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Anesthetics Consideration and Literature Review in Traumatic Biliothoracic Fistula

Priscila Alvarenga[1, *], Lucas Ferreira Gomes Pereira[2], Carlos Darcy Alves Bersot[3], Augusto José Cavalcanti Neto[4], José Eduardo Guimarães Pereira[5]

[1]Department of Anesthesiology, Barra Mansa Wholy House of Mercy Hospital, Barra Mansa, Rio de Janeiro, Brazil

[2]University Centre of Volta Redonda, UniFOA, Volta Redonda, Rio de Janeiro, Brazil

[3]Department of Anesthesia at the Pedro Ernesto University Hospital, RJ, Brazil

[4]Vale Imagem Radiology Department of Wholy House of Mercy Hospital, Barra Mansa, Rio de Janeiro, Brazil

[5]Department of Anesthesiology, Valença Medical School, Valença, Rio de Janeiro

Email address:

priscila.alvarenga@hotmail.com (P. Alvarenga)

[*]Corresponding author

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Abstract: The literature is sparse about anesthetic management for thoracobiliary fistula (TBF) correction surgeries. A gunshot wound victim to the right thoracoabdominal region presented a green colored secretion draining from the right hemithorax during the postoperative period. Laboratory analysis of the secretion along with ultrasound and CT scan confirmed the clinical suspicion of pleurobiliary fistula (PBF). Laparotomy with diaphragm and liver repair plus thoracic drainage was performed. The patient was discharged home after an uneventful postoperative recovery and returned 15 days later for follow-up visit without complaints. PBF is a clinical condition prone to complications and its recognition along with the differential diagnosis from BBF is important to determine which anesthetic and surgical measures should be taken. Anesthesia for PBF correction should preconize appropriate analgesia and remain vigilant to the risk of cardiovascular instability during fistula correction.

Keywords: Biliary Fistula, Bronchial Fistula, Anesthesia

1. Introduction

Thoracobiliary fistula (TBF) was first described by Graham [1] in 1897, and they may derive from three different pathophysiological processes: a) congenital; b) complicate from inflammatory conditions (pyogenic [2, 3], amoebic [2, 3], echinococcal [3-5] or tuberculous [6]), neoplasms [7, 8] and c) following interventional procedures [3, 9] on the biliary tract. TBF may communicate with either the pleural space (pleurobiliary) or the bronchus (bronchobiliary).

Pathogenesis may be, except in the case of the congenital form of the disease, explained by two mechanisms: a) when biliary tract obstruction is the primary reason for fistula formation and may vary from causes such as scars (trauma, surgery, after radiation) and inflammatory diseases, which obstruct the bile ducts and gradually erodes the diaphragm and may directly involve a bronchus, forming a bronchobiliary fistula (BBF), or the pleural space, thus forming a pleurobiliary fistula (PBF) with pleural empyema; b) when the formation of a thoracobiliary fistula (TBF) takes place without biliary tract obstruction. In this case a hydatid cyst or a liver abscess is the primary reason for the fistula formation directly eroding the diaphragm without biliary obstruction [10-12]. Clinical features include: late or early onset right sided pleural effusion with biliary content, fever, chills and leukocytosis comprehending around 50% of all cases. Jaundice is a frequent finding and is associated to biliary tract obstruction.

The possible diagnostic methods listed in the literature for TBF are bronchoscopy [10, 13], bronchogram [10, 11] CT [13, 14] and MRI [13] that are routinely used in every clinical praxis [15, 16]. In the case of a biliocutaneus fistula. [10, 11], cholecystography [11, 17], magnetic resonance

cholangiopancreatography (MRCP) [14, 17], percutaneous transhepatic cholangiography (PTC) [10, 14], endoscopic retrograde cholangiopancreatography (ERCP) [10, 14, 17] and fistulography are the diagnostic options.

Although there has been great development of interventional and endoscopic surgical therapies there is no consensus on diagnosis and treatment for such condition. Surgical approach remains the main stem of thoracobiliary fistula and consists of laparotomy with biliary tract drainage and abdominal cavity toilet and/or thoracotomy with diaphragm muscle repair [3]. Recently, more conservative treatments (percutaneous transhepatic biliary drainage – PTBD; endoscopic retrograde cholangiopancreatography – ERCP) for thoracobiliary fistulas appeared, and their goal is to minimize the pressure in the biliary tree, draining existing abscesses, thus preventing the flow of bile through the fistula [18, 19].

