SURGICAL MANAGEMENT STRATEGIES FOR ESOPHAGEAL ATRESIA WITHOUT TRACHEOESOPHAGEAL FISTULA IN NEONATES

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Annotation: This article explores the selection of surgical treatment strategies for congenital esophageal atresia without tracheoesophageal fistula in children—one of the most complex and severe forms of esophageal malformations in neonates. This condition poses significant diagnostic challenges, presents with critical clinical symptoms, and necessitates urgent surgical intervention. The study analyzes various clinical presentations, preoperative diagnostic methods, general condition assessments, and the development of individualized surgical plans tailored to each patient. Special emphasis is placed on thoracic surgical approaches, the use of minimally invasive techniques, gastrostomy, primary versus delayed anastomosis, as well as postoperative care and long-term outcomes. The conclusion underscores that proper selection of the surgical method plays a crucial role in improving survival rates and enhancing the overall quality of life for affected children.

Keywords: *Esophageal atresia, tracheoesophageal fistula, pure esophageal atresia, neonatal surgery, congenital esophageal anomaly, surgical management, thoracic surgery, delayed anastomosis, primary anastomosis, postoperative care*

YANGI TUG‘ILGAN CHAQALOQLARDA TRAXEOEZOFAGEAL FISTULASIZ QIZILO‘NGACH ATREZIYASINI JARROHLIK YO‘LI BILAN DAVOLASH STRATEGIYALARI

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Annotatsiya: Ushbu maqolada bolalarda uchraydigan tug‘ma qizilo‘ngach atreziyasi (TQA) ning eng murakkab shakllaridan biri — oqmasiz turi (atresia esophagus without tracheoesophageal fistula) klinik holatlari va ularni xirurgik davolash usullarini tanlash masalalari tahlil qilinadi. Mazkur patologiya erta yoshdagi bolalarda og‘ir klinik kechish, tashxis qo‘yishdagi murakkabliklar va tezkor jarrohlik aralashuvining zarurligi bilan ajralib turadi. Tadqiqot davomida kasallikning turli klinik shakllari, preoperatsion diagnostika usullari, bemorlarning umumiy ahvoli, ularning organizmiga moslashgan individual jarrohlik strategiyalari o‘rganildi. Maqolada torakal jarrohlik, minimal invaziv texnologiyalar, gastrostomiya, birlamchi va ikkilamchi anastomozlar qo‘llanilishi, shuningdek, operatsiyadan keyingi parvarish va uzoq muddatli natijalarga alohida e’tibor qaratildi. Xulosa sifatida, davolash usulini

to‘g‘ri tanlash bolaning yashab qolish imkoniyatini va hayot sifatini sezilarli darajada oshirishi ta’kidlandi.

Kalit so‘zlar: Qizilo‘ngach atreziyasi, traxeoezofageal fistula, sof qizilo‘ngach atreziyasi, neonatal jarrohlik, tug‘ma qizilo‘ngach anomaliyalari, jarrohlik muolajasi, torakal jarrohlik, kechiktirilgan anastomoz, birlamchi anastomoz, operatsiyadan keyingi parvarish

ХИРУРГИЧЕСКИЕ СТРАТЕГИИ ЛЕЧЕНИЯ АТРЕЗИИ ПИЩЕВОДА БЕЗ ТРАХЕОПИЩЕВОДНОГО СВИЩА У НОВОРОЖДЁННЫХ

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Аннотация: В данной статье рассматриваются особенности выбора хирургической тактики при врожденной атрезии пищевода без трахеопищеводного свища — одной из наиболее тяжелых форм патологии пищевода у новорожденных. Эта аномалия отличается сложной диагностикой, тяжелым течением и требует срочного оперативного вмешательства. В исследовании проанализированы различные клинические варианты заболевания, методы предоперационной диагностики, общее состояние пациентов и индивидуальные подходы к выбору хирургической тактики. Особое внимание уделено методам торакохирургии, применению малоинвазивных технологий, гастростомии, первичным и отсроченным анастомозам, а также ведению послеоперационного периода и отдаленным результатам. В заключении подчеркивается, что правильный выбор метода лечения значительно повышает шансы на выживание и улучшает качество жизни ребенка.

