



Case report

Pneumoperitoneum following cardiopulmonary resuscitation: An unusual case

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ABSTRACT

Introduction and importance: High-quality cardiopulmonary resuscitation (CPR) is the foundation of cardiac arrest resuscitation. Pneumoperitoneum due to gastric perforation is a rare surgical complication of CPR that, if left untreated, can result in significant morbidity and mortality.

Case presentation: We present a 51-year-old male patient with sealed perforation who received an urgent but non-diagnostic exploratory laparotomy after initial esophageal intubation and resuscitation in cardiac arrest, despite significant evidence of surgical pneumoperitoneum.

Clinical discussion: It is unusual to experience spontaneous pneumoperitoneum after cardiopulmonary resuscitation. We should promote cardiopulmonary resuscitation training for both medical and non-medical personnel.

Conclusion: Early endotracheal intubation, avoidance of esophageal intubation, and quick insertion of an orogastric tube may reduce the risk of gastric perforation.

1. Introduction

High-quality cardiopulmonary resuscitation (CPR) is the foundation of resuscitation in cardiac arrest [1]. Early event detection and prompt activation of the emergency response system are critical for survival with favorable neurological outcomes after cardiac arrest, but so is the quality of CPR performed [2]. Furthermore, it is widely acknowledged that the quality of CPR delivered during resuscitation attempts falls short of standard guidelines due to a lack of formal training, which can be harmful. Complications from CPR can include rib fractures, haemothorax, pneumothorax, hepatosplenic injuries, and cardiac contusion or laceration [3,4]. Pneumoperitoneum can occasionally result from chest compressions and positive pressure ventilation, which cause esophageal tears and tracheobronchial disruption, allowing air to move from the thoracic cavity to the peritoneal cavity [5]. We present a case of sealed gastric perforation in a middle-aged male patient who received chest compressions and esophageal intubation in the first attempt during cardiopulmonary resuscitation.

2. Case presentation

A 51-year-old man with a known case of hypertension presented to the urgent care services (UCS) with a complaint of chest discomfort for

the last 4 to 5 h. He had no recent history of fever, cough, and shortness of breath. He was taking Tablet Perindopril (2 mg QD) on daily basis. On arrival, he was vitally stable. General physical and systemic examination was unremarkable. A 12-lead Electrocardiogram (ECG) was performed which showed Anterior Wall Myocardial Infarction (Fig. 1).

Baseline workup was sent, and the patient was given Tablet Aspirin 300 mg, Tablet Clopidogrel 600 mg and Injection Heparin 5000 IU intravenously. Online cardiology consultation was generated and the patient was planned to shift to the tertiary care center for primary percutaneous coronary intervention (PCI). Before shifting, the patient suddenly went into cardiac arrest. Ventricular tachycardia was detected on the cardiac monitor. CPR was started according to the Advanced Cardiac Life Support (ACLS) guidelines. Defibrillation with 200 J was done twice, and the patient achieved a return of spontaneous circulation (ROSC) after 6 min of CPR. After 6 min of CPR and two 200 J defibrillations, the patient achieved return of spontaneous circulation (ROSC). Following ROSC, an advanced airway with rapid sequence intubation (RSI) was attempted. The on-call senior medical officer performed the intubation. The first attempt resulted in esophageal intubation, which was immediately detected by auscultation and colorimetric end tidal carbon dioxide along with a significant drop in oxygen saturation below 90 %, abdominal distension, and an episode of vomiting. The endotracheal tube (ETT) was pulled immediately, and the patient

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was successfully intubated in the second attempt.

The patient was transferred immediately to a tertiary care hospital for primary PCI. He was hypotensive and tachycardic when he arrived at the emergency department, with a blood pressure of 90/40 mmHg and a heart rate of 110 beats per minute. A central venous catheter was inserted, and a norepinephrine infusion was started. The cardiology team was consulted, and the patient was taken to the catheterization laboratory for coronary angiography, which revealed that the mid-left anterior descending artery (LAD) was 100 % occluded. PCI to LAD was performed and the patient was shifted to the Cardiac Critical Care Unit (CCU).

In the CCU, an upright chest radiograph and abdominal X-rays were taken as the patient's abdomen was distended, hard and tympanic, showing subdiaphragmatic free air bilaterally, indicating significant pneumoperitoneum (Fig. 2). General surgery team was taken on board and the patient was transported to the operating room for an emergency exploratory laparotomy under general anesthesia. A sound of burst was heard upon opening the peritoneum and a large amount of compressed air was released; a thorough examination of the entire bowel revealed no signs of perforation. There was a 3 cm hematoma in the stomach's lesser curvature and bruising of the lesser momentum. An Upper gastrointestinal endoscopy performed by the Gastroenterology team in OR showed pangastritis with non-bleeding ulcers in the distal esophagus, stomach and duodenum. More than 200 ml of clots were retrieved from the stomach. A considerable improvement in cardiorespiratory parameters characterized the initial postoperative course and norepinephrine infusion was tapered and eventually discontinued. There was a complete resolution of the pneumoperitoneum on subsequent chest and abdominal x rays. The patient was extubated after two days. The swallow esophagogram showed no evidence of contrast leakage from the esophagus, stomach, or duodenum with mildly prominent visualized jejunal loops and moderate gastro-esophageal reflux. The patient made an uneventful recovery and was sent home six days later. He was advised

to follow up in the cardiology and general surgery clinic.

