Case Study

Anesthesia Management in Neonates with Esophageal Atresia

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DEPARTMENT
RSUD DR MOEWARDI / FAKULTAS KEDOKTERAN UNS
SURAKARTA
2017
ALIDITY SHEET

Case study with title:
Anesthesia Management in Neonates with Esophageal Atresia

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Day :

Date :

Place : Scientific Room SMF Anesthesiology and Intensive Therapy
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Chapter I
Introduction.

Tracheoesophageal fistula (TEF) and esophageal atresia (EA) are defects that may present as part of the VACTERL syndrom. TEF/EA patients require careful attention to airway management and ventilation with the goal of prevention of aspiration.

There are several types of tracheoesophageal fistula (TEF); the most common is an upper esophagus that ends in a blind pouch and a lower esophagus that connects to the trachea. Breathing results in gastric distention, and feeding leads to choking, coughing, and cyanosis (the three Cs). TEF is suspected by failure to pass a catheter into the stomach and confirmed by the catheter coiled in a blind, upper esophageal pouch. Aspiration pneumonia and other congenital anomalies (e.g., cardiac) are common, including vertebral defects, anal atresia, TEF with esophageal atresia, and radial dysplasia.

- Preoperative management includes identifying congenital anomalies and preventing aspiration pneumonia by nursing in a head-up position, using an oral-esophageal tube, and avoiding feedings.
- Sometimes a gastrostomy is placed under local anesthesia. Surgical treatment is usually postponed until any pneumonia clears or improves with antibiotic therapy.
- Copious pharyngeal secretions are common and require frequent suctioning. Suctioning of the gastrostomy tube and upper esophageal pouch tube helps prevent aspiration. However, postoperative suctioning of the esophagus may disrupt the surgical repair.
- PPV is avoided before intubation because gastric distention may interfere with lung expansion. Intubation is often done awake and without muscle relaxants.
• Correct ETT position is crucial. Ideally, the tip of the tube lies between the fistula and the carina. This is impossible if the fistula connects to the carina or a mainstem bronchus; venting using an in situ gastrostomy tube may permit PPV without gastric distention.

• Surgical retraction can compress the contralateral lung, great vessels, trachea, heart, and vagus nerve. A drop in O2 saturation may indicate that the retracted lung needs to be reexpanded. BP should be monitored with an arterial line. 100% O2 is usually required, and blood should be available.

A wide variety of congenital anomalies arise from the organs of the foregut, each associated with unique management principles. The foregut derivatives include the pharynx and its derivatives, the lower respiratory system, the esophagus and stomach, the duodenum, the liver, biliary apparatus, and pancreas (1). While many children with anomalies of the foregut have isolated malformations, it is also possible for these problems to occur in association with other anomalies or as part of a syndrome that may impact anesthetic management.
Chapter II
Tracheoesophageal fistula, esophageal atresia

1. BACKGROUND.

The incidence of tracheoesophageal fistula (TEF) is between 1:3,000 and 1:4,000 live births (2), with more than 85% associated with esophageal atresia (EA). This defect is slightly more common in males, and approximately 20% to 30% of babies with TEF are born prematurely. Many affected infants, especially those with isolated EA, have additional congenital anomalies. As many as 35% of infants with TEF have associated congenital heart disease such as: ventricular septal defect, atrial septal defect, tetralogy of Fallot, atrioventricular canal, and coarctation of the aorta. Other associated anomalies include gastrointestinal disorders, musculoskeletal anomalies, and central nervous system abnormalities (2). The survival rate of patients with TEF/EA has increased over the past few decades, with the greatest risk factors for increased mortality being birth weight <2,000 g or severe associated cardiac anomalies (3).

VACTERL: The likelihood of coexisting anomalies is greatest in cases of isolated EA and least with isolated TEF. The VACTERL syndrome is the most widely recognized with TEF/EA.

a. The VACTERL syndrome occurs when three or more of these anomalies are present.