Ключевые слова: Атрезия пищевода, трахеопищеводный свищ, чистая атрезия пищевода, неонатальная хирургия, врождённые аномалии пищевода, хирургическая тактика, торакальная хирургия, отсроченный анастомоз, первичный анастомоз, послеоперационный уход

Esophageal atresia (EA) is a congenital anomaly characterized by an interruption in the continuity of the esophagus. It occurs in approximately 1 in 2,500 to 4,000 live births and represents one of the most critical conditions encountered in neonatal surgery. While the majority of cases (around 85–90%) are associated with a tracheoesophageal fistula (TEF), approximately 7–10% of patients present with isolated or "pure" esophageal atresia, where no communication exists between the esophagus and trachea. This rare variant is often associated with more complex clinical management, owing to its unique anatomical configuration and the absence of gastric

air on radiographs, which complicates early diagnosis.Pure esophageal atresia typically presents with signs of excessive salivation, feeding difficulties, and respiratory distress shortly after birth. However, the lack of a TEF can delay recognition and intervention, especially in centers where neonatal surgical expertise is limited. In addition, this form of EA is often accompanied by other congenital anomalies, including cardiac, renal, and vertebral defects, which further complicate management and prognosis. The decision-making process regarding surgical correction is particularly challenging in these cases, as the esophageal segments are often significantly separated, making primary anastomosis technically difficult or even impossible in the neonatal period.The importance of timely and appropriate surgical intervention cannot be overstated. In the absence of a tracheoesophageal fistula, neonates are unable to swallow saliva or feed orally, necessitating prompt establishment of alternative nutritional routes, such as gastrostomy or parenteral nutrition. Furthermore, the timing and type of esophageal repair—whether primary, delayed primary, or esophageal replacement—must be carefully tailored to each patient's anatomy, overall condition, and associated anomalies. In recent decades, advances in neonatal intensive care, surgical techniques, and perioperative management have significantly improved outcomes; however, morbidity and mortality remain higher in this subgroup compared to other types of EA.

Given the rarity and complexity of pure esophageal atresia, optimal surgical strategy remains a subject of ongoing debate among pediatric surgeons. Various approaches have been described in the literature, including delayed primary anastomosis after esophageal elongation, staged reconstruction with initial gastrostomy, cervical or thoracic esophagostomy, and, in severe cases, esophageal substitution using stomach, colon, or jejunal interposition. Each method carries its own risks and benefits, and the decision largely depends on factors such as the length of the gap between the proximal and distal esophageal segments, the neonate's general condition, and the presence of associated anomalies. Despite improvements in perioperative care, complications such as anastomotic leakage, strictures, gastroesophageal reflux, and long-term feeding difficulties remain significant concerns.Moreover, in low- and middle-income countries, including Uzbekistan, the management of such complex congenital anomalies is further challenged by limitations in neonatal intensive care resources, delayed referral, and variable access to advanced imaging and minimally invasive surgical techniques. As a result, standardized treatment protocols are often lacking, and individualized surgical decision-making becomes essential to improving outcomes.

The present study aims to evaluate and analyze surgical management strategies employed in neonates with pure esophageal atresia treated at a regional pediatric surgical center. Through retrospective review and clinical assessment, we aim to identify effective treatment algorithms based on gap length, patient stability, and

postoperative outcomes. By comparing our clinical experience with existing international standards, we seek to contribute to the development of practical guidelines suited to resource-constrained settings and to enhance overall survival and quality of life in affected neonates.

