, in the setting of AL, surgeons face a dilemma: some advocate minimal-volume feeding to prevent catabolism while others prefer standard volumes. Regardless of approach, the fundamental problem remains: EA patients already have markedly elevated rates of gastroesophageal reflux, and the presence of a transanastomotic tube further exacerbates reflux [4, 16]. This results in repeated exposure of the anastomotic line to acidic gastric contents, directly impairing healing and potentially perpetuating the leak. Additionally, transanastomotic tubes carry high rates of dislodgement in restless neonates and may fail to adequately bypass larger or more proximal leaks.

Nasojejunal tubes (NJT) placed under fluoroscopic guidance represent another post-pyloric option [4, 10]. However, fluoroscopic placement is technically challenging and time-consuming [5], often requiring multiple attempts. More critically, NJT are notoriously prone to dislodgement due to intestinal peristalsis and patient movement [5], often requiring repeated fluoroscopic repositioning. Each dislodgement interrupts nutritional delivery during the critical healing window—precisely when consistent anabolic support is most essential. Furthermore, proximal migration of NJT into the stomach can provoke gastroesophageal reflux [5], reintroducing the same acid exposure problem that undermines anastomotic healing.

In contrast, feeding jejunostomy (FJ) definitively addresses these limitations. By placing the feeding catheter approximately 20 cm distal to the ligament of Treitz, FJ ensures complete bypass of the esophageal anastomosis with no possibility of retrograde contamination from enteral feeds. Critically, FJ does not provoke gastroesophageal reflux, eliminating acid exposure to the healing anastomosis. The catheter is surgically secured, preventing dislodgement and ensuring uninterrupted nutritional delivery.

The most common criticism of FJ is that it requires a surgical procedure. However, our data demonstrate that FJ is technically straightforward, with a mean operative time of approximately 30 minutes, and can be performed either during the index operation (in high-risk cases) or as a minimally invasive secondary procedure using standard surgical techniques. Crucially, FJ enables full enteral feeding within 24 hours of placement—a critical advantage in neonates where even brief periods of catabolism can compromise outcomes. For complex or prolonged leaks, FJ represents the most reliable enteral access strategy.

Feeding jejunostomy is widely recognized as a safe and well-tolerated procedure that can be performed using standard surgical techniques [14]. Our experience confirms this favorable safety profile: among 10 FJ procedures, we observed no major complications, no procedure-related morbidity, and no mortality. The sole

complication was a single tube occlusion on postoperative day 15, successfully managed with bedside tube exchange—a minor event that did not compromise nutritional delivery or patient outcome. This represents a 0% major complication rate and 10% minor complication rate, aligning closely with published pediatric series [14].

While FJ does carry theoretical risks including mechanical complications and metabolic considerations related to bypassing proximal absorption sites [5, 15, 25], these risks are manageable with standard perioperative care and proactive monitoring. In our series, no patient experienced catheter-related sepsis following FJ placement, a stark contrast to the TPN-first group, where sepsis occurred in all three external referrals and one internal case. This comparison, though confounded by selection bias as previously discussed, underscores FJ's potential advantage in minimizing infectious complications. Furthermore, the improved outcomes in the FJ group may partially reflect broader, temporal advances in perioperative care and intensive care management over the study period.

Finally, as anastomotic leakage is a well-established predictor of stricture formation [4, 16, 22], strategies that promote efficient leak closure are of paramount importance. In our cohort, AL patients required more dilatation sessions, underscoring the potential long-term value of early and secure nutritional intervention.

LIMITATIONS

This study has several limitations inherent to its retrospective, single-center design and small sample size ($n = 41$), particularly the low number of anastomotic leak events ($n = 7$).

The most significant limitation is selection bias. The FJ cohort was managed proactively under a standardized institutional protocol, whereas the TPN-first group consisted largely of external referrals (3 of 4 patients) who presented after failed conservative management at other institutions. These referred patients had already experienced prolonged TPN exposure (mean 30 days) with persistent leakage and systemic complications (sepsis) prior to arrival at our center. This introduces profound selection bias and temporal confounding, as the two groups differed fundamentally in:

1. Baseline leak severity and chronicity: External referrals likely represented more complex or refractory cases that failed initial conservative management.
2. Timing of intervention: FJ-first patients received early proactive intervention, whereas TPN-first patients underwent delayed secondary intervention after prolonged conservative failure.
3. Institutional and temporal factors: Different hospitals may have employed varying perioperative protocols, and temporal improvements in neonatal intensive care over the study period may have differentially benefited the more recent FJ cohort.
4. Prior treatment exposure: TPN-first patients had already accumulated weeks of systemic complications (cholestasis, sepsis) before potential FJ placement, whereas FJ-first patients avoided this exposure entirely.