• Vertebral anomalies: hemivertebrae, vertebral fusion, scoliosis
• Anorectal anomalies: imperforate anus, cloacal deformity
• Cardiac anomalies: includes all the defects listed earlier
• Tracheoesophageal fistula • Esophageal atresia
- Renal anomalies: renal agenesis, renal dysplasia, horseshoe kidney, polycystic kidneys, urethral atresia, ureteral malformations, defects of external genitalia
- Limb anomalies: radial dysplasia, absent radius, syndactyly, polydactyl

2. Pathophysiology:

There are several types of tracheoesophageal fistula (Figure II. 1). The most common (type IIIB) is the combination of an upper esophagus that ends in a blind pouch and a lower esophagus that connects to the trachea. Breathing results in gastric distention, whereas feeding leads to choking, coughing, and cyanosis (three Cs).

The diagnosis is suspected by failure to pass a catheter into the stomach and confirmed by visualization of the catheter coiled in a blind, upper esophageal pouch. Aspiration pneumonia and the coexistence of other congenital anomalies (eg, cardiac) are common. These may include the association of vertebral defects, anal atresia, tracheoesophageal fistula with esophageal atresia, and radial dysplasia, known as the VATERL syndrome. The VACTERL variant also includes cardiac and limb anomalies. Preoperative management is directed at identifying all congenital anomalies and preventing aspiration pneumonia. This may include maintaining the patient in a head-up position, using an oral-esophageal tube, and avoiding feedings. In some instances gastrostomy may be performed under local anesthesia. Definitive surgical treatment is usually postponed until any pneumonia clears or improves with antibiotic therapy.

CLINICAL PEARL: Approximately 25% of all patients with EA have VACTERL. Therefore, if any of the anomalies mentioned above are present, diagnostic testing must be performed to evaluate for the other possible anomalies. A preoperative echocardiogram to assess for cardiac anomalies and evaluate the aortic arch, as well as a preoperative renal ultrasound can help identify the presence of these lesions, which when present may affect anesthetic management.
Most cases of TEF/EA are not diagnosed prenatally, but should be suspected in cases of maternal polyhydramnios, which results from the inability of the fetus to swallow amniotic fluid. In the majority of cases, the diagnosis is made in the immediate neonatal period. The infant may be unable to swallow secretions and appear to drool excessively. Significant coughing, respiratory distress, and cyanosis may occur as a result of antegrade aspiration as the blind esophageal pouch fills (4). In patients with a distal TEF, the stomach may fill with air allowing gastric secretions to reflux back into the lungs. The diagnosis of EA is often confirmed by the inability to pass a catheter from the esophagus into the stomach. A radiograph may reveal a catheter in the blind esophageal pouch. The presence of gas in the stomach and small intestine on chest or abdominal film establishes the presence of a distal TEF.

3. Physiologic considerations:

- Airway management and ventilation is the crucial issue.

Excessive positive pressure ventilation (PPV) can be quite detrimental to these patients. Ineffective ventilation can also be problematic, and may be due to placement of the endotracheal tube (ETT) in or above the fistula, obstruction of the ETT lumen with a mucous plug or clotted blood, or an excessive leak due to an inadequate seal.

Figure II.1: Of the five types of tracheoesophageal fistula, type IIIB represents 90% of cases.
• Gastric dilation.

Malposition of the ETT combined with PPV may also lead to gastric dilation and subsequent aspiration. Gastric distension may also impair ventilation.

• Severe preexisting lung disease

from either aspiration of gastric contents or respiratory distress syndrome (RDS) due to prematurity.

• Pathophysiology of associated anomalies, particularly cardiac anomalies (5).

• Prematurity considerations:

hypoglycemia, hypocalcemia, low birth weight, hypothermia, apnea/bradycardia, and anemia (2).

4. Surgical repair:

Surgical repair: EA. Surgical strategies include immediate primary repair, delayed primary repair, and esophageal replacement.

A. Immediate primary repair.

Most infants with EA/TEF are candidates for immediate primary repair without gastrostomy. A single layer end-to-end primary anastomosis between the proximal esophageal pouch and the distal esophageal segment is performed once the TEF is repaired. In most patients, a gap exists between the proximal and distal esophagus requiring mobilization of both ends.

