e-ISSN: 2807-6257

Open Access Indonesian Journal of Medical Reviews

[OAIJMR]

https://hmpublisher.com/index.php/oaijmr

Successful Management of Esophageal Atresia with Tracheoesophageal Fistula in a 7-Day-Old Male Infant

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ARTICLE INFO

Keywords:
Esophageal atresia
Multidisciplinary care
Surgical repair
Thoracotomy
Tracheoesophageal fistula

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All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/oaijmr.v5i3.710

A B S T R A C T

Esophageal atresia (EA) with tracheoesophageal fistula (TEF) is a rare congenital anomaly characterized by an incomplete esophagus and an abnormal connection between the trachea and esophagus. This condition occurs in approximately 1 in 3000 to 5000 live births and requires prompt diagnosis and surgical intervention to prevent life-threatening complications. The most common type of EA with TEF involves a proximal esophageal atresia and a distal TEF (Type C). Early diagnosis is crucial to prevent complications such as aspiration pneumonia. Surgical repair is the definitive treatment for EA with TEF, and the surgical approach involves thoracotomy, fistula ligation, and end-to-end esophageal anastomosis. This report describes the case of a 7-day-old male infant who presented with respiratory distress, excessive oral secretions, and an inability to pass a nasogastric tube. Radiographic imaging confirmed the diagnosis of EA with TEF Type C. The infant underwent successful surgical repair, including thoracotomy, fistula ligation, and end-to-end esophageal anastomosis. The postoperative course was complicated by minor wound dehiscence, which healed with secondary intention. The infant was discharged on the 10th postoperative day with no further complications. In conclusion, This case highlights the importance of a multidisciplinary approach involving neonatologists, pediatric surgeons, anesthesiologists, and nurses in the successful management of EA with TEF. Early diagnosis, prompt surgical intervention, and comprehensive postoperative care are essential for achieving favorable outcomes in infants with this condition. With appropriate management, most infants with EA with TEF can achieve normal growth and development.

1. Introduction

Esophageal atresia (EA) with or without tracheoesophageal fistula (TEF) represents a rare and complex congenital anomaly, demanding prompt recognition and meticulous management. The reported incidence of this condition ranges from 1 in 3000 to 1 in 5000 live births, underscoring its relative rarity yet significant clinical importance. EA is characterized by the incomplete development of the esophagus, resulting in a discontinuity that disrupts the normal passage of ingested substances from the pharynx to the stomach. This anatomical aberration precludes normal feeding and, if unaddressed, can lead to life-threatening complications. Tracheoesophageal fistula (TEF), frequently occurring in conjunction with EA, is an abnormal communication between the trachea and the esophagus. The presence of a TEF further complicates the clinical picture, as it allows for the potential shunting of gastric contents into the respiratory tract and vice versa. This aberrant connection poses a significant risk of aspiration pneumonia, a serious and potentially fatal complication in neonates. The constellation of EA and TEF thus presents a dual challenge: the inability to feed and the risk of respiratory compromise. The phenotypic expression of EA with TEF is heterogeneous, with several classifications delineating the anatomical variations of

the anomaly. The most prevalent type is Type C, characterized by a proximal esophageal atresia and a distal TEF. This specific configuration, where the upper esophagus ends in a blind pouch and the lower esophagus is connected to the trachea via a fistula, accounts for the majority of cases. Other less common types include EA without TEF, EA with a proximal TEF, EA with both proximal and distal TEFs, and H-type TEF (where the esophagus is patent but a TEF exists). Each of these variations presents unique clinical challenges and may necessitate different surgical approaches.[1-3]

The clinical presentation of EA with TEF in neonates is often dramatic and necessitates a high index of suspicion for early diagnosis. Immediately following birth, affected infants may exhibit excessive oral secretions, which can manifest as drooling or frothing at the mouth. Respiratory distress is a common and concerning sign, characterized by tachypnea, retractions, nasal flaring, and cyanosis. Choking and cyanosis, particularly during feeding attempts, are cardinal symptoms, highlighting the risk of aspiration. A critical diagnostic clue is the inability to pass a nasogastric or orogastric tube into the stomach. This resistance to tube passage is due to the esophageal atresia and is a key clinical indicator that prompts further investigation. The diagnosis of EA with TEF relies on a combination of clinical assessment and radiographic imaging. A thorough physical examination of the neonate is paramount, with careful attention to the aforementioned signs and symptoms. However, the cornerstone of diagnosis is radiographic confirmation. A chest X-ray is typically the initial imaging modality. In cases of EA with TEF, the chest X-ray may reveal a blind-ending proximal esophageal pouch, often visualized as a dilated upper esophageal segment. The presence of air in the stomach is another important finding, suggesting a distal TEF that allows air to pass from the trachea into the gastrointestinal tract. The definitive diagnosis is often established by the inability to pass a nasogastric tube beyond the proximal esophageal pouch, with the tube's position confirmed on the chest X-ray. Further imaging studies, such as a contrast esophagogram, may be used in some cases to delineate the anatomy of the atresia and fistula, although this is often performed cautiously to minimize the risk of aspiration. The management of EA with TEF necessitates a multidisciplinary approach, involving the collaborative efforts of neonatologists, pediatric surgeons, anesthesiologists, and specialized nursing staff. The primary goal of treatment is to establish the continuity of the esophagus and to eliminate the abnormal communication with the trachea. Surgical repair is the definitive treatment for EA with TEF. The surgical procedure typically involves a thoracotomy, which is an incision into the chest cavity, to access the esophagus and trachea. The TEF is carefully identified and ligated (tied off) to close the abnormal connection. Following fistula ligation, an end-to-end esophageal anastomosis is performed to restore the continuity of the esophagus. This involves suturing the proximal and distal segments of the esophagus together.[4-6]