All methods were performed according to the SCARE 2020 criteria [6].

3. Discussion

Gastric perforation during cardiopulmonary resuscitation (CPR) had previously been reported in the literature [7,8]. It is a rare complication, with an estimated incidence of one in 1000 cases [9]. During the laparotomy, only a 3 cm hematoma and bruising in the lesser curvature of the stomach were discovered, with no evidence of perforation. The rupture was most likely caused by closed chest compressions and significant gastric distension caused by esophageal intubation. Numerous studies have revealed that lesser curvature has been identified as the predominant site for CPR-induced gastric perforation, which often occurs near the gastroesophageal junction due to the region's lack of elasticity and fewer mucosal folds [10].

According to the literature, 92 % of patients with pneumoperitoneum had exploratory laparotomy, while the remaining 8 % were treated conservatively [11].

In our case, the patient also had significant pneumoperitoneum and gastric distention, indicating that he received a lot of oxygen during CPR and that the sealed perforation was caused by excessive positive pressure and elevated intraluminal pressures sustained during chest compressions. It can also cause esophageal perforation, allowing mediastinal air into the peritoneal cavity through the diaphragmatic hiatus. To avoid these calamities, we must perform CPR correctly to avoid excessive gastric distention. Cardiopulmonary resuscitation training for both medical and non-medical personnel should be promoted. However, any technique that jeopardizes the body's normal integrity can lead to life-threatening complications. Endotracheal intubation techniques such as Sellick's cricoid pressure and prolonged expiration that reduce air passage into the stomach, should be considered. Early detection and

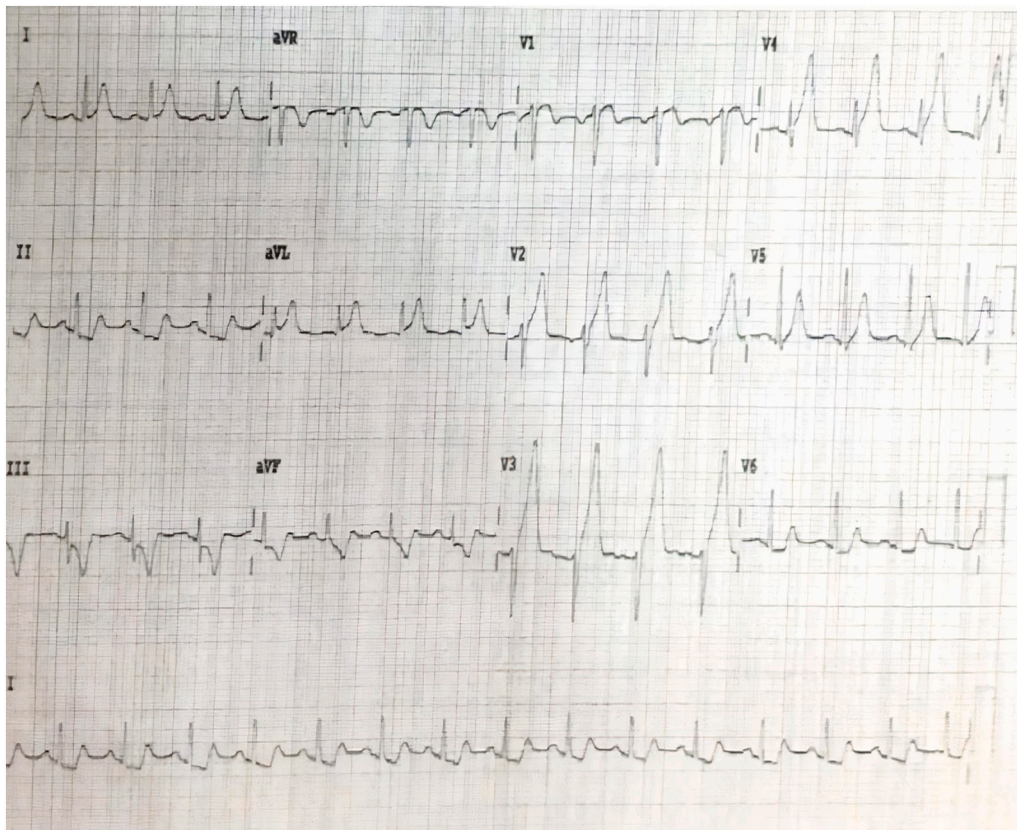


Fig. 1. 12 Lead ECG showing ST elevation in Leads I, aVL, V1-V4 with reciprocal ST depression and T wave inversions in Inferior leads suggestive of Anterior wall MI.