Literature is sparse about anesthetic management for thoracobiliary fistula correction surgeries and there are no specific tutorials for its anesthetic management, but there is a tutorial from the Royal College of Anesthetists (RCA) on anesthesia for BBF correction, and it recommends double lumen tube (DLT) intubation, invasive monitoring, epidural analgesia and postoperative referral to the intensive care unit (ICU) (Figure 1). [20]

Bronchopleural fistula

- Communication from major bronchus to pleural space
- Commonly associated with pneumonectomy, trauma, abscess or empyema
- Relevant complications
  - Pus may contaminate other lung-associated injuries with trauma

Surgery

- Usually semi-elective
- Resuturing of bronchial stump, muscle flap to stump, drainage of abscess
  - High risk surgery requiring GA and one-lung ventilation
- If incidental surgery, GA may be avoided, regional preferred
  - Positioning still important to avoid soiling

Patient

- Commonly debilitated, may have coexistent medical problems
- Respiratory function assessed
  - Clinical, spirometry, ABGs
- Routine assessment for thoracic surgery
  - Consideration of epidural

Decision to proceed

- Respiratory function optimized
- Chest drain inserted to avoid tension pneumothorax and drain pleural collection

Induction

- Objectives
  - Maintain oxygenation and ventilation, avoid tension pneumothorax
  - Avoid soiling good lung
- Protection of lung requires DLT, bronchial lumen to good side
- Small leak without infection may be manageable with single-lumen ETT
- Paediatric patients are typically too small for DLT or FOB --> blocker or endobronchial intubation
- Fistula reduces effectiveness of mask IPPV, so spontaneous ventilation
- Ideally awake DLT intubation
  - Topical local anaesthetic to airway
  - Position head-up and bad side down
  - Sedation for intubation
- Alternatively spontaneously ventilating GA with DLT insertion when deep
- Verification of DLT position with differential ventilation or FOB

Maintenance

- IPPV to healthy lung
- Lung with fistula may benefit from small VT ventilation or CPAP below critical pressure for fistula or HFJV

Emergence

- Avoid high airway pressures if fistula has been repaired
  - Hand ventilation or SIMV

Postoperative

- Epidural analgesia
- HDU monitoring post-op
  - High incidence of arrhythmia post-thoracotomy

Figure 1. *Anesthetic management of bronchopleural fistula.*

2. Case Presentation

Male patient, 24 years of age, brought to the emergency department victim of shot wound to the right thoracoabdominal region and left hemithorax. His presented with Glasgow 15, his blood pressure (BP) was 91x55 mmHg, heart rate (HR) 56 bpm, respiratory rate (RR) 22 ipm, temperature 35.6C.

He was taken to the surgical theater and after pre-oxygenation rapid sequence general anesthesia was induced using fentanyl 5mcg/Kg, propofol 2mg/Kg, rocuronium 1mg/Kg, airway was secured uneventfully, and IPPV started. Laparotomy and thoracotomy were performed, surgical correction of the wounds have been performed and drain have placed in both hemithoraces.

There was no need for blood products or vasoactive drugs and the patient received a total of 1000 ml of crystalloids plus 500ml of hydroxyethyl starch 6%. After surgery he was discharged from post anesthesia care unit (PACU) to the surgical ward with Aldrete-Kroulik score of 10.

On the ninth postoperative day a green colored secretion started to drain from the right hemithorax. The secretion was collected, and the analysis revealed an amber peritoneal liquid with the following characteristics: pH 8.0; LDH 960 U/L; total bilirubin 25.7; direct bilirubin 16.5; indirect bilirubin 9.2.

An abdominal ultrasonography evidenced a focal distortion of the hepatic parenchyma architecture compatible with traumatic injury and ascites, as shown on figure 2.

Figure 2. *Ultrasound images of hepatic parenchyma.*

Total abdomen computed tomography (CT) scan revealed a small amount of per hepatic soiling, hemorrhagic ascites in the pelvis and areas of pneumoperitoneum. There were also evidences of liver trauma injuries in the right lobus, as shown on figure 3.