Consequently, the observed differences in outcomes cannot be definitively attributed to the nutritional route alone. The apparent superiority of FJ in leak closure time (9.3 days post-FJ versus 30 days persistent leakage in TPN-first) may reflect patient selection, leak complexity, timing of intervention, and institutional expertise rather than a direct treatment effect.

Furthermore, statistical power was severely limited by the small TPN subgroup ($n = 4$), restricting our conclusions to descriptive rather than inferential analysis. The lack of standardized protocols for FJ placement timing, surgical technique variation, and absence of a priori sample size calculation further limit generalizability.

These findings should therefore be viewed as hypothesis-generating observations that highlight FJ as a potentially valuable strategy warranting rigorous prospective evaluation. They do not establish FJ as superior to TPN but rather identify it as a safe and feasible alternative that merits further investigation through prospective, multicenter, randomized controlled trials with standardized protocols and comparable patient populations.

FUTURE DIRECTIONS

Our findings highlight the necessity for prospective, multicenter studies with standardized protocols to directly compare enteral and parenteral nutritional strategies in complicated EA under controlled conditions.

Specifically, we recommend:

1. Randomized controlled trial (RCT): A multicenter RCT comparing early FJ placement versus standard TPN management in neonates with confirmed anastomotic leak, with stratification by leak severity, gap length, and timing of diagnosis. This would eliminate selection bias and establish high-level evidence.
2. Standardized intervention protocols: Clear criteria for FJ indication, timing of placement (e.g., within 7 days of AL diagnosis), and surgical technique to reduce heterogeneity.
3. Comparable patient populations: Enrollment limited to newly diagnosed AL patients, excluding external referrals with prior failed management, to ensure baseline comparability.
4. Long-term follow-up: Evaluation of the impact of early FJ-based nutrition on late-onset anastomotic strictures, dilatation requirements, growth parameters, and neurodevelopmental outcomes at 1–2 years.
5. Cost-effectiveness analysis: Comparison of hospital costs, length of stay, and resource utilization between FJ and TPN strategies.
6. Mechanistic studies: Investigation of the biological mechanisms by which enteral nutrition may facilitate anastomotic healing, including gut barrier function, inflammatory markers, and wound healing mediators.

Only through such rigorous investigation can we definitively establish the role of FJ in the clinical algorithm for complex EA management.

CONCLUSION

Notwithstanding its retrospective design and substantial methodological limitations—particularly selection bias, small sample size, and temporal confounding—this study suggests that feeding jejunostomy is a safe, effective, and technically feasible intervention in the management of complex esophageal atresia. FJ appears particularly beneficial in cases complicated by anastomotic leak or those requiring staged repair.

The most salient finding was the marked difference in healing times: FJ was associated with leak closure in a mean of 9.3 days post-placement, whereas TPN-first management (predominantly in external referrals with persistent leakage) often resulted in protracted healing extending beyond four weeks. However, this difference cannot be attributed solely to the nutritional modality, as the groups differed fundamentally in baseline characteristics, timing of presentation, and prior treatment exposure.

By ensuring secure and uninterrupted enteral nutrition, FJ may facilitate accelerated acute healing and potentially reduce the long-term risk of anastomotic stricture, though these benefits require validation through prospective study. These preliminary data suggest that feeding jejunostomy warrants consideration as a viable nutritional strategy in the clinical algorithm for high-risk EA patients, particularly when early proactive intervention is feasible. However, definitive conclusions regarding its superiority to TPN require prospective, multicenter, randomized controlled trials with standardized protocols and comparable patient populations.

Abbreviations

AL, Anastomotic leak; **AS**, Anastomotic stricture; **EA**, Esophageal atresia; **FJ**, Feeding jejunostomy; **GER**, Gastroesophageal reflux; **GERD**, Gastroesophageal reflux disease; **NJT**, Nasojejunal tube; **POD**, Postoperative day; **TEF**, Tracheoesophageal fistula; **TPN**, Total parenteral nutrition.