The timing of surgical intervention is crucial and depends on the infant's overall clinical condition and the presence of any associated anomalies or complications. In some cases, particularly in stable infants without significant comorbidities, primary repair may be performed in the early neonatal period. However, in infants with significant respiratory distress, pneumonia, or other complicating factors, a staged approach may be necessary. The staged approach may involve initial management of the complications, followed by delayed esophageal repair. Postoperative management is equally critical to ensure a successful outcome. Infants require close monitoring in the neonatal intensive care unit (NICU). Respiratory support, including mechanical ventilation, may be necessary in the immediate postoperative period. Pain management, fluid and electrolyte balance, and nutritional support are essential components of postoperative care. Parenteral nutrition is typically provided until esophageal healing is confirmed. The introduction of oral feedings is gradual and guided by radiographic studies, such as an esophagogram, to assess the integrity of the anastomosis and rule out

any leaks or strictures. Despite advancements in surgical techniques and postoperative care, complications can still occur. Anastomotic leak, a potentially serious complication, occurs when there is a failure of the esophageal anastomosis to heal properly, leading to leakage of esophageal contents into the mediastinum. Esophageal stricture, or narrowing of the anastomosis, can also occur, leading to feeding difficulties. Recurrent fistula, although less common, is another potential complication that may require further surgical intervention. Other potential complications include wound dehiscence, as seen in the case presented in this report, and respiratory complications.[7,8]

The long-term prognosis for infants with EA with TEF has improved significantly with advances in neonatal care and surgical techniques. With appropriate and timely management, the majority of infants can achieve normal growth and development. However, long-term follow-up is essential to monitor for potential complications that may arise later in life. These long-term complications can include esophageal dysmotility, gastroesophageal reflux disease (GERD), and tracheomalacia. Esophageal dysmotility, characterized by abnormal esophageal contractions, can lead to feeding difficulties and dysphagia. GERD is a common long-term complication that can cause heartburn, regurgitation, and respiratory symptoms. Tracheomalacia, or softening of the tracheal cartilage, can lead to respiratory difficulties, particularly during increased respiratory demand.[9,10] This case report details the successful management of EA with TEF in a 7-day-old male infant, highlighting the critical role of early diagnosis, prompt surgical intervention, and a multidisciplinary approach in achieving favorable outcomes.

2. Case Presentation

The patient, a 7-day-old male infant, presented to the medical service exhibiting a constellation of clinical signs and symptoms that prompted a thorough diagnostic evaluation. A detailed account of the patient's demographics, anamnesis, physical examination findings, laboratory investigations, imaging studies, and subsequent diagnoses is presented below to provide a comprehensive overview of the case. The infant was a male, born at 37 weeks of gestational age. His birth weight was recorded as 3600 grams, and his length measured 52 centimeters. These parameters are important for assessing the neonate's overall growth and development in the context of his gestational age and for comparison with standard growth curves. The birth weight and length are critical baseline measurements for monitoring the infant's progress during hospitalization and follow-up. The primary concern that led to the patient's presentation was a yellow mucus discharge emanating from the mouth following breastfeeding attempts. This chief complaint is a significant indicator of potential feeding difficulties and raises suspicion for upper gastrointestinal tract abnormalities. The history of the present illness revealed a cluster of concerning symptoms. The infant exhibited respiratory distress, a key sign of potential pulmonary compromise or underlying congenital anomalies. This respiratory distress was further characterized by observable breathing difficulties, such as increased work of breathing. Excessive oral secretions were also noted, a common manifestation in neonates with conditions affecting the upper aerodigestive tract. Furthermore, the infant demonstrated an inability to breastfeed, highlighting a functional impairment in a fundamental neonatal activity. The combination of respiratory distress, excessive secretions, and feeding difficulties strongly suggested a complex underlying pathology. The past medical history of the infant was reported as non-significant. This implies that there were no previously diagnosed medical conditions or health issues that could have contributed to the current presentation. This is an important factor in narrowing the differential diagnosis and focusing the investigative efforts on the acute presenting symptoms. The maternal history included pre-eclampsia in the third trimester of pregnancy. Pre-eclampsia, a hypertensive disorder of pregnancy, can have implications for both maternal and fetal health.

