



A Rare Case of Gastrointestinal Barotrauma in Pediatric Age: A Case Report

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Abstract

Gastric perforation by barotrauma is a rare entity in children. Its diagnosis is based on clinical symptoms; however, adequate anamnesis and imaging studies are required to reach definitive diagnosis. A four-year old preschool female patient was admitted at our hospital because of pain, progressive abdominal distension, and hematemesis in 6 occasions. Gastrointestinal barotrauma was diagnosed based on clinical data, imaging study and abdominal radiograph. The patient was subjected to asepsis and antiseptic procedure. Subsequently, an incision was made in the mid supra umbilical region that permitted access into the peritoneum. The peritoneum cavity was distended, and a perforation of 1 cm in diameter on the gastric body with an erosion of 5 cm on the muscular layer was found. The perforation was closed in two planes with vycril 3-0 simple and Lemberg stitches. Cephalosporin and metronidazole were started to treat abdominal sepsis. Six days after the surgery, oral route feeding was started and it was well tolerated. The patient showed good evolution. She was discharged after 13 days without complications. Currently, there is no algorithm for the management of gastrointestinal barotrauma. The management solely depends on the experience and skills of the interdisciplinary team in charge of the case.

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Keywords: Acute abdominal pain; Barotrauma; Gastric perforation; Pediatrics

Abbreviations

BT: Barotrauma; ABP: Arterial Blood Pressure; GBT: Gastrointestinal Barotrauma; BR: Breathing Frequency; CBG: Capillary Blood Glucose; HR: Heart Rate; NSAID: Non-Steroidal Anti-Inflammatory Drugs; PICC: Pediatric Intensive Care Unit

Introduction

Barotrauma (BT) is a tissue lesion produced by a change in gas volume pressure in the body compartments, due to modifications in the ambient pressure. The gas pressure in any body compartment should be equal to the ambient pressure. In distensible body compartments, e.g. the digestive tract, the imbalance in this equation can occur with ease. In such compartments, this situation can cause tissue rupture and bleeding when the free-flow of gas in and out of the compartment is blocked. BT diagnosis is usually clinical, and can be supported by imaging studies and adequate anamnesis [1]. Gastrointestinal Barotrauma (GBT) is a rare entity. It should be suspected based on the clinical presentation of the patient, particularly when there are predisposing factors such as the consumption of flatulent foods. The definitive diagnosis is reached with imaging studies portraying extraluminal free air and/or a fluid pool [2]. Perforation by GBT is an infrequent event in children. Most of the cases reported in children had been in the newborns with previous risk factors e.g. suffocation, prematurity, ischemia, congenital absence of gastric muscle or increased intraluminal pressure. Other causes of gastrointestinal perforation in pediatric population are peptic ulcer, nasogastric tube, positive pressure ventilation, eosinophilic gastritis and traumatic gastritis such as that occurring in the case of Heimlich maneuver [3]. Gastric perforation should always be considered in all cases of acute abdomen as possible diagnostic entity [4].

Case Presentation

A four-year old preschool female patient was admitted in our hospital for presenting pain and progressive abdominal distension. Previously, she was healthy. The incidence presented 3 h



Figure 1: Radiograph on admission showing extraluminal accumulation of free air in subdiaphragmatic region with displacement of lung base and upper hemiabdominal viscera.

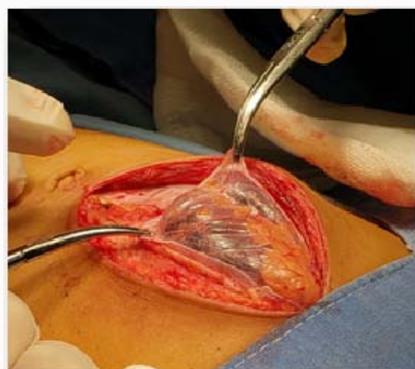


Figure 2: Perforation of 1 cm in diameter on gastric body and erosion of 5 cm in the muscular layer.

following the placement of a lighted air compressor hose in her mouth. Subsequently, she began with hematemesis, which occurred in 6 occasions. In the ward, she was subjected to physical examinations, which reported the following: Heart Rate (HR) 128 bpm, Breathing Frequency (BR) 29 rpm, Arterial Blood Pressure (ABP) 145/128 mmHg, Oxygen Saturation (O_2 Sat) 96%, abdominal circumference 49.5 cm and Capillary Blood Glucose (CBG) 313 mg/dl (Figure 1). Neurological examination revealed a tendency of drowsiness and Glasgow 14 due to discordant speech. At the circulatory level, signs of blotchy skin and integument was appreciated, while ABP was above 99 percentile. In addition, there were excoriations of approximately 3 cm on the chin, and the mouth cavity had traces of blood and perioral cyanosis. She was experiencing shortness of breath (dyspnea). The abdomen was distended, stiff and without bowel movement (lack of peristalsis); thus, underlying peritoneal irritation. In addition, there was generalized tympanism. Data from laboratory tests reported leukocytosis, mild asymptomatic neutrophilia and hypernatremia. Abdominal radiograph was performed, and this revealed abundant gas in the gastric chamber.