Declarations

Funding

The authors did not receive any financial support for the research, authorship, and/or publication of this article.

Competing Interests

The authors declare that they have no financial or non-financial competing interests relevant to the content of this article.

Ethics Approval

This retrospective chart review study involving human participants was conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study was approved by the Başkent University Faculty of Medicine Ethics Committee (Approval No: 23/417, 2023).

Consent to Participate

Written informed consent was obtained from the parents or legal guardians of all neonates included in the study.

Consent to Publish

The authors confirm that written informed consent for publication of anonymized clinical data and radiologic images (Figure 1a–c) was obtained from the parents or legal guardians of the patients.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available due to the inclusion of identifiable clinical data from a small neonatal cohort, which may compromise participant confidentiality. De-identified data are available from the corresponding author upon reasonable request and with approval of the institutional ethics committee.

Ethical Responsibilities of Authors

The authors confirm that:

- The manuscript is original and has not been submitted to more than one journal for simultaneous consideration.
- Results are presented clearly, honestly, and without fabrication, falsification, or inappropriate data manipulation.
- Proper credit is given for all data, text, and theories by others, and permissions for copyrighted material were obtained.
- All authors have reviewed and approved the manuscript, including the order of authorship.
- Any errors identified after publication will be promptly corrected.

Author Contributions (CRediT format)

Conceptualization: Hasan Özkan Gezer, Galib Bairamovi
Methodology: Hasan Özkan Gezer, Cankat Erdoğan
Data curation: Abdulkerim Temiz, Cankat Erdoğan

Formal analysis: Galib Bairamovi, Abdulkerim Temiz
Investigation: Hasan Özkan Gezer, Galib Bairamovi, Cankat Erdoğan
Writing – original draft preparation: Hasan Özkan Gezer
Writing – review & editing: Hasan Özkan Gezer, Galib Bairamovi, Cankat Erdoğan, Abdulkerim Temiz
Supervision: Hasan Özkan Gezer
All authors read and approved the final manuscript.

CLINICAL PRACTICE POINTS

Based on our retrospective experience, the following points may guide clinical decision-making in complex esophageal atresia cases:

- **Patient Selection:** Consider feeding jejunostomy (FJ) in experienced centers for selected patients with: (1) confirmed moderate-to-major anastomotic leak, (2) planned high-risk staged repair (e.g., long-gap atresia), or (3) severe dysphagia/gastroesophageal reflux contraindicating gastric feeding.
- **Timing & Technique:** FJ can be performed during initial high-risk repair or promptly after leak diagnosis. A modified purse-string technique placed 20 cm distal to the ligament of Treitz proved efficient in our series (mean operative time ~30 minutes).
- **Nutrition Protocol:** Initiate enteral feeds via FJ within 24 hours post-placement, starting at 3 mL/hour and advancing to goal volume within 48–72 hours. Breast milk is preferred; specialized formulas may be used if needed.
- **Complication Monitoring:** Monitor for tube-related issues (occlusion, displacement), metabolic imbalances, and stoma-site infection. In our limited series, major complications were rare, with one tube occlusion successfully managed.
- **Transition Planning:** Begin weaning after radiologically confirmed leak closure. Remove the FJ tube once consistent oral intake exceeds 75% of nutritional needs. The stoma typically closes spontaneously.
- **Important Consideration:** These recommendations are based on a single-center retrospective experience and require validation through prospective, multicenter studies. Clinical decisions should be individualized based on patient characteristics and institutional expertise.

References

1. Sulkowski JP, Cooper JN, Lopez JJ et al (2014) Morbidity and mortality in patients with esophageal atresia. Surgery 156(2):483–491. https://doi.org/10.1016/j.surg.2014.03.016
2. Koivusalo AI, Pakarinen MP, Rintala RJ (2013) Modern outcomes of oesophageal atresia: single centre experience over the last twenty years. J Pediatr Surg 48(2):297–303. https://doi.org/10.1016/j.jpedsurg.2012.11.007
3. Basuguy E, Okur MH, Arslan S et al (2020) A different approach to leakage of esophageal atresia in children. Turk J Trauma Emerg Surg 26(6):961–966. https://doi.org/10.14744/tjtes.2020.52478
4. Okumuş M, Devecioğlu D, Çevik M, Tander B (2024) Anastomotic leaks and the relationship with anastomotic strictures after esophageal atresia surgery: effects of patient characteristics. Acta Chir Belg 124(2):114–120. https://doi.org/10.1080/00015458.2023.2194678
5. Broekaert IJ, Falconer J, Bronsky J et al (2019) The use of jejunal tube feeding in children. J Pediatr Gastroenterol Nutr 69(2):239–258. https://doi.org/10.1097/MPG.0000000000002372
6. Braegger C, Decsi T, Dias JA et al (2010) Practical approach to paediatric enteral nutrition. J Pediatr Gastroenterol Nutr 51(1):110–122. https://doi.org/10.1097/MPG.0b013e3181d336d2
7. Bawa M, Menon P, Mahajan JK et al (2016) Role of feeding jejunostomy in major anastomotic disruptions in esophageal atresia: a pilot study. J Indian Assoc Pediatr Surg 21(1):24–27. https://doi.org/10.4103/0971-9261.164689