Potential fetal complications can include preterm birth, intrauterine growth restriction, and placental insufficiency. The presence of pre-eclampsia in the maternal history adds a layer of complexity to the case, as it may contribute to neonatal morbidities. The birth history indicated that the infant was the fifth child. While birth order itself may not be directly causative of the presenting condition, it can be a relevant factor in considering broader family and obstetric history. The general appearance of the infant was described as weak. This observation suggests a reduced level of activity and overall physiological reserve, which is consistent with the reported respiratory distress and feeding difficulties. A weak general appearance in a neonate warrants prompt attention and further evaluation. The vital signs of the infant revealed several abnormalities. The heart rate was 140 beats per minute (bpm), which is elevated and indicates tachycardia. Tachycardia in neonates can be a response to various stressors, including respiratory distress, infection, or pain. The respiratory rate was 60 breaths per minute, which is significantly increased and signifies tachypnea. Tachypnea is a hallmark of respiratory distress and reflects the infant's increased work of breathing to maintain adequate oxygenation. The oxygen saturation was 96% on room air. While this oxygen saturation level is within the lower end of the normal range, it should be interpreted in the context of the elevated respiratory rate and other signs of respiratory distress. It is possible that the infant was compensating for underlying respiratory compromise. The body temperature was recorded as 37.8°C (100.04°F), indicating a slight elevation and borderline fever. This temperature elevation could be indicative of an infectious process or a systemic inflammatory response. The head and neck examination revealed that the infant was normocephalic, meaning the head size and shape were within normal limits. There were no facial dysmorphisms noted, which is significant in ruling out certain genetic syndromes or congenital anomalies that are associated with characteristic facial features. Copious oral secretions were observed, corroborating the history of excessive oral secretions reported in the anamnesis. This finding is a key clinical sign in the evaluation of feeding difficulties and potential upper aerodigestive tract abnormalities. The chest examination revealed subcostal retractions, a critical sign of respiratory distress. Subcostal retractions occur when the muscles below the rib cage are drawn inward with each breath, indicating increased effort to expand the lungs. Bilateral rales were auscultated on chest auscultation. Rales are abnormal crackling or rattling sounds heard during inspiration, often indicative of fluid in the alveoli or small airways. Bilateral rales are suggestive of a pulmonary process affecting both lungs, such as pneumonia or other forms of respiratory distress. The cardiovascular examination revealed tachycardia, consistent with the vital signs. No murmurs were detected, which is important in ruling out significant congenital heart defects that could contribute to respiratory distress or feeding difficulties. The abdominal examination revealed a soft, non-distended abdomen with no palpable masses. This finding is relevant in excluding abdominal causes of respiratory distress or feeding difficulties, such as abdominal distension from bowel obstruction or other intra-abdominal pathology. The genitourinary examination revealed normal male genitalia. This observation is important in the overall assessment of the neonate and excludes genitourinary abnormalities. The musculoskeletal examination revealed no abnormalities. This is significant in ruling out musculoskeletal causes of respiratory distress or other presenting symptoms. The neurological examination revealed normal tone and reflexes. Normal tone and reflexes are important indicators of neurological development and function in the neonate. The laboratory investigations included a complete blood count, blood chemistry, arterial blood gas analysis, and blood culture. The complete blood count (CBC) revealed a lymphocyte count of 28.40% and a monocyte count of 11.20%. While the specific percentages of lymphocytes and monocytes should be interpreted in the context of the complete blood count with white blood cell count and differential, these

