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ANAESTHETIC MANAGEMENT OFA CASE OF INTESTINAL PERFORATION DUE TO BAROTRAUMA

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Abstract:

This case report describes the acute care of a 19-year-old male who had several intestinal perforations caused by high-pressure air forced into the rectum—an uncommon and severe type of barotrauma. Initially, the patient showed significant tachycardia, a moderately compromised Glasgow Coma Scale score, and evidence of considerable internal injuries such as hemoperitoneum and bilateral pneumothorax, which were verified by diagnostic EFAST and CT scanning. The patient quickly progressed to hemodynamic instability, necessitating immediate resuscitation in the emergency room, including dual inotropic support and vigorous fluid resuscitation, followed by an emergency exploratory laparotomy. The anesthetic management was difficult, requiring cautious administration of Fentanyl and Hydrocortisone, as well as diligent monitoring during surgery. The multidisciplinary team approach, which included emergency physicians, surgeons, anesthesiologists, and critical care experts, was important to the patient's effective stabilization and subsequent management in the intensive care unit. This paper emphasizes the complexities of detecting and addressing atypical causes of abdominal injuries, as well as the significance of a well-coordinated, rapid-response healthcare team in effectively managing critical crises.

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Introduction:

Barotrauma is defined as lung injury produced by high pressures, high lung volume, and lung hyperinflation during mechanical ventilation. It can cause pneumothorax, lung interstitial emphysema, subcutaneous emphysema, and other complications [1]. Barotrauma can occur when overdistended alveoli break, allowing air to escape into surrounding tissues and spaces. Risk factors include severe lung disorders such as ARDS, ALI, COPD exacerbation, and hyperinflationary conditions. Volutrauma is another word for lung injury resulting from overdistention during ventilation. [2]

The therapy of intestinal perforations caused by barotrauma poses considerable challenges in the fields of emergency medicine and anesthesia [3, 4]. This case report describes the acute and complex care needed for a young patient who had several bowel perforations as a result of high-pressure air being forced into the rectum, an uncommon and life-threatening condition. This report aims to emphasize the importance of a coordinated, multidisciplinary approach in managing such unusual and severe cases of abdominal trauma, with a focus on anesthesia's role in managing hemodynamic instability, severe metabolic disturbances, and the need for prompt surgical intervention.

Case Report:

A 19-year-old male presented to the ER with a history of high-pressure air tube insertion into the rectum and symptoms of severe abdominal pain. On presentation, he had severe tachycardia with HR > 140/min, GCS- 13/15, and blood pressure and saturation were normal. EFAST done showed the presence of free fluid with moderate to severe hemoperitoneum and CT- -chest showed B/L pneumothorax. Preoperative hemoglobin was 7g/dl and total counts were 16,570. The patient was diagnosed with multiple bowel perforations due to barotrauma. Given deteriorating GCS and hemodynamic instability, the patient was intubated and started on dual inotropic support in the ER. He was shifted to OT immediately for emergency exploratory laparotomy with non-recordable blood pressure and saturation. The central line, arterial line, and wide-bore peripheral intravenous cannulae were secured and the

patient was induced with Inj.Fentanyl 100 mcg IV. Inj.Hydrocortisone 300 mg IV is given. The patient is ventilated with VCV mode, PEEP-0, TV-350ml, RR-12. 2units of packed red blood cells, units of fresh frozen plasma, and 2 units of colloids were transfused. Around 1 liter of blood clots as concealed hematoma were found. Total intraoperative blood loss was 2300 ml with a urine output of 300 ml. ABG was done which revealed metabolic acidosis (ph-7.23), lactate 4.5, and hemoglobin 8.6g/dl. At the end of surgery saturation and BP were recordable, and inotropes were tapered. The patient was shifted to the ICU with the ET Tube because of metabolic acidosis, pneumothorax, and hemodynamic instability with single inotrope support

Discussion:

This case report describes the acute care of a 19-year-old guy who sustained several intestinal perforations as a result of an unusual kind of injury—high-pressure air forced into the rectum. This occurrence resulted in severe abdominal trauma, as evidenced by the presence of free fluid, moderate to severe hemoperitoneum, and bilateral pneumothorax, all of which indicate extensive internal damage. The patient's clinical presentation comprised acute tachycardia, compromised awareness (GCS-13/15), and normal initial blood pressure and saturation levels, which quickly progressed to hemodynamic instability, demanding immediate medical attention.