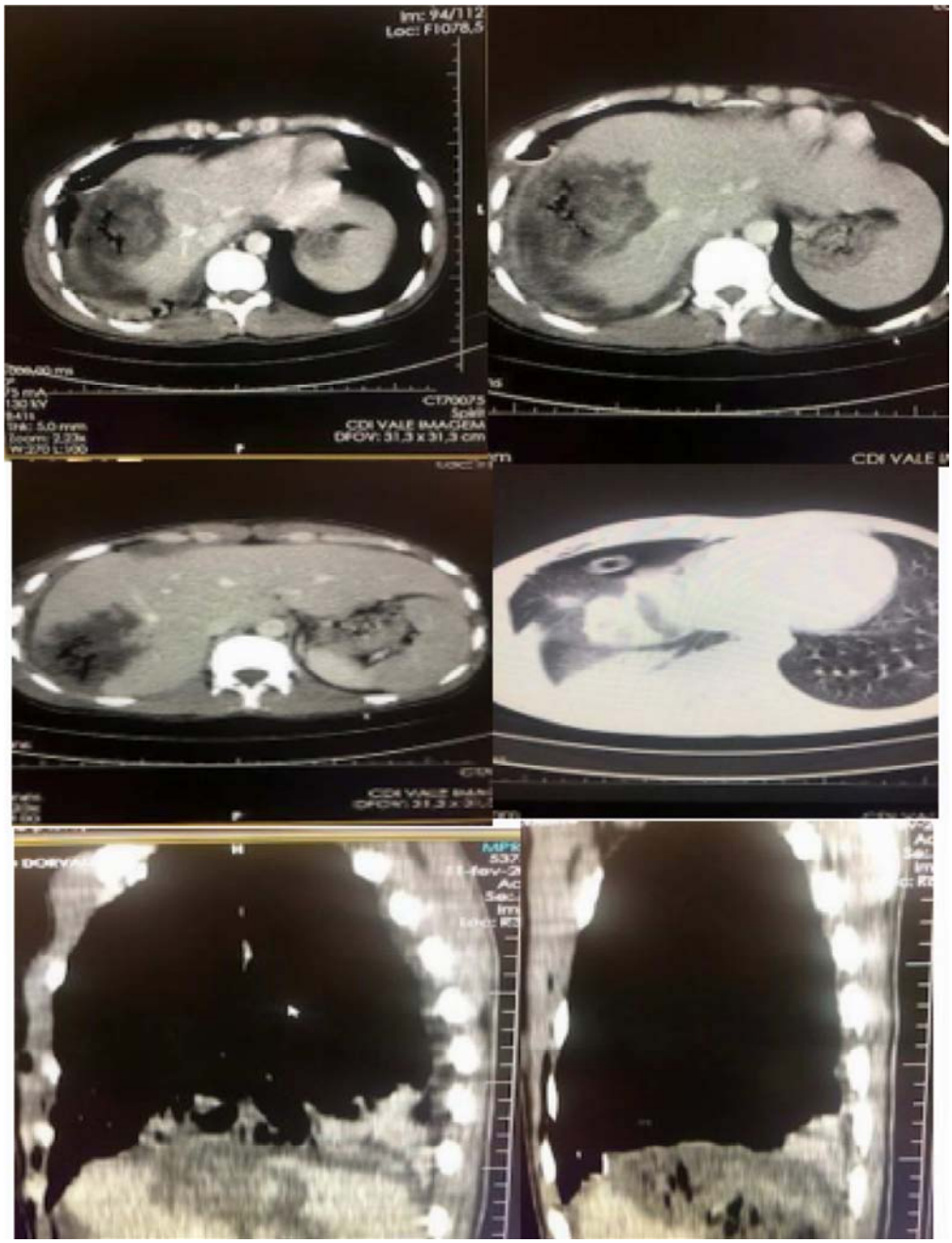

Figure 3. *Total abdomen computed tomography (CT).*

Since this case of thoracobiliary fistula presented no bronchial involvement, the surgical team opted for laparotomy with diaphragm and liver repair and thoracic drainage and the anesthesia team decided to take measures as for liver resection surgeries [21], with large bore peripheral catheter insertion, central venous line placement and arterial line catheterization for invasive blood pressure and arterial gases monitoring.

Epidural catheter placement was not performed due to elevated bilirubin levels associated with prolonged PT time (INR:1.6). 0.2 mg of intrathecal morphine with a 25G needle was administered instead for analgesia purposes right before general anesthesia induction.