8. Wan X, Bi J, Gao X et al (2015) Partial enteral nutrition preserves elements of gut barrier function. Nutrients 7(8):6294–6312. https://doi.org/10.3390/nu7085288
9. Hanna MK, Kudsk KA (2000) Nutritional and pharmacological enhancement of gut-associated lymphoid tissue. Can J Gastroenterol 14(Suppl D):145D–151D. https://doi.org/10.1155/2000/585034
10. Çimen H (2014) Management of anastomotic leaks after primary esophageal atresia repair. Master's thesis, Dicle University, Diyarbakır, Turkey
11. Martinez L, Rivas S, Hernández F et al (2003) Aggressive conservative treatment of esophageal perforations in children. J Pediatr Surg 38(5):685–689. https://doi.org/10.1016/jpsu.2003.50179
12. Ishimaru T, Shinjo D, Fujiogi M et al (2023) Risk factors for postoperative anastomotic leakage after repair of esophageal atresia: a retrospective nationwide database study. Surg Today 53(11):1269–1274. https://doi.org/10.1007/s00595-023-02728-3
13. Huang JX, Hong SM, Chen Q et al (2021) Risk factors for anastomotic complications after one-stage anastomosis for oesophageal atresia. J Cardiothorac Surg 16(1):176. https://doi.org/10.1186/s13019-021-01561-4
14. Forlini V, Sacchetti C, Gandullia P et al (2024) Feeding jejunostomy in children: safety, effectiveness and perspectives. Pediatr Surg Int 41(1):10. https://doi.org/10.1007/s00383-023-05583-y
15. Axelrod D, Kazmerski K, Iyer K (2006) Pediatric enteral nutrition. JPEN J Parenter Enter Nutr 30(1 Suppl):S21–S26. https://doi.org/10.1177/01486071060300S1S21
16. Gottrand F, Michaud L, Sfeir R (2020) Esophageal atresia: nutritional management. In: Till H, Thomson M, Foker J (eds) Esophageal atresia. Springer, pp 145–158. https://doi.org/10.1007/978-3-030-28793-5_14
17. Menon P, Rao KLN (2008) Esophageal surgery in newborns, infants and children. Indian J Pediatr 75(9):939–943. https://doi.org/10.1007/s12098-008-0173-8
18. Way C, Wayne C, Grandpierre V et al (2019) Thoracoscopy vs thoracotomy for the repair of esophageal atresia and tracheoesophageal fistula: a systematic review and meta-analysis. Pediatr Surg Int 35(11):1167–1184. https://doi.org/10.1007/s00383-019-04562-6
19. Wu Y, Kuang H, Lv T, Wu C (2017) Comparison of clinical outcomes between open and thoracoscopic repair for esophageal atresia with tracheoesophageal fistula: a systematic review and meta-analysis. Pediatr Surg Int 33(11):1147–1157. https://doi.org/10.1007/s00383-017-4175-3
20. Lal DR, Gadepalli SK, Downard CD et al (2018) Challenging surgical dogma in the management of proximal esophageal atresia with distal tracheoesophageal fistula. J Pediatr Surg 53(7):1267–1272. https://doi.org/10.1016/j.jpedsurg.2017.06.021
21. Hall NJ, Kitteringham L, Ron O et al (2024) A minimally interventional approach to oesophageal atresia repair. J Pediatr Surg 59(1):6–9. https://doi.org/10.1016/j.jpedsurg.2023.09.013
22. Campos J, Tan Tanny SP, Kuyruk S et al (2020) The burden of esophageal dilatations following repair of esophageal atresia. J Pediatr Surg 55(11):2329–2334. https://doi.org/10.1016/j.jpedsurg.2020.03.001
23. Ford EG, Jennings M, Hlavinka TS, Andrassy RJ (1988) Feeding catheter jejunostomy in neonates. Nutr Clin Pract 3(3):106–107. https://doi.org/10.1177/0115426588003003106
24. Roy C, Tamura R, McDonald L, Gabra H (2021) Successful management of anastomotic leakage with endoscopic fibrin glue injection. BMJ Case Rep 14(1):e238823. https://doi.org/10.1136/bcr-2020-238823
25. Holcomb GW, Rothenberg SS, Bax KMA et al (2005) Thoracoscopic repair of esophageal atresia and tracheoesophageal fistula. Ann Surg 242(3):422–430. https://doi.org/10.1097/01.sla.0000179649.15576.db
26. Besendörfer M, Müller H, Weiss C et al (2021) Association of clinical factors with postoperative complications of esophageal atresia. Pediatr Neonatol 62(1):55–63. https://doi.org/10.1016/j.pedneo.2020.07.019