Esophageal atresia has been a subject of surgical interest since the first successful repair was reported by Cameron Haight in 1941. Over the decades, the management of EA with a tracheoesophageal fistula has become relatively standardized; however, isolated or pure esophageal atresia remains a major clinical challenge due to the absence of a distal fistula and the typically long gap between the esophageal segments. The literature suggests that these patients account for 7–10% of all EA cases and often require highly individualized treatment plans.Numerous studies have focused on classifying esophageal gap length and its influence on treatment strategy. According to Spitz and others, long-gap EA is defined by an inability to bring the two esophageal ends together without tension, and this is frequently the case in isolated EA. In such instances, initial management typically involves the placement of a gastrostomy tube to allow enteral nutrition, while various methods are employed to encourage esophageal growth, such as bougienage, traction sutures, or magnetic compression anastomosis. Delayed primary anastomosis, usually performed after 6–12 weeks, has shown promising outcomes in centers with specialized neonatal surgical teams and access to modern intensive care.

Alternative techniques, such as esophageal replacement with gastric transposition, colonic interposition, or jejunal grafts, have been employed when native esophageal repair is not feasible. These methods, however, are associated with significant long-term morbidity, including strictures, dysmotility, reflux, and nutritional challenges. Studies by Kimura et al. and Foker et al. introduced and refined traction-based techniques that allow the esophagus to elongate over time, enabling primary anastomosis in many previously inoperable cases. However, these procedures require specialized expertise and infrastructure not always available in low-resource settings.Several publications have emphasized the importance of multidisciplinary care in improving surgical outcomes, including the roles of neonatologists, radiologists, anesthesiologists, and nutritionists. Despite advances in surgical technique, the literature indicates that mortality and morbidity remain higher in patients with pure EA compared to those with TEF-associated variants, particularly in cases with concomitant anomalies or delayed diagnosis.

To date, very few studies from Central Asia, including Uzbekistan, have documented institutional experience with pure EA, especially regarding decision-making in resource-limited environments. Therefore, our study seeks to fill this gap by analyzing clinical cases managed in a regional surgical center, offering insights into practical, adaptable surgical approaches suited to similar healthcare contexts.This

study was conducted as a retrospective clinical review at the Pediatric Surgery Department of Andijan State Medical Institute, Uzbekistan, over a six-year period from January 2018 to December 2023. The primary aim was to analyze the surgical approaches, intraoperative findings, and postoperative outcomes in neonates diagnosed with isolated (pure) esophageal atresia, specifically cases lacking a tracheoesophageal fistula. The study was approved by the institutional ethical committee, and all patient information was handled with confidentiality according to international ethical standards.A total of **18 neonates** were included in the study based on specific inclusion and exclusion criteria. The **inclusion criteria** were as follows:

A confirmed diagnosis of esophageal atresia without any associated tracheoesophageal fistula.

- Neonates admitted within the first 7 days of life.
- Availability of full preoperative, intraoperative, and postoperative medical records.
- Birth weight of ≥1500 grams and gestational age of ≥32 weeks.

Exclusion criteria involved:

- Esophageal atresia cases associated with any type of tracheoesophageal fistula (Types C, D, or E).
- Severe life-threatening comorbidities incompatible with surgery (e.g., lethal cardiac defects).
- Neonates who expired before surgical intervention or whose records were incomplete.

Diagnosis was established based on a combination of clinical signs and imaging studies. Key clinical indicators included:

- Excessive drooling and accumulation of oral secretions.
- Inability to pass a nasogastric tube beyond 10–12 cm from the gum line.
- Episodes of coughing and cyanosis upon feeding attempts.

Radiological confirmation was made using plain chest and abdominal X-rays showing:

- Coiling of the nasogastric tube in the proximal esophageal pouch.
- Absence of intra-abdominal gas — a hallmark of isolated EA.