B. Delayed primary repair.

This is often carried out in patients that have a long-gap EA, though the size of the gap between esophageal pouches is difficult to quantify for a variety of reasons. Surgeons may find a variety of gap lengths amenable to primary closure, and measurement of gap length is not consistently performed (methods vary from
radiologic measurements to direct measurements either before or after mobilization). Therefore, there is no precise definition of “long gap” EA (3), but for the purposes of discussion, long-gap patients are those requiring staged repair. In cases of isolated EA, there is almost always a substantial gap between the esophageal ends. If primary repair is not feasible, a gastrostomy tube is placed and primary repair is delayed for up to 3 months during which time there may be growth of the upper esophageal pouch.

C. Serial dynamic lengthening.

As a general rule, the patient’s own esophagus is preferable to any replacement. Preliminary traction on the atretic esophageal ends allows subsequent primary anastomosis (6,7). More specifically, the Foker technique involves the placement of traction sutures on both proximal and distal esophageal segments. Traction sutures exit the chest wall and are serially pulled in opposite directions over a period of 1 to 2 weeks, until the esophageal pouches approximate and can be anastomosed (3).

D. Other maneuvers that may facilitate anastomosis

in long-gap EA include myotomy of the upper pouch, gastric pull-up, division of the lesser curvature, and greater curve elongation (8).

E. Esophageal replacement.

If the previous measures fail, two options are available. First, the more conventional approach is to perform a cervical esophagostomy and esophageal replacement using colon or stomach at 12 to 18 months of age. Second and more recently, esophageal replacement with gastric interposition is performed during the initial thoracotomy (9).

5. ANESTHESIA CONSIDERATIONS

A. Preoperative issues:
(1) Minimize risk of aspiration. Patients with these lesions have typically been NPO since diagnosis. Infant should be kept in a semi-upright position, and the upper esophageal pouch should be continuously suctioned.

(2) If respiratory distress and hypoxemia exist preoperatively regardless of etiology (aspiration most likely), then urgent tracheal intubation and mechanical ventilation may be necessary. Respiratory failure may be due to pulmonary aspiration, RDS, gastric distension, or congestive heart failure. The endotracheal tube (ETT) should be positioned carefully to avoid gastric distension and aspiration, which is best accomplished if the tip of the ETT is distal to the fistula in patients with TEF.

(3) Rule out associated congenital anomalies, especially cardiac defects. An echocardiogram should be obtained along with a chest X-ray and renal ultrasonography. The presence of a right-sided aortic arch (5%) must be identified because a left thoracotomy approach will be required; the thoracotomy approach is the side opposite to the aortic arch.

(4) Preoperative laboratory tests should include glucose, hematocrit, serum electrolytes, blood urea nitrogen (BUN), and creatinine.

B. Anesthesia goals:

(1) Avoidance of excessive PPV. This is especially important before the placement of the Fogarty balloon catheter or the ligation of the fistula. Stomach distension due to high airway pressures will decrease the functional residual capacity (FRC), impair ventilation, and oxygenation, and increase the chance of aspiration.

(2) Accurate positioning of the ETT. The tip should be beyond the opening of the fistula in the trachea but above the carina. This can be extremely challenging because the distal fistula (seen in type C) is often very close to the carina. The fistula may also occur distal to the carina. ETT positioning must always be rechecked following changes of patient position (i.e., supine to lateral) because of the small distances involved between the fistula, the tip of the ETT, and the carina. Tube
movement distally or proximally with patient repositioning and movement of the head and neck is common.

(3) Prevention of aspiration. This is accomplished by avoidance of gastric distension during PPV.

(4) Achieve adequate perioperative pain control. This may be achieved in a variety of ways as discussed below.

C. Management of anesthesia for TEF/EA:

The patient will be in the left lateral decubitus position for a right thoracotomy (left thoracotomy if right-sided aortic arch). The typical surgical time is 2 to 4 hours for primary repair.

(1) Equipment and monitoring. Equipment should include a low compression volume anesthesia breathing circuit (circle absorption system vs. Mapleson D vs. Bain circuit). Monitoring: Standard noninvasive monitoring (may include pre- and postductal pulse oximeters); arterial line for continuous blood pressure monitoring and analysis of blood gases; precordial stethoscope is useful in detecting intraoperative airway obstruction (10). Placement of two adequate peripheral intravenous (IV) lines.

(2) Induction

(a) Suction the proximal esophageal pouch before induction.