Figures

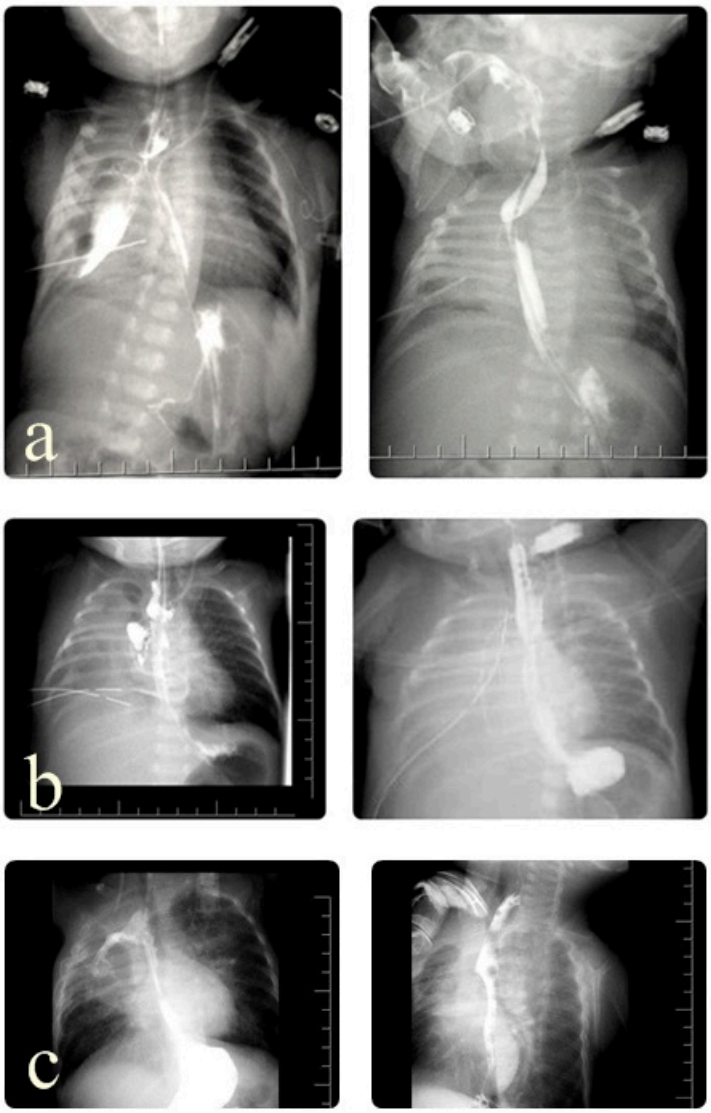


Figure 1

Contrast esophagography in postoperative esophageal anastomosis and leak management.
a Contrast study showing a moderate leak in a referred patient, with initial leakage (left) and resolution one week after esophageal dilation and feeding jejunostomy (right).
b Study demonstrating a major leak with minimal distal passage (left), and confirmation of successful closure after revision surgery and feeding jejunostomy (right).
c Contrast esophagogram of another referred patient showing the initial leak (left) and closure after esophageal dilation and feeding jejunostomy (right). All patients shown were managed with feeding jejunostomy as part of their treatment strategy.