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Case Report

Multiple ileal perforations as late complications of electrical injury: A rare case report

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ABSTRACT

Introduction: Electric injury-induced intestinal perforation is one of rare and lethal complications. Direct injury and ischemic changes are the mechanism of intestinal perforation. Proper surgical and non-surgical management may increase the survival chance.
Case presentation: A 21-year-old male was referred from rural hospital with history of electric burn injury two days before. On arrival, the patient started complaining bloating and abdominal x-ray revealed small intestine dilation. On fourth day post-event, the symptoms worsened and abdominal CT-scan revealed free peritoneal air. Exploratory laparotomy was performed, and two ileal perforations were found. Suturing of perforation and ileostomy were performed. Forequarter amputation of the right superior limb was performed on the seventh day post-event. On the third month, the ileostomy was closed.
Conclusion: Intestinal perforation may be one of late complications of electrical injury in abdomen. Proper clinical evaluation and management helps in morbidity and mortality reduction.

Introduction

Peritonitis is inflammation of the peritoneum and represents one of important surgical morbidity and mortality. Peritonitis is commonly caused by bacteria but can be caused by other microorganisms or by rarer etiologies [1]. One of the rare etiologies is electric injury. Electrocution injuries are uncommon yet devastating, particularly in high voltage injury (>1000 V) [2].

Following severe thermal injury, there is a loss of gut-barrier function and bacterial translocation into mesenteric lymph nodes and other extraintestinal sites, such as the liver or blood. This phenomenon induces sepsis, hypovolemia, and multiple organ hypoperfusion resulting in reduced gastrointestinal perfusion. Gastrointestinal hypoperfusion induces vasoconstriction with vasoactive agents such as angiotensin II, vasopressin, vasoactive intestinal polypeptide 4 and thromboxane. Prolonged hypovolemia and vasoconstriction may

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cause ulceration and ischemia within the gastrointestinal tract leading to perforation. Optimal enteral nutrition and early recognition of sepsis may help reduce the risk of perforation [3]. The treatment varies from primary closure with or without protective colostomy to exteriorization and the Hartmann operation [4] (Fig. 1).

Case presentation

A 21-year-old male was referred to secondary referral hospital from rural hospital with history of electrical burn injury two days before. The patient had burn injury of 32 % Total Body Surface Area (TBSA) especially on right superior extremity. Burn wound care and fasciotomy had been done on right superior extremity and right side of abdomen at the rural hospital. Physical examination revealed blood pressure of 132/96 mmHg, respiratory rate of 24 times per minute, heart rate of 99 times per minute, and body temperature of 36.4C. On arrival, patient also started complaining bloating. Abdominal x-ray showed dilation of small intestine. On the third day post-injury, patient started to complain about progressive abdominal pain with rigidity and fever. On the fourth day, the pain worsened and abdominal MSCT without contrast showed free peritoneal air. Laparotomy exploration was conducted, and intestinal fluid was found in peritoneal cavity with two ileal perforations with necrotic margin at 90 cm cranial from ileocaecal junction with diameter of 0.9 cm, and 30 cm cranial from ileocaecal junction with diameter of 0.5 cm. The surgery team did freshening and primary suturing on ileal perforation at 30 cm from ileocaecal junction and loop ileostomy at proximal of ileal perforation at 90 cm from ileocaecal junction. Further evaluation of right superior extremity showed diffuse necrosis and unmeasurable peripheral oxygen saturation. Then, the patient was referred to the burn center of tertiary referral hospital, which forequarter amputation and routine burn injury care were performed on the seventh day post-event. On the third month post-event, the ileostomy was closed (Fig. 2).

This study is in line with the Declaration of Helsinki. Informed consent is obtained from the patient before the study and approval from institutional review board is also obtained.

Discussion

Electric injury is one of rare etiology of burn injury, which composed only 4 % of burn injury patients and more common in men [5,6]. It is classified into high voltage (>1000 V) and low voltage injury (<1000 V) [5,6]. The mechanism of injury is divided into injury from the electrical current itself, electrical arc, and flame injury from other objects near the victim [5]. Electrical insults may also damage internal organs due to electrical current itself or thermal injury from heating [5]. In one retrospective study in South China, the main complications of electric injury are brain coma, cardiac injury, liver injury, and compartment syndrome in both of high-voltage and low-voltage injury [7]. Electric current can also directly cause coagulative necrosis, and one of complications which closely related to this mechanism is abdominal visceral perforation [4]. Heat produced by electricity can injure internal organs by causing protein denaturation, with the bowel being the most common organ [2,4]. In this case we found that not only electric injury causes superficial skin injury, but also necrosis of right upper limb and ileal perforation which later leads to sepsis (Fig. 3).