values provide information about the infant's immune response. Abnormalities in the CBC can be indicative of infection, inflammation, or other hematologic disorders. The blood chemistry revealed a sodium level of 129 mmol/L. This value is below the normal range for neonates, indicating hyponatremia. Hyponatremia can be caused by various factors, including fluid imbalance, certain medical conditions, or medications. The clinical significance of this hyponatremia needs to be evaluated in conjunction with the infant's overall clinical status and other laboratory findings. The arterial blood gas (ABG) analysis revealed a pH of 7.453 and a partial pressure of oxygen (PaO2) of 120.0 mmHg. The pH is within the normal range, indicating that the infant did not have significant acidemia or alkalemia at the time of the blood gas analysis. The PaO2 is elevated, which could be due to supplemental oxygen administration or potentially reflect the infant's respiratory status at the time of sampling. However, this PaO2 must be interpreted cautiously, as the oxygen saturation on room air was 96% and the infant exhibited respiratory distress. The blood culture showed no microbial growth. This result is significant in that it does not provide evidence of a bacterial infection at the time the culture was taken. However, it's important to note that a single negative blood culture does not definitively rule out the possibility of infection, especially in the context of early-onset neonatal sepsis, as mentioned in the secondary diagnoses. The imaging studies included a chest X-ray (initial), a chest X-ray (post-PICC placement), and an echocardiography. The initial chest X-ray revealed a blind-ending proximal esophageal pouch at the level of the second thoracic vertebra. This finding is a hallmark of esophageal atresia, where the upper portion of the esophagus ends in a pouch rather than connecting to the stomach. The chest X-ray also demonstrated a distal tracheoesophageal fistula connected to the trachea. This confirms the presence of an abnormal connection between the trachea and the distal esophagus. Additionally, the initial chest X-ray showed a distended stomach with air. The presence of air in the stomach in the setting of esophageal atresia is indicative of a distal tracheoesophageal fistula, as it allows air to pass from the trachea through the fistula into the stomach. These findings collectively establish the diagnosis of esophageal atresia with tracheoesophageal fistula. The chest X-ray taken after the placement of a peripherally inserted central catheter (PICC) showed unilateral pneumonia on the right, hepatomegaly (enlarged liver), the ETT (endotracheal tube) tip at the level of the second thoracic vertebra, the PICC tip at the level of the second thoracic vertebra, and normal intestinal gas distribution. The presence of unilateral pneumonia on the right highlights a pulmonary complication, which may have developed due to aspiration or other factors. Hepatomegaly is an abnormal enlargement of the liver, which can be associated with various conditions, including infection, heart failure, or metabolic disorders. The positions of the ETT and PICC were confirmed on the X-ray. The normal intestinal gas distribution suggests that there was no evidence of bowel obstruction at the time of this X-ray. The echocardiography revealed a patent foramen ovale (PFO). A PFO is a small opening between the right and left atria of the heart. While a PFO is common in newborns and often closes spontaneously, it can have clinical significance in certain situations. In the context of this case, the PFO was noted as a finding, and its clinical relevance would depend on the infant's overall hemodynamic status and the presence of any other cardiac abnormalities. The primary diagnosis established in this case was esophageal atresia with tracheoesophageal fistula (Type C). This diagnosis is based on the clinical presentation of respiratory distress, excessive oral secretions, and feeding difficulties, as well as the confirmatory findings on the chest X-ray, which demonstrated a blind-ending proximal esophageal pouch and a distal tracheoesophageal fistula. The Type C classification refers to the most common anatomical variant of this condition. The secondary diagnoses included neonatal pneumonia with respiratory distress, early-onset neonatal sepsis, hyperbilirubinemia due to breastfeeding jaundice, and

PFO. Neonatal pneumonia with respiratory distress is consistent with the clinical findings of respiratory distress, tachypnea, subcostal retractions, bilateral rales on auscultation, and the radiographic evidence of unilateral pneumonia. Early-onset neonatal sepsis was considered in the context of the infant's clinical presentation and the potential risk factors, although the initial blood culture was negative. Further evaluation and monitoring for sepsis would be warranted. Hyperbilirubinemia due to breastfeeding jaundice is a common condition in newborns, characterized by elevated bilirubin levels, leading to jaundice. The PFO, as discussed earlier, was an incidental finding on echocardiography (Table 1).

The management of this 7-day-old male infant with esophageal atresia (EA) and tracheoesophageal fistula (TEF) was a multi-phased process, encompassing preoperative stabilization, definitive surgical intervention, postoperative care, and a structured follow-up plan. Each phase was crucial to address the complex physiological challenges posed by this congenital anomaly and to optimize the infant's chances of a favorable outcome. Upon admission, the infant was immediately transferred to the Neonatal Intensive Care Unit (NICU). This decision reflects the critical nature of the infant's condition, characterized by respiratory distress, feeding difficulties, and the inherent risks associated with EA/TEF. The NICU environment provides the specialized resources and expertise necessary for close monitoring and advanced support of critically ill neonates. The admission to the NICU facilitated continuous monitoring of vital signs, respiratory status, and overall clinical condition, enabling prompt recognition and management of any deterioration. Respiratory support was a cornerstone of the preoperative management. Mechanical ventilation was initiated to manage the infant's respiratory distress. The rationale for mechanical ventilation was to ensure adequate oxygenation and ventilation, thereby mitigating the risk of hypoxemia and respiratory failure. The positive pressure provided by the ventilator assisted in lung expansion, improved gas exchange, and reduced the work of breathing. Ventilatory support also provided a controlled environment for the infant while further diagnostic and treatment plans were formulated. The specific mode and parameters of ventilation were likely tailored to the infant's individual needs and adjusted based on continuous monitoring of blood gases and clinical parameters. To establish secure intravenous access, a peripherally inserted central catheter (PICC) was placed. The PICC line provided a reliable and long-term route for the administration of fluids, medications, and parenteral nutrition. In neonates, peripheral intravenous access can be challenging to maintain, and a PICC line minimizes the need for repeated needle sticks, reducing the risk of complications such as infection and extravasation. This secure access was essential for delivering necessary therapies and maintaining the infant's hemodynamic stability throughout the preoperative and postoperative periods. The infant was kept nil per os (NPO), meaning nothing by mouth. This critical intervention was implemented to prevent aspiration. In the context of EA/TEF, the abnormal connection between the trachea and esophagus poses a significant risk of aspiration of oral secretions or feeds into the lungs, which can lead to pneumonia and other respiratory complications. By strictly adhering to NPO status, the medical team aimed to minimize this risk and protect the infant's delicate respiratory system. To further mitigate the risk of aspiration, the infant's head was elevated. This simple yet effective measure utilizes gravity to minimize the reflux of gastric contents into the esophagus and trachea. Elevating the head of the bed or using specialized positioning devices helps to prevent regurgitation and subsequent aspiration, complementing the NPO status and further safeguarding the infant's respiratory health. Frequent suctioning of oral and nasopharyngeal secretions was performed regularly. This intervention aimed to maintain airway patency and prevent aspiration of accumulated secretions. Neonates with EA/TEF often produce copious amounts of oral and respiratory secretions, which can obstruct the airway and compromise respiratory function. Regular suctioning