(b) A safe approach for managing the airway is an inhalation induction with or without muscle relaxation with careful, gentle PPV (no >10 to 15 cm H2O).

Awake intubation is an alternate technique for securing the airway; however, oropharyngeal trauma and increases in intracranial pressure must be considered in a vigorous neonate (10). A rise in intracranial pressure may contribute to the occurrence of intraventricular hemorrhage in premature infants.
(c) Once the infant is adequately anesthetized, the surgeon is able to perform rigid bronchoscopy with a ventilating bronchoscope, following removal of the ETT. At this point, the exact location and size of the fistula can be determined, and it can be occluded using a Fogarty balloon catheter. The ETT can then be replaced under direct visualization.

(d) In cases where bronchoscopy is not performed, other means are necessary to confirm the position of the ETT. After induction, an intentional right mainstem intubation may be followed by the slow withdrawal of the ETT until breath sounds are heard on the left. The use of a cuffed ETT may minimize the risk of either gastric distension or aspiration in this scenario (11). It is recommended to confirm the position of the ETT with direct fiberoptic visualization. While confirming ETT position radiographically is also an option, this method of confirmation may not ensure that the ETT is below the fistula.

(3) Maintenance of anesthesia

(a) A balanced anesthetic is recommended using either an inhalation agent/opioid technique or a combined general and epidural anesthetic consisting of an inhalation agent/thoracic epidural blockade technique.

Nitrous oxide is best avoided. FIO2 should be carefully monitored to maintain a preductal SpO2 of 95% to 100%

(b) Healthy infants may tolerate spontaneous ventilation, but most often neuromuscular blockade is necessary especially once the chest is opened and the lungs are retracted. It can be difficult to obtain adequate oxygenation, ventilation, and surgical conditions in a spontaneously breathing patient during open thoracotomy (5).

(c) Gentle PPV with minimal peak inspiratory pressure (PIP) to avoid gastric distension. Manual ventilation allows for the adjustment of ventilation during surgical retraction of the lung and also continuous direct monitoring of lung compliance.
(d) Ventilation difficulties may be encountered intraoperatively. Hypoxia/hypercarbia may be caused by retraction of the lung, kinking of the trachea or ETT from surgical manipulation and traction, occlusion of the ETT by blood clots or secretions, and malposition of the ETT. Hypercarbia may be particularly problematic in thoracoscopic repairs. These problems may be poorly tolerated by the infant with preexisting lung disease.

(e) Blood loss is usually minimal. Volume support with colloid and crystalloid is usually adequate without the need for blood products unless the infant was anemic preoperatively (which may occur in a premature infant). Maintain hematocrit >35%. In general, the judicious use of IV fluids is recommended to minimize the risk of fluid overload and pulmonary edema.

(f) Blood gas monitoring is recommended to check pH, Po2, Pco2, hematocrit, glucose, electrolytes, and possibly coagulation status.

(g) Maintain body temperature intraoperatively. The infant is prone to hypothermia from infusion of cold IV fluids, cool ambient room temperature, and high-flow anhydrous gas delivery.

(h) Ten percent dextrose-containing infusion should be continued intraoperatively because of the minimal glycogen stores in neonates and the risk of hypoglycemia.

(4) Emergence.

(a) In an otherwise healthy infant requiring a straightforward ligation of a TEF, extubation in the operating room (OR) may be possible, but this is not routine. Reintubation may be necessary due to tracheomalacia or a defect in the tracheal wall at the site of the repair (9). In addition, reintubation may compromise the repair.

(b) Most infants remain intubated postoperatively and are transported to the neonatal intensive care unit (NICU).
D. Postoperative care

(1) Most infants require postoperative ventilation for a minimum of 24 to 48 hours. Those infants who have had repair of a long-gap EA usually require intubation and ventilation for 5 to 7 days (7). Any patient with preexisting lung disease, cardiac disease, or a complicated repair may require prolonged ventilatory support. On the other hand, term infants without significant comorbidities can be extubated at the end of surgery and may indeed do better without an ETT abutting the less competent tracheal cartilage. This decision must be made on the basis of the availability of excellent perioperative critical care support with the goal of avoiding reintubation under emergency conditions.