The patient's health deteriorated rapidly, necessitating prompt life-saving surgical and anesthetic procedures in the emergency setting, emphasizing the gravity of the situation. The situation was further complicated by the requirement for dual inotropic support and extensive fluid resuscitation, which included transfusions of blood products and colloids, highlighting the enormous difficulty in handling such a patient.

The mechanism of the damage, a high-pressure air-induced barotrauma resulting in intestinal perforations, is unusual in clinical practice and rarely mentioned in medical literature. This article intends to add to the limited available knowledge on managing such atypical instances, highlighting the importance of a rapid, coordinated multidisciplinary approach to enhance patient outcomes in acute and complex emergencies of this sort. This presentation will go into the complexities of anesthetic administration, surgical problems, and critical care considerations, emphasizing the importance of such unusual catastrophic injuries in medical practice.

Barotrauma, which is commonly associated with lung injuries caused by mechanical ventilation, occurs when lung tissue is damaged owing to high pressure or volume. The conventional definition of barotrauma is the rupture of overdistended alveoli during mechanical ventilation, which causes air leaks that might result in pneumothorax, pneumomediastinum, or even systemic air embolism [5]. However, this case represents a distinct type of barotrauma generated by the direct introduction of high-pressure air into the rectum, revealing a novel and uncommon pathophysiological mechanism.

When high-pressure air is forced into the rectum, it takes the path of least resistance, quickly filling and enlarging the intestinal lumen. This rapid and abnormal distention can significantly increase pressure within the bowel segments, exceeding their physiological tolerance [6]. The mechanical effect of this high pressure might break the integrity of the intestinal wall, resulting in perforations. These perforations develop because the gut wall, which consists of layers such as mucosa, submucosa, muscularis, and serosa, is not meant to tolerate such abrupt and drastic expansions. The tensile strength of human intestinal tissue is limited, and when intraluminal pressure exceeds this limit, rips or full ruptures occur [7].

Furthermore, the pushed air can spread down the mesenteric attachments, potentially causing additional dissection of the intestinal wall layers and exacerbating the lesion [8]. This propagation can also disrupt the circulatory supply to the damaged segments of the intestine, worsening the damage and raising the risk of ischemic disorders in addition to mechanical perforations [9]. Understanding the mechanics of this sort of barotrauma is critical for medical personnel to properly manage and treat such injuries, which, while uncommon, can have fatal implications if not managed quickly and efficiently [10,11]. This discussion emphasizes the necessity of detecting other types of barotrauma besides those frequently associated with mechanical breathing, especially in emergency medicine settings.

The diagnosis and treatment of intestinal perforations caused by non-traditional causes of barotrauma, such as the high-pressure air introduction reported in this case, provide unique problems. These issues are partly owing to the condition's rarity and

the wide range of potential traumas that might confuse the clinical picture [12]. The primary problem in identifying this sort of trauma is determining the severity based on the patient's history and symptoms. In this case, the patient reported acute abdominal discomfort and anguish after an unexpected and distressing occurrence. The main diagnostic tools employed were:

- Extended Focused Assessment with Sonography for Trauma (EFAST): This rapid bedside ultrasound examination is critical in trauma situations because it quickly detects the presence of free fluid in the abdominal cavity, which is a common indicator of internal bleeding or perforation. In this case, the EFAST helped reveal moderate to severe hemoperitoneum, indicating considerable internal injury [13].
- Computed Tomography (CT) Scan: CT imaging of the abdomen and chest was critical in this case, demonstrating bilateral pneumothorax and documenting the extent of the hemoperitoneum. CT scans are more detailed than ultrasounds and can aid in surgery planning by providing a better view of the injury's location and severity [14].