ensured a clear airway, facilitated effective ventilation, and reduced the risk of aspiration pneumonia. Broad-spectrum antibiotics were administered to treat suspected neonatal sepsis and pneumonia. The rationale for initiating antibiotic therapy was to address potential infections. Neonates, particularly those with congenital anomalies and those requiring invasive procedures, are at increased risk of infection. Furthermore, the presence of pneumonia, as suggested by the chest X-ray findings and clinical presentation, warranted prompt antibiotic treatment. Broad-spectrum antibiotics were chosen to provide coverage against a wide range of potential pathogens, ensuring that empiric therapy was initiated while awaiting the results of blood cultures and other diagnostic tests. The choice of antibiotics and the duration of therapy would have been guided by established protocols and adjusted based on the infant's clinical response and the results of microbiological investigations. The definitive management of EA/TEF involved surgical repair. A right posterolateral thoracotomy was the chosen surgical approach. This approach provides adequate exposure of the esophagus and trachea, allowing the surgeon to visualize and access the anatomical structures involved in the anomaly. The right posterolateral thoracotomy is a standard approach for the repair of EA/TEF, offering optimal visualization and access for the necessary surgical maneuvers. The first critical step in the surgical procedure was fistula ligation. The tracheoesophageal fistula was carefully identified and ligated. Ligation of the fistula involves closing the abnormal connection between the trachea and esophagus, thereby preventing the shunting of air and gastric contents between the two structures. This step is crucial in eliminating the risk of aspiration pneumonia and restoring normal respiratory physiology. The fistula was likely ligated using sutures or clips, with meticulous care taken to ensure complete closure and prevent recurrence. Following fistula ligation, an end-to-end esophageal anastomosis was performed. This procedure aimed to restore the continuity of the esophagus, allowing for normal swallowing and digestion. The proximal and distal segments of the esophagus were carefully approximated and sutured together using interrupted sutures. The type of suture material and the specific suturing technique employed would have been at the discretion of the surgeon, based on their experience and the specific anatomical characteristics of the atresia. The goal of the anastomosis was to create a tension-free, leak-proof connection that would allow for future esophageal function. In some cases, the azygos vein is ligated to improve surgical exposure. This step may be necessary to facilitate access to the esophagus and fistula, particularly in cases where the anatomy is complex or visualization is challenging. Ligation of the azygos vein is a safe and well-established surgical maneuver that can enhance the precision and safety of the repair. Following the surgical procedure, the infant remained in the NICU for continued close monitoring and supportive care. The immediate postoperative period is critical for ensuring adequate recovery and managing potential complications. The NICU environment provides the necessary resources for vigilant observation, timely intervention, and specialized care. Respiratory support was continued postoperatively, with mechanical ventilation gradually weaned as the infant's respiratory status improved. The weaning process involved a gradual reduction in ventilator support, allowing the infant to assume more of the work of breathing. This process was guided by continuous monitoring of the infant's respiratory rate, oxygen saturation, blood gases, and clinical signs of respiratory distress. The goal was to facilitate spontaneous breathing and minimize the risks associated with prolonged mechanical ventilation, such as ventilator-associated pneumonia. Wound care was a crucial aspect of postoperative management. Routine wound care, including dressing changes and monitoring for signs of infection, was provided. The surgical incision site was inspected regularly for redness, swelling, drainage, or other signs of infection. Meticulous wound care practices are essential to promote wound healing and prevent complications