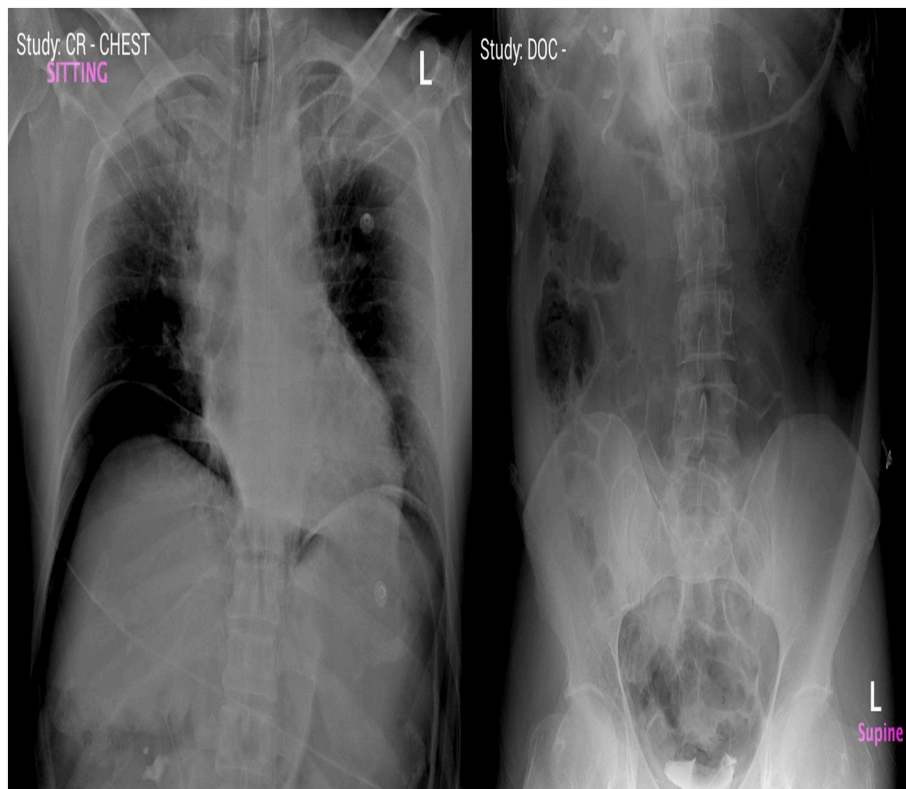


Fig. 2. Chest X-ray showing subdiaphragmatic free air is present suggesting significant PNEUMOPERITONEUM. No evidence of bilateral effusion and pneumothorax. X-ray abdomen showing extensive pneumoperitoneum is seen with no significant dilation of the bowel loops.

removal of intraperitoneal gas via emergency laparotomy resulted in a successful outcome in this case.

Contrast extravasation through the perforated region during a gastrografin contrast test is common and has been shown to be effective for pneumoperitoneum [11,12]. Our patient underwent a swallow esophagram two days after initial stabilization, which was unremarkable. In this case, an exploratory laparotomy was performed after chest radiographs revealed pneumoperitoneum but no signs of peritonitis, resulting in improved hemodynamic parameters that could be attributed to the release of air that was causing abdominal compartment syndrome.

4. Conclusion

Although sealed gastric perforation is an uncommon cause of pneumoperitoneum after cardiopulmonary resuscitation, it is a serious and potentially fatal event that necessitates immediate intervention to improve patient outcomes.

Abbreviations

ACLS	Advanced Cardiac Life Support
AWMI	Anterior Wall Myocardial Infarction
CPR	cardiopulmonary resuscitation
ECG	electrocardiogram
ETT	endotracheal tube
PCI	percutaneous coronary intervention
ROSC	return of spontaneous circulation
RSI	rapid sequence intubation
UCS	urgent care services

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Ethical approval

Ethical approval was taken from the Ethical Review Committee of Aga Khan University.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

CRediT authorship contribution statement

Conceptualization & Supervision: Dr. Noman Ali.
Investigation and Data Curation: Dr. Naheed Habibullah.
Writing, Reviewing and Editing: Dr. Noman Ali and Salman Muhammad Soomar.

Patient perspective

The patient was pleased and satisfied with the treatment.

Research registration

Not applicable.

Guarantor

Corresponding author is the guarantor of this case report.

Declaration of competing interest

None.

Acknowledgment

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Provenance and peer review

Not commissioned, externally peer-reviewed.

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