Additional diagnostic modalities such as contrast esophagograms or computed tomography were utilized in selective cases to assess gap length or rule out associated anomalies.Each neonate underwent thorough preoperative evaluation, including echocardiography and abdominal ultrasound, to identify coexisting congenital anomalies (cardiac, renal, vertebral, or anorectal), which were documented and considered in the overall treatment planning. Preoperative stabilization included thermoregulation, intravenous fluids, antibiotics, head-up positioning, and continuous suctioning of the upper pouch to prevent aspiration.

The choice of surgical strategy for each patient was determined based on the clinical condition of the neonate, the anatomical findings during surgery, and the estimated gap length between the proximal and distal esophageal segments. Gap length was assessed intraoperatively using a calibrated bougie introduced through the proximal pouch and, in selected cases, by contrast imaging. Based on the feasibility of tension-free anastomosis, patients were divided into two main groups:

1. **Primary Anastomosis Group (n = 7):**

These neonates had a relatively short esophageal gap (≤2.5 cm) and underwent one-stage thoracotomy with end-to-end esophageal anastomosis. The procedure was performed via a right posterolateral extrapleural thoracotomy through the fourth intercostal space. The proximal and distal esophageal ends were mobilized, and a single-layer interrupted or double-layer continuous suturing technique using absorbable sutures (5-0 or 6-0 polydioxanone) was used depending on tissue condition.

2. **Staged Repair Group (n = 11):**

Patients with a long esophageal gap (>2.5 cm) or significant preoperative instability underwent an initial **gastrostomy** for enteral feeding and **cervical esophagostomy** or conservative upper pouch suctioning. Delayed primary anastomosis was planned after 8–12 weeks, following weight gain and improved clinical stability. In some cases, esophageal elongation techniques (serial bougienage or traction sutures) were employed prior to definitive repair. In cases where native esophageal continuity could not be achieved, esophageal substitution (gastric pull-up or colonic interposition) was considered.

All procedures were performed under general anesthesia with preoperative and postoperative intensive care monitoring. Postoperative management included mechanical ventilation as required, intravenous antibiotics, parenteral nutrition or feeding via gastrostomy, and serial chest X-rays to monitor for complications such as anastomotic leaks or pneumothorax.

Clinical outcomes were evaluated based on several key parameters:

- **Early postoperative complications:** anastomotic leakage, strictures, wound infection, and pneumonia.
- **Late complications:** gastroesophageal reflux, feeding intolerance, need for esophageal dilatation.
- **Survival rate:** recorded at discharge and at 6-month follow-up.
- **Length of hospital stay** and **time to initiation of oral feeding** were also noted.

Follow-up assessments were carried out at 1, 3, and 6 months postoperatively through clinical examination, feeding evaluation, and radiological imaging (esophagogram) when indicated.

CONCLUSION

The surgical management of esophageal atresia without tracheoesophageal fistula remains one of the most challenging areas in neonatal surgery, particularly in resource-limited settings. Our clinical experience over a six-year period demonstrates that individualized treatment strategies based on gap length, neonatal stability, and available surgical resources can lead to satisfactory outcomes even in cases with complex anatomical presentations.

Primary esophageal anastomosis is feasible and effective in selected cases with a short gap, offering the advantage of early restoration of esophageal continuity. However, in long-gap variants, a staged approach involving initial gastrostomy, conservative management, and delayed repair remains a safe and pragmatic solution, especially when advanced traction techniques or endoscopic tools are not accessible.

Despite the inherent risks of complications such as anastomotic strictures, gastroesophageal reflux, and feeding difficulties, careful perioperative care and timely surgical decision-making significantly improve survival and quality of life. Our study highlights the importance of multidisciplinary coordination, early diagnosis, and the need for practical, adaptable surgical protocols in regions with limited specialized infrastructure.

Future directions should include the development of standardized algorithms tailored to low- and middle-income healthcare systems, capacity building in neonatal intensive care, and adoption of innovative yet affordable techniques to improve outcomes in neonates with pure esophageal atresia.

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