such as wound infection or dehiscence. Nutritional support was carefully managed during the postoperative period. Parenteral nutrition was provided initially, followed by a gradual introduction of oral feeding. Parenteral nutrition, delivered via the PICC line, provided the necessary nutrients to support the infant's metabolic needs while the esophagus healed. Once the esophageal anastomosis was deemed to be healed, as confirmed by radiographic studies, oral feedings were gradually introduced. The introduction of oral feeds was a carefully staged process, starting with small volumes of clear liquids and gradually advancing to formula or breast milk, as tolerated. This gradual approach minimized the risk of complications such as anastomotic leak or stricture. An esophagogram was performed on the 7th postoperative day to assess for anastomotic leak or stricture. An esophagogram is a radiographic study in which a contrast agent is administered orally or via a nasogastric tube, and X-ray images are taken to visualize the esophagus. This study is crucial for evaluating the integrity of the esophageal repair, confirming that there is no leakage from the anastomosis, and assessing the patency of the esophagus. The timing of the esophagogram may vary depending on the surgeon's preference and the infant's clinical course. Discharge planning was initiated to ensure a smooth transition to home and continued monitoring. The infant was discharged home on the 10th postoperative day, with instructions provided to the parents on feeding, medication administration, and follow-up care. Discharge planning involves a multidisciplinary team approach, including physicians, nurses, and other healthcare professionals, to prepare the family for the infant's care at home and to address any concerns or questions they may have. Long-term follow-up care is essential for infants with EA/TEF to monitor for potential complications and assess growth and development. Regular outpatient visits were scheduled to monitor for complications such as esophageal stricture, recurrent fistula, or gastroesophageal reflux disease (GERD). These follow-up visits also provided an opportunity to assess the infant's growth, nutritional status, and overall development. The frequency and timing of follow-up visits would be tailored to the individual infant's needs and any specific concerns that may arise. Endoscopy may be performed as needed to evaluate for esophageal stricture or other complications. Esophageal stricture is a common long-term complication of EA/TEF repair, characterized by a narrowing of the esophageal lumen, which can lead to feeding difficulties. Endoscopy allows for direct visualization of the esophagus and can be used to diagnose and treat esophageal strictures through dilation procedures. The decision to perform endoscopy would be based on the infant's clinical symptoms and the findings of other diagnostic tests (Table 2).

3. Discussion

Esophageal atresia (EA) with tracheoesophageal fistula (TEF) is a congenital anomaly that necessitates prompt diagnosis and intervention to optimize patient outcomes. The case presented here underscores the critical importance of the early recognition of this condition. The infant presented with classic symptoms, including respiratory distress, excessive oral secretions, and an inability to pass a nasogastric tube. These clinical manifestations are key indicators that should raise suspicion for EA/TEF in the neonatal period. Early diagnosis is crucial in preventing a cascade of potentially life-threatening complications. Aspiration pneumonia, a frequent and serious sequela of undiagnosed EA/TEF, can lead to significant respiratory morbidity and mortality. The presence of a TEF allows for the abnormal passage of gastric contents into the respiratory tract, predisposing the infant to aspiration events. Furthermore, delayed diagnosis can lead to nutritional deficiencies, electrolyte imbalances, and increased risk of infection. In this particular case, the infant presented with respiratory distress and excessive oral secretions, which prompted further investigation.

Table 1. Summary of patient findings.

Domain	Subheading	Details
Demographics	Age	7 days old
	Gender	Male
	Weight	3600 grams
	Length	52 cm
	Gestational Age	37 weeks
Anamnesis	Chief Complaint	Yellow mucus discharge from the mouth after breastfeeding
	History of Present Illness	Respiratory distress, excessive oral secretions, inability to breastfeed
	Past Medical History	None significant
	Maternal History	Pre-eclampsia in the third trimester
	Birth History	Fifth child
Physical examination	General Appearance	Weak
	Vital Signs	Heart rate: 140 bpm, Respiratory rate: 60 breaths/min, Oxygen saturation: 96% on room air, Temperature: 37.8°C
	Head and Neck	Normocephalic, no facial dysmorphisms, copious oral secretions
	Chest	Subcostal retractions, bilateral rales on auscultation
	Cardiovascular	Tachycardia, no murmurs
	Abdomen	Soft, non-distended, no masses
	Genitourinary	Normal male genitalia
	Musculoskeletal	No abnormalities
	Neurological	Normal tone and reflexes
Laboratory investigations	Complete Blood Count	Lymphocytes: 28.40%, Monocytes: 11.20%
	Blood Chemistry	Sodium: 129 mmol/L
	Arterial Blood Gas	pH: 7.453, PaO2: 120.0 mmHg
	Blood Culture	No microbial growth
Imaging studies	Chest X-ray (Initial)	Blind-ending proximal esophageal pouch at the level of the second thoracic vertebra, distal tracheoesophageal fistula connected to the trachea, distended stomach with air (Figure 1)
	Chest X-ray (Post-PICC Placement)	Unilateral pneumonia on the right, hepatomegaly, ETT tip at the level of the second thoracic vertebra, PICC tip at the level of the second thoracic vertebra, normal intestinal gas distribution (Figure 2)
	Echocardiography	Patent foramen ovale (PFO)
Diagnosis	Primary Diagnosis	Esophageal atresia with tracheoesophageal fistula (Type C)
	Secondary Diagnoses	Neonatal pneumonia with respiratory distress, early-onset neonatal sepsis, hyperbilirubinemia due to breastfeeding jaundice, PFO

Table 2. Treatment and follow-up.