Diagnosis and management

Based on the clinical and imaging study data, intestinal perforation was diagnosed. Management was begun with prophylactic antibiotic therapy. The initial management consisted on administration of crystalloid solution at basal requirement, prophylactic antibiotic therapy and Non-Steroidal Anti-Inflammatory Drugs (NSAID). An inter-consultation was requested, and the patient was examined and evaluated by Pediatric Surgery Service. In the service, she was



Figure 3: Perforation of 1 cm in diameter on gastric body and erosion of 5 cm in the muscular layer.

subjected to evacuating paracentesis with the objective of achieving abdominal decompression. Subsequently, diagnostic-therapeutic laparotomy was performed due to her condition.

Description of the surgical technique

The patient was subjected to asepsis and antiseptic procedure. Subsequently, an incision was made in the mid supra umbilical region that permitted access into the peritoneum, finding this to be distended. The abdominal cavity was checked and abundant collection of gastric fluid was found. This was eviscerated and drained. The area was explored without finding damage at the level of small intestine and colon (Figure 2, 3). The stomach was explored and a perforation of 1 cm in diameter on the gastric body with an erosion of 5 cm on the muscular layer was found. The perforation was closed in two planes with vycril 3-0 simple and Lemberg stitches. Orogastric tube was inserted and left in position under direct vision. 22cc air was introduced to corroborate the absence of leakage through hydropneumatic maneuvers. Penrose drainage was placed, and a second right subclavian central catheter was installed using the modified technique of Seldinger on the first attempt without eventualities. The patient was transferred to Pediatric Intensive Care Unit (PICU) after the surgery where she stayed 6 days without any need of aminergic management. She was extubated with adequate respiratory automation. Due to surgical findings, antibiotic therapy based on 3rd generation cephalosporin (ceftriaxone) and prophylactic metronidazole against abdominal sepsis were started. Six days after the surgery, oral route feeding was started and this was well tolerated. The patient showed good evolution during her stay in the PICU, and was moved to the ward of Pediatric Surgery Service to continue her recovery. She was discharged 13 days after admission without complications.

Discussion and Conclusion

Gastric perforation is an entity that is seen in both adults and children. The origin is attributed to different causes depending on the age of the patient. In adults, the most frequent causes of gastric perforation are peptic ulcer, obstructions, sepsis, traumas and neoplasms [5]. In children, the etiology is even more complex for the age. In newborns, the causes that have been described are prematurity, defects in the gastric muscular wall, and the use of invasive or non-invasive ventilator [6]. In preschool-age, the entity is infrequent, and it is usually due to peptic ulcer, trauma, aerophagia or use of medications such as corticosteroids [7]. Iatrogenic gastric perforation, e.g., closed trauma provoked by the placement of nasogastric tube could be another cause. In addition, increased

distension of the stomach due to positive pressure ventilation can result to gastric perforation [8]. Apparently, the present case was a trauma caused by increased distension of the stomach due to positive pressure ventilation caused by the lighted air compressor hose that she placed in her mouth. However, when positive pressure ventilation occurs without tracheal intubation, it can cause increased cryopharyngeal pressure, leading to an increased dilatation of the stomach and increased intragastric pressure [9]. This mechanism gives rise to barotrauma, including pneumothorax and gastric rupture seen in less than 5% [10]. In the present case, the decrease in venous flow, probably caused by increased intragastric pressure, could have caused ischemia or infarction of gastric wall and thus, conditioned the gastric perforation. Gastric rupture has a mortality rate of 30% to 70% [11], in children aged 3 to 5 years. It is more frequent in the female sex. Anatomically, an incidence of the lesion has been reported in the minor coverture of the stomach owing to the lesser elasticity and due to the absence of folds in the gastric mucous membrane in this area [12]. Gastric rupture due to barotrauma is a rare and urgent entity. The suspicion should be based on the mechanism of the injury. Only in this form, we could offer prompt intervention, and prevent acute abdomen as well as avoid complications such as chemical peritonitis, sepsis and multiorgan failure. Currently, there are no statistical data on gastric barotrauma injuries, as well as algorithms for the management of the entity. Therefore, the management of the case depends purely on the experience and skills of the emergency team as well as on the surgeon in charge of the case. Despite being rare, it is an entity potentially lethal in preschool age, and in which good prognosis can be achieved if treated promptly. Moreover, in all cases of acute abdomen, this entity should be considered in differential diagnosis.

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