Initial Management in the Emergency Room:

The patient presented with indicators of extreme distress, including tachycardia and altered mental status, which indicated shock and extensive intra-abdominal pathology. The early management actions employed were crucial in stabilizing the patient for further intervention [15-17]:

- Hemodynamic Stabilization: Immediate steps were taken to stabilize the patient's vital signs. This included the start of dual inotropic support to treat shock and keep cardiac output stable despite continued blood loss.
- Airway Management: Due to the patient's deteriorating Glasgow Coma Scale (GCS) score and the requirement for emergent surgery, rapid sequence intubation was performed to secure the airway and guarantee adequate ventilation, especially in the presence of pneumothorax.
- Fluid Resuscitation and Transfusion: To treat the considerable blood loss and maintain circulation volume, aggressive fluid resuscitation with crystalloids was

required, as was the delivery of blood products (packed red blood cells and fresh frozen plasma).

- Preparing for surgery: With non-recordable blood pressure and saturation, an exploratory laparotomy was urgently required. Central and arterial lines were inserted to improve monitoring and fluid management during the surgery.

The ER decision-making process concentrates around quickly diagnosing the severity of the injuries, stabilizing the patient's key functions, and preparing for emergent surgical intervention. The urgency of these actions indicates the intensity of the event and the need for the trauma team's synchronized reaction. This case demonstrates the challenges of detecting and treating severe barotraumatic injuries, as well as the significance of a systematic approach to emergency care.

The anesthetic care of intestinal perforation due to barotrauma presented major problems, owing to the patient's precarious condition and the urgent requirement for emergency surgery. The concerns and tactics used were critical in preserving viability during the perioperative phase.

Choice of Drug [18]:

- Fentanyl: This strong opioid analgesic was chosen due to its quick onset and brief duration of action, which is critical in controlling severe pain while retaining control of the patient's hemodynamic response. Fentanyl's great potency makes it appropriate for patients who have experienced major trauma and stress, as it delivers adequate analgesia without significantly impairing cardiovascular function.
- Hydrocortisone: Given as a high-dose intravenous injection, hydrocortisone was used to treat and prevent probable adrenal insufficiency in the setting of shock and extreme stress. This corticosteroid also helps to reduce systemic inflammation, which is sometimes aggravated by severe trauma and infection.

Treatment of Severe Hemodynamic Instability [19]

- Inotropic sustain: Due to the patient's non-recordable blood pressure and extreme tachycardia, inotropic drugs were administered to maintain cardiac output and sustain systemic blood pressure. Dual inotropic support, most likely involving drugs such as dopamine and norepinephrine, was critical in this situation. These drugs serve to increase myocardial contractility and vascular tone, thereby regulating blood pressure and ensuring appropriate perfusion to vital organs.
- Fluid Management: Along with inotropic support, vigorous fluid resuscitation was critical. This entailed providing crystalloids and blood products to mitigate the effects of substantial blood loss and persistent hemoperitoneum.

Techniques used for rapid stabilization during anesthesia induction and maintenance [20]:

- Rapid Sequence Induction (RSI): Given the patient's danger of aspiration and the urgent necessity for surgery, RSI was the preferred method for securing the airway. This approach enables the rapid construction of a protected airway and the commencement of controlled breathing, which is critical in managing patients with pneumothorax and severe metabolic abnormalities.
- Controlled Ventilation: Following intubation, the patient was ventilated using volume control ventilation (VCV) mode, with precise settings altered to reduce additional barotrauma and manage existing pneumothoraces. Setting PEEP to 0 and a conservative tidal volume (TV) of 350 ml were critical in preventing further pressure on the wounded lungs and intestines.
- Continuous Monitoring and Adjustment: Intraoperative monitoring included continuous arterial blood gas (ABG) analysis, which revealed metabolic acidosis. This monitoring was crucial for modifying ventilator settings and directing more fluid and inotropic treatment to rectify acid-base imbalances and maintain tissue oxygenation.