Phase	Procedure/Intervention	Details	Rationale
Preoperative management			
	Admission to NICU	The infant was admitted to the Neonatal Intensive Care Unit (NICU) for close monitoring and respiratory support.	To provide a controlled environment and specialized care for the critically ill neonate.
	Respiratory Support	Mechanical ventilation was provided to manage respiratory distress.	To ensure adequate oxygenation and ventilation.
	PICC Placement	A Peripherally Inserted Central Catheter (PICC) was placed for secure intravenous access.	To facilitate administration of fluids, medications, and parenteral nutrition.
	NPO (Nil per os)	The infant was kept NPO (nothing by mouth) to prevent aspiration.	Aspiration of oral secretions can lead to pneumonia and respiratory complications.
	Head Elevation	The infant's head was elevated to reduce the risk of aspiration.	Gravity helps to minimize the reflux of gastric contents into the esophagus and trachea.
	Frequent Suctioning	Oral and nasopharyngeal suctioning was performed regularly to clear secretions.	To maintain airway patency and prevent aspiration.
	Antibiotics	Broad-spectrum antibiotics were administered to treat suspected neonatal sepsis and pneumonia.	To address potential infections.
Surgical management			
	Surgical Approach	A right posterolateral thoracotomy was performed.	This approach provides adequate exposure of the esophagus and trachea.
	Fistula Ligation	The tracheoesophageal fistula was identified and ligated.	To close the abnormal connection between the trachea and esophagus.
	Esophageal Anastomosis	An end-to-end esophageal anastomosis was performed using interrupted sutures.	To restore the continuity of the esophagus.
	Azygos Vein Ligation	The azygos vein was ligated to improve surgical exposure.	This step is sometimes necessary to facilitate access to the esophagus and fistula.
Postoperative management			
	Continued NICU Care	The infant remained in the NICU for close monitoring and supportive care.	To ensure adequate recovery and manage potential complications.
	Respiratory Support	Mechanical ventilation was gradually weaned as the infant's respiratory status improved.	To facilitate spontaneous breathing and minimize ventilator-associated complications.
	Wound Care	Routine wound care was provided, including dressing changes and monitoring for signs of infection.	To promote wound healing and prevent complications.
	Nutritional Support	Parenteral nutrition was provided initially, followed by gradual introduction of oral feeding.	To ensure adequate nutrition during the recovery period.
	Esophagogram	An esophagogram was performed on the 7th postoperative day to assess for anastomotic leak or stricture.	To evaluate the integrity of the esophageal repair.
	Discharge Planning	The infant was discharged home on the 10th postoperative day with instructions on feeding and follow-up care.	To ensure a smooth transition to home and continued monitoring.
Follow-up care			
	Outpatient Visits	Regular follow-up visits were scheduled to monitor for complications and assess growth and development.	To ensure long-term well-being and address any potential issues.
	Endoscopy (as needed)	Endoscopy may be performed to evaluate for esophageal stricture or other complications.	To assess the esophagus and manage any complications that may arise.

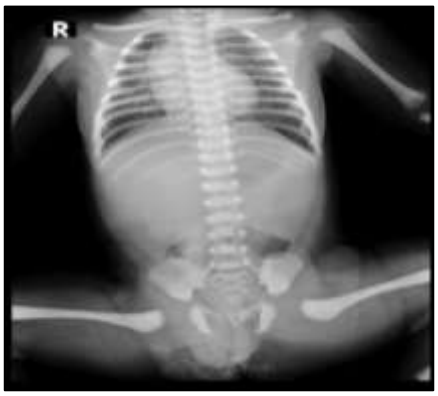

Figure 1. Babygram initial.

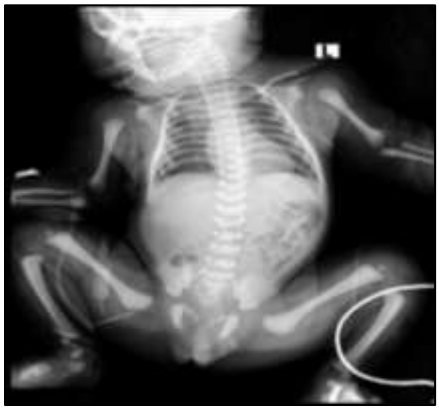

Figure 2. Babygram post PICC.