(2) Nasopharyngeal and oropharyngeal suctioning catheters should be carefully marked to avoid insertion down to the level of the anastomosis.

(3) Excessive extension of the neck should be avoided to minimize tension on the anastomosis.

(4) Pain management is most commonly accomplished with epidural analgesia or continuous narcotic infusion. Thoracic epidural analgesia may be ideal, providing a more expeditious progression to spontaneous ventilation and extubation. Recently, paravertebral catheters have also been used to manage postoperative pain after infant thoracotomies, with good results (12).
Chapter III
Case study

Patient identity
Name : By. Ny. Nining Wahyuningsih
age : 8 days
date of birth : 11 April 2016
address : Kembangan RT 2 RW 6 Sukomoro Magetan Jawa Timur
No. RM : 01-33-69-07
Enter RSDM : 19 April 2016
Date of Operation : 21 April 2016

Anamnnesis

Main complaint: Vomiting when giving mother milk.

Disease History.

The patient is a referral from Madiun Hospital with a diagnosis of esophageal atresia. Baby boy, 8 days old, was born by sectio caesarea with oligohydranmios of 9 months' gestation.

At birth the patient immediately cries strongly, never become bluish in color and active motion. Amniotic fluid is unknown in color. Apgar Score also unknown. Birth weight 2900 gram with body length 49 cm. No history of fever, hypertension, hepatitis, or diabetes in mother. 2 days before entering the hospital, patients are given breast milk but regurgitated. When given a drink, the patient also vomits. This happens quite often with an unknown number of vomiting and vomitus greenish yellow. They try to install OGT but retained, Due to the limited facilities, the patient
then referred to the RSDM. On arriving at RSDM, the patient is conscious, crying strongly with active motion. There is no bluish in color. Defecate and urine normal

Past medical history
Asthma: denied.
Milk allergy denied.
Congenital heart disease: denied.
A similar history of disease: denied.
Mother with polyhydramnus (+)

Physical Examination
Pre-operation date 20 April 2017
a. Tanda vital sign
   Body weight  : 2630 gram
   Length      : 49 cm
   pulse rate  : 160 rate/menit, regular, and full
   Respiratory rate : 50 rate/menit, thoracoabdominal.
   Saturation  : 92 – 96 %.
   Temp        : 36.7°C
b. General condition
   moderate ill looking, comos mentis, active.
c. head
   Mesocephal, no apparent abnormalities in fontanella major or minor.

d. Eye
   The eyes are not sunken, the conjunctiva is not anemic, the sclera is not jaundiced, pupil isocor with diameter 2 mm/2 mm, light reflex positive.

e. Nose
   No respiratory distress. Patensi and nasal septum normal.

f. mouth
   Mucosal wet, open mouth is difficult to evaluate, malampaty difficult to assess, mandible / maxillary abnormality not found.

   NO cyanosis. Installed NGT with colorless production of whitish liquid and volume of about 10 ml.

g. Ear
   Normal shape.

h. Neck
   Free movement of neck, not rigid, no deviation of trachea. No enlargement of lymphnod.

i. Thorac

j. Jantung
   Bunyi jantung I dan II teratur dengan intensitas normal. Murmur tidak ada.

k. Abdomen.
convex shape, not distended. normal intestines sound and liver and spleen are normal

1. Extremities.

Warm, there is no cyanosis or oedem

**Investigation Table 9.** result laboratorium 19 April 2017

<p>| | | |</p>
<table>
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<td>GDS 95 mg/dl</td>
<td>Ureum 11 mg/dl</td>
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<td>Hct 45 %</td>
<td>Gol darah O</td>
<td>Creatinin 0,4 mg/dl</td>
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<td>AL 8,1 ribu/ul</td>
<td>Na 135 mmol/l</td>
<td>Albumin 4,1 mg/dl</td>
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<td>AT 245 ribu/ul</td>
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<td>HbsAg non reaktif</td>
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<td>Cl 106 mmol/l</td>
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<td>PT 14,3 detik</td>
<td>APTT 36,4 detik</td>
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</table>

16 April 2017

Figure III.1 Babygram
FIGURE 4. Babygram.

Area luscent on right hemithorax suspect fistula

Foto BNO

Intestinal gas shadows in the abdominal cavity and pelvic.