Induction was performed with alfentanyl (30 mcg/Kg), propofol (2 mg/Kg) and atracurium (0.6 mg/Kg).

An 8.0 mm ETT tube was placed, IPPV on VCV mode was initiated (6-8 ml/Kg of tidal volume, respiratory rate of 12 ipm, I:E=1:2, 5 cm H_2O PEEP and a mixture of O_2:Air of 1:1) and anesthesia maintenance was achieved by administration of isoflurane (1.2%) with intermittent alfentanyl boluses (250 mcg every 20-30 minutes). Neuromuscular block was maintained with atracurium intermittent boluses of 0.6 mg/Kg every 45 minutes.

Before the beginning of the procedure ketoprofen 100 mg i.v and metamizole 3000 mg i.v were given for supplemental analgesia, and dexamethasone 4 mg i.v for PONV prophylaxis. Ondansetron 4mg i.v was given for PONV prophylaxis at the end of the procedure.

Mean arterial blood pressure was 73 mmHg (56-83). Mean heart rate was 80 bpm (64-92). Mean urinary output was 50 ml/Kg/h throughout the procedure. CVP was kept below 5 cm H_2O. There was no significant bleeding (250 ml) throughout the procedure. Total volume administered was 2000 ml of crystalloid solution.

After the procedure anesthesia was discontinued, the patient recovered from anesthesia and was extubated at the operating room following administration of atropine 1 mg i.v + neostigmine 2 mg i.v, airway aspiration was performed and appropriate ventilation and reflexes were achieved.

The patient was discharged to the ICU presenting 10 points score on the Aldrete-Kroulik scale. Pain was reported as level 3 at operating room discharge.

The patient had an uneventful stay at the ICU for 3 days and then was discharged to the surgical ward where he remained for five more days and then discharged home. He returned 15 days later for follow-up visit without complaints.

3. Discussion

Anesthesia for major abdominal surgeries require special attention due to trauma, surgical stress, prolonged surgical length of time, blood losses, and manipulation of major important organs and structures.

Upper abdomen surgical incisions are associated to respiratory dysfunction during the postoperative period, especially due to pain and diaphragm manipulation [22]. Analgesia plays a major role on prevention of adverse outcomes and epidural analgesia is the gold standard for abdominal surgeries, offering comfort, reducing both respiratory restriction and the incidence of ileus, thus allowing faster recovery and better outcomes [23].

Maintenance of normothermia is paramount, since hypothermia increases risk of infections, bleeding, oxygen consumption and delays awakening from anesthesia [24].

Metabolic response to trauma reduces insulin secretion. Thus, glycemic control must be conducted avoiding the occurrence of hyperglycemia, which is associated to higher incidences of infections amongst other adverse postoperative outcomes [25].

TBF is a rare condition and early diagnosis is crucial for the success of treatment. Late diagnosis is associated to adverse outcomes and complications. TBF predisposes to empyema, subsequent development of pleural adherences and further compromising of pulmonary function [26].

In this case, the patient had prompt diagnosis and early intervention was adopted. Anesthesia was conducted with attention regarding temperature and glycemic controls, invasive monitoring with central and arterial lines placement and with good pain control provided, despite the substitution of epidural analgesia for intrathecal morphine due to prolonged prothrombin time at operation time.

4. Conclusion

PBF is a rare condition that consists on a pathological communication between the biliary tract to the pleural space and is prone to severe complications. Early recognition of the clinical features with differential diagnosis from BBF is important to determine which anesthetic and surgical measures should be taken, consequently improving prognosis. Epidural analgesia favors fast recovery after abdominal surgery by providing very efficient analgesia that not only prevents respiratory complications but also permits early mobilization and promotes a significant reduction of analgesic and opioids consumption, thus reducing the incidence of ileus. Tight temperature control prevents postoperative cognitive dysfunction and plays a major role on coagulation, cicatrization and infection prevention. Invasive monitoring allows early recognition of any cardiovascular instability enabling quick response actions to be taken by the anesthetic and surgical team.

Anesthesia for PBF correction should preconize appropriate analgesia with epidural catheter placement (unless contraindications are met), protective lung ventilation, tight temperature control, and invasive monitoring, due to increased risk of cardiovascular instability during fistula correction.

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