The anesthetic administration was thus intricately designed to address the patient's urgent life-threatening problems, with an emphasis on maintaining hemodynamic stability, providing appropriate analgesia and sedation, and minimizing future complications from the current injuries. These measures were vital in stabilizing the

patient enough to survive the demands of emergency surgery and following critical care.

The studies examining anesthetic management in cases of intestinal perforation due to barotrauma provide crucial insights into the required specialized care.
In the study by Reza Widianto Sudjud and colleagues, critical care for patients with severe trauma and hemorrhagic shock is discussed, emphasizing rapid stabilization before surgery [21].
The study by Kiran Sharma, Mritunjay Kumar, and Upma Bhatia Batra, reviews a range of anesthetic considerations for managing perforation peritonitis, showing the complexity of such cases [22].
S. S. Karbhari, Veeresh Hosamani, and R. B. Dhaded provide a broad overview of various anesthetic strategies in their review of small intestinal perforations [23].
Sudhir Kumar Bisherwal and his team discuss the complexities of managing gastrointestinal perforations in patients also suffering from diabetic ketoacidosis, highlighting the intricate balance required in anesthetic management [24].
Govind K. Makharia and his team explore conservative management of colonoscopic barotrauma with high-flow oxygen therapy, offering an alternative to surgical approaches [25].

The treatment of complex and severe health situations such as intestinal perforation caused by non-traditional barotrauma necessitates a well-coordinated interdisciplinary approach. This technique brings together a variety of professionals, each with unique talents and views that are critical for providing comprehensive patient care. Emergency physicians, surgeons, anesthesiologists, and critical care experts must all work together to treat intestinal perforation caused by barotrauma [17].

Emergency physicians are generally the first to evaluate and stabilize patients. They play an important role in the early detection of barotrauma and are in charge of emergency life support interventions, fast assessment, and coordination of care transfers [14]. Their capacity to swiftly assess and implement management strategies is critical to the survival of patients with severe traumatic injuries. Surgeons play a crucial role in treating intestinal perforations, and addressing physical damage produced by barotrauma. Their experience doing emergency procedures like

exploratory laparotomies is critical for repairing the perforations and managing any complications that may arise during the procedure, including infections or more bleeding [18].

Anesthesiologists control patients' pain and vitals during surgery, administering anesthetic and monitoring their hemodynamic state. They are critical for maintaining stability during the procedure, regulating fluid resuscitation, and keeping the patient's physiological parameters within acceptable ranges [18]. Their job extends beyond the operating area, as they frequently continue to assist essential care needs after the procedure. Critical Care Specialists are responsible for monitoring and stabilizing patients in the ICU after surgery. They oversee continuing care, which includes ventilation, inotropic support, and surveillance for signs of sepsis or other problems. Their knowledge guarantees that challenging cases receive ongoing, comprehensive care that addresses both urgent postoperative demands and long-term recovery objectives [16].

Coordinated care improves quality, reduces complications, and increases survival rates. Each specialist's function is interrelated, and effective communication and teamwork are required to handle the crucial phases of patient care efficiently. This collaborative approach guarantees that clinical choices are made quickly and interventions are coordinated, resulting in more effective management and improved patient outcomes.

Conclusion:

This case report described the emergency care of a youngster who had several intestinal perforations as a result of a rare and severe type of barotrauma produced by high-pressure air. The intricacies of this case, particularly the patient's quick decline and the severity of his injuries, necessitated immediate and decisive interventions from many specialists. The successful resolution of this case emphasizes the necessity of a rapid, thorough diagnostic approach utilizing EFAST and CT imaging, which allowed for timely surgical intervention. Emergency physicians, surgeons, anesthesiologists, and critical care experts worked together to handle both the immediate life-threatening problems and the patient's subsequent stabilization and recovery. Finally, this case

highlights the challenges and critical strategies for managing acute barotrauma, emphasizing the importance of rapid diagnosis, integrated specialist care, and the skilled use of both surgical and critical care resources to effectively handle unexpected and life-threatening emergencies. Future considerations should involve more studies on preventive measures and standardized protocols for similar patients to improve outcomes and influence healthcare practices worldwide.

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