Consul Pediatrics

Assessment:

1. Atresia Oesophagus

   Therapy

1. admitted in NICU.

2. O₂ 2 L/min. Nasal canula

3. Fasting.

4. D1/4 NS 191 ml160 ml + D40 35 ml + KCl 5 ml + Ca Gluconas 10 ml → 9,4 ml/hrs/SP

5. Inj. Cefotaxime 130 mg/8 hrs/IV

6. Inj. Gentamicin 10 mg/24 hrs/IV

7. Infus Aminosteril 7,3 ml/day.

8. Observasion General condition and sign vital.

   Anesthesiology Assessment.

   Neonates (8 days) with atresia esophagus, neonatal, pro Thoracotomy

   Esophagostomy Physical status ASA II Plan GAET respiratory control
Surgery
Preparation
check the patient's identity
Check the preparation of tools and anesthetic drugs
Check the monitor and anesthesia machine
General condition : baby crying, active movement.
Pulse rate : 160 kali/menit, regular, good vol.
Respiratory rate : 50 kali/menit.
SpO2 : 96 %.

Anesthesia Technique: General Anesthesia, wake intubation, ET 2.5 cuff. Respiratory control.

Premedication : Sulfas Atropin 0,1 mg & Fentanyl 6 mcg, given prior to intubation.
Induction : Inducted with sevoflurane 4 vol%.

After that given muscle relaxant atracurium 1.5 mg. untuk intubation

Maintenance : O2: airbar = 3,5 L/menit: 2,5 L/menit.
Sevoflurane 3 vol%.

Other drugs : Dexametason 0,5 mg.
Metamizole 50 mg.
Fentanyl 5 mcg /30 mnt.
Atracurium 1 mg/ 30 mnt.

Position of patient with left lateral decubitus. Installed WSD on the right hemitorax at the end of the operation.

Anesthesia started : hrs 09:00 WIB
Anesthesia finished : hrs 13:00 WIB
Operasi started : hrs 09.30 WIB
Operasi finished : hrs 12:40 WIB

Balance of fluid

1. The patient gets parenteral nutrition with an intravenous infusion that
   Fasting period = 4 ml/kgBB/hrs x 2,7 kg x 4 hrs = 43,2 ml.
2. Maintenance = 4 ml/kgBB/hrs x 2,7 kg = 10,8 ml/hrs.
3. Stress of big surgery = 6 ml/kgBB/hrs x 2,7 kg = 16,2 ml.
4. Estimated Blood Volume = 85 ml/kg x 2,7 kg = 229,5 ml ~ 230 ml.
5. Allowable Blood Loss = (44 – 30) x 230 / 33,33 = 96 ml.
6. first-hour fluids = 43,2/2 + 10,8 + 16,2 = 48,6 ml.
   Second dan third hrs = 43,2/4 + 10,8 + 16,2 = 37,8 ml/hrs.
   fourth and later hours = 10,8 + 16,2 = 27 ml/hrs.

Ditambah dengan perdarahan yang terjadi selama operasi.

General conditions during operation:
Heart rate between 135 – 145 beat/menit
SpO₂ 98–100%.
Bleeding about 35 ml.
The operation lasts about 3 hours.
Urine production is approximately 6 ml.
Post Operative (NICU)

Day 0:

vital Sign: HR 165x/mnt RR 50 x/mnt temp 37,2°C Body w.t 2700 gr

Sign of infection (-), Clean surgical wound, No bleeding/ fluid.

urine (+), feces (-). Production WSD (+), undulation (+).

Balance of fluid + 25 ml.


<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<td>Hct</td>
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<td>Albumin</td>
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<tr>
<td>BE</td>
<td>-4,4 mmol/L</td>
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<td>Natrium</td>
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<td>pCO₂</td>
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<tr>
<td>SpO₂</td>
<td>97 %</td>
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Plan:

Ventilator PCV + Neonatal, P Control 8 cmH₂O; PEEP 5 FiO₂ 50% RR 40

D10%, D1/4 NS 191ml +D40% 35ml + Ca Gluconas 10ml + KCl 5Meq → 9,4 ml/jam.