The inability to pass a nasogastric tube served as a critical clinical sign, leading to radiographic imaging that confirmed the diagnosis. This diagnostic pathway highlights the importance of a systematic approach in evaluating neonates with these presenting symptoms. A high index of suspicion, coupled with a thorough clinical examination and appropriate use of diagnostic tools, is essential for timely diagnosis. The diagnostic process relies heavily on radiographic imaging. Chest radiography plays a pivotal role in visualizing the anatomical abnormalities associated with EA/TEF. In this case, the chest X-ray revealed a blind-ending proximal esophageal pouch and a distal TEF, confirming the diagnosis of EA/TEF Type C. The presence of air in the stomach on the initial radiograph is a significant indicator of a distal TEF, as it demonstrates the passage of air from the trachea through the fistula into the gastrointestinal tract. The clinical presentation of EA/TEF can vary, and it is imperative for clinicians to be aware of the spectrum of possible symptoms. While the classic triad of respiratory distress, excessive oral secretions, and feeding difficulties is highly suggestive, some infants may present with more subtle or atypical signs. Therefore, a comprehensive assessment, including a detailed history, thorough physical examination, and appropriate use of diagnostic investigations, is crucial in all neonates with suspected upper aerodigestive tract anomalies.[11-15]

Surgical repair is the definitive treatment for EA/TEF. The primary goals of surgery are to restore the continuity of the esophagus and to eliminate the

abnormal communication between the trachea and the esophagus. The surgical approach typically involves a thoracotomy, fistula ligation, and end-to-end esophageal anastomosis. In this case, the infant underwent successful surgical repair, including thoracotomy, fistula ligation, and end-to-end esophageal anastomosis. The procedure aimed to correct the anatomical defect and establish a functional esophagus. The surgical technique employed in this case is consistent with the standard approach for EA/TEF repair. The timing of surgical intervention in EA/TEF is a critical consideration. While early primary repair is often preferred in stable infants, the optimal timing can vary depending on the infant's clinical condition and the presence of associated anomalies or complications. Factors such as prematurity, low birth weight, respiratory status, and the presence of pneumonia or other infections can influence the decision to proceed with immediate or delayed surgical intervention. In this particular case, the infant underwent surgery on the fifth day of life due to the presence of pneumonia. The presence of pneumonia complicated the clinical picture and necessitated a delay in surgical repair until the infection was adequately treated. This decision highlights the importance of optimizing the infant's condition prior to surgery to minimize the risk of postoperative complications. The surgical approach to EA/TEF repair has evolved over time. While open thoracotomy has been the traditional approach, minimally invasive techniques, such as thoracoscopic repair, have gained popularity in recent years. Thoracoscopic repair offers potential advantages, including smaller incisions, reduced postoperative pain, and potentially improved cosmetic outcomes. However, the choice of surgical approach depends on various factors, including the surgeon's experience, the infant's anatomy, and the presence of associated anomalies. The surgical technique involves meticulous dissection and precise anatomical reconstruction. Fistula ligation is a critical step to prevent the abnormal passage of air and gastric contents. End-to-end esophageal anastomosis aims to restore esophageal continuity and function. The success of the surgical repair depends on the surgeon's skill and experience, as well as the careful management of postoperative complications.[16-20]

4. Conclusion

This case report underscores the successful management of a 7-day-old male infant with esophageal atresia and tracheoesophageal fistula (EA/TEF). The case highlights the importance of the early recognition of EA/TEF through careful clinical assessment and prompt utilization of radiographic imaging. The classic triad of respiratory distress, excessive oral secretions, and inability to pass a nasogastric tube served as key indicators, prompting further investigation and timely diagnosis. The successful surgical repair, involving thoracotomy, fistula ligation, and end-to-end esophageal anastomosis, demonstrates the effectiveness of the standard surgical approach in correcting this congenital anomaly. The case also emphasizes the significance of a multidisciplinary approach in the management of EA/TEF. The collaborative efforts of neonatologists, pediatric surgeons, anesthesiologists, and nurses were crucial in ensuring optimal preoperative stabilization, successful surgical intervention, and comprehensive postoperative care. Furthermore, the report highlights the importance of meticulous postoperative management, including respiratory support, wound care, nutritional support, and regular monitoring for potential complications. The successful outcome in this case, despite a minor wound dehiscence, underscores the overall favorable prognosis associated with EA/TEF with appropriate and timely management. In conclusion, this case report contributes to the existing body of knowledge on EA/TEF by reinforcing the importance of early diagnosis, multidisciplinary care, and meticulous surgical and postoperative management in achieving favorable outcomes. It also highlights the potential challenges and complications that may arise, such as wound dehiscence and pneumonia, and the importance of prompt recognition and management of

these issues. The long-term follow-up care and monitoring for potential complications, such as esophageal stricture, recurrent fistula, or GERD, are essential to ensure continued well-being in these patients.

5. References

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