Cefotaxime 130 mg/8 jam/IV

Gentamicin 10 mg/24 jam/IV

Aminosteril 185 ml/24 jam → 7,5 ml/jam

OGT Alirkan

Analgetic: Ketamin 0,2 mg/kg bw/hrs
Day 1:
Vital sign: HR 138 x/mnt  RR 44 x/mnt  Suhu 37,5°C  BB 2730 gr
Sign of infection (-), Clean surgical wound, No bleeding/ fluid.
urine (+), faces (-). Production WSD (-), undulation(+).
Balance of fluid + 10 ml.
Plan: On ventilator SIMV + P Control; PEEP 5 FiO2 40% RR 40
D10%, D1/4 NS 191ml + D40% 35ml + Ca Gluconas 10ml + KCl 5Meq → 9,4 ml/jam.
  Cefotaxime 130 mg/8 jam/IV
  Gentamicin 10 mg/24 jam/IV
  Aminosteril 185 ml/24 jam → 7,5 ml/jam
  OGT Alirkan

Day 2:
Tanda vital: HR 144x/mnt  RR 45 x/mnt  temp 37,1OC  BB 2740 gr
Tanda – tanda infeksi (-), Clean surgical wound, No bleeding/ fluid.
urine (+), faces (-). Production WSD (-), undulation (+).
Balance of fluid + 20 ml.
Masalah ventilasi belum adekuat; asidosis metabolik primer.
Plan: On ventilator SIMV + P Control; PEEP 5 FiO2 40 RR 40
D1/4NS 198ml + D40% 54ml + Ca Gluconas 10ml + KCl 5Meq → 10,5 ml/hrs.
Cefotaxime 130 mg/8 jam/IV
Gentamicin 10 mg/24 hrs/IV
Aminosteril 182 ml/24 hrs $\rightarrow$ 2,5 ml/hrs

Analgetic: Metamizole 27 mg/12 hrs

Day 3:
Vital sign: HR 142 x/mnt   RR 45 x/mnt   temp 36,6^\circ\text{C}   BB 2810 gr.
Sign of infection (-), Clean surgical wound, No bleeding/ fluid.
urine (+), facse (-). Production WSD (-), undulation (+).
Balance of fluid + 15 ml.
Plan:   On ventilator SIMV + P Control; PEEP 5 FiO_2 40 RR 40
Diet ASI 8X 5-10cc
D1/4NS 204ml + D40% 55ml + Ca Gluconas 10ml + KCl 5Meq $\rightarrow$ 10,7 ml/jam.
Cefotaxime 130 mg/8 hrs /IV
Gentamicin 10 mg/24 hrs /IV
Aminosteril 182 ml/24 hrs $\rightarrow$ 2,5 ml/hrs
Analgetic: Metamizole 27 mg/12 hrs/IV

Day 4:
Vital sign: HR 142 x/mnt   RR 44 x/mnt   temp 36,8^\circ\text{C} BB 2830 gr
Sign of infection (-), Clean surgical wound, No bleeding/ fluid.
urine (+), feces (-). Production WSD (-), undulation (+).

Balance of fluid + 15 ml.

Plan: On ventilator SIMV + P Control; PEEP 5 FiO2 40 RR 40

   Diet ASI 8X 5-10cc

   D1/4NS 204ml + D40% 56ml + Ca Gluconas 10ml + KCl 5Meq →
   10.8 ml/jam.

   Cefotaxime 130 mg/8 hrs /IV

   Gentamicin 10 mg/24 hrs /IV

   Aminosteril 182ml/24 hrs → 2,5 ml/ hrs

Analgetik: Metamizole 27 mg/12 hrs /IV

Pasien dilakukan ekstubasi pasca perawatan di NICU hari ke 7.
Chapter IV

Conclusion

A thoracotomy repair of the esophagus was performed in an 8-day-old male neonate patient, weighing 2.7 kg, with a diagnosis of esophageal atresia, Sepsis Neonatorum. Anesthesia techniques performed are with general anesthesia and awake intubation. Both rehydration and induction have been conducted based on existing literature sources. Problems that occur durante operations have also been handled in accordance to the appropriate steps. Postoperatively, patients are hospitalized at NICU with mechanical ventilation.
REFERENCES