Intestinal perforation is a potentially devastating complication in electric burn injury. The physical signs of intestinal perforation are abdominal distension, tenderness, guarding and rigidity, absent bowel sounds and free fluid in the abdominal cavity [8]. Intestinal perforation may cause bacterial contamination of the abdominal cavity. Peritonitis from abdominal contamination may increase morbidity and mortality [9]. In one study, 21 % of surviving patients and 57 % of deceased patients suffered abdominal complications from electric burn injury [10]. One of complications and risk factor of burn injury (including electric) is sepsis. The odds of sepsis as complication are 7 times more likely in electric burn injury [10]. In our case, we assume that sepsis is caused by electric burn wound and the ileal perforation may increase the risk of developing sepsis.

In one study, the most common site of perforation was the caecum (50 %), followed by transverse colon (31 %) and sigmoid colon

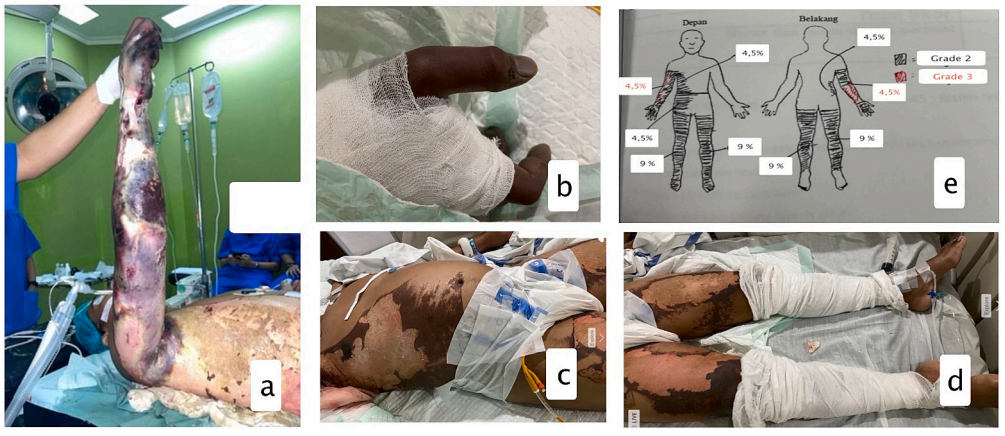

Fig. 1. Patient's condition in early phase of management: (a–d) Electric burn wound on right upper limb, right side of abdomen, and both lower extremities. (e) Calculation and schematic of Total Body Surface Area (TBSA).

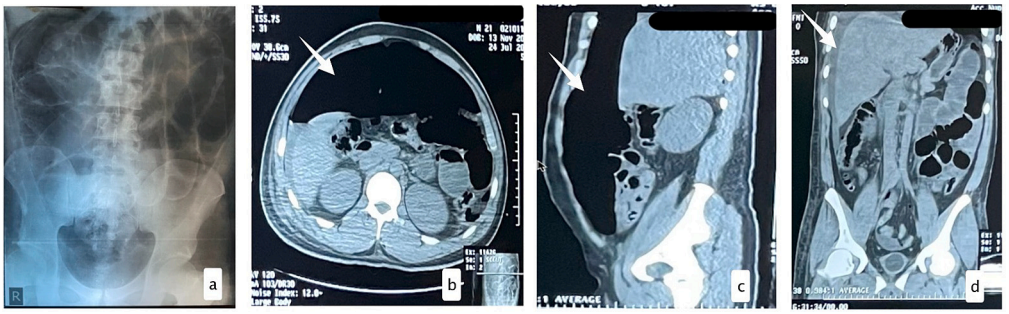

Fig. 2. Radiological examination of patient: (a) Abdominal X-ray showing small intestine dilation. (b–d) Abdominal MSCT-Scan without contrast showing free peritoneal air (from left to right: transversal, sagittal, coronal).

Fig. 3. Peri-operative documentation of findings and surgical management: (a) Two ileal perforations which located 30 cm cranial from ileocaecal junction and 90 cm cranial from ileocaecal junction. (b) Creation of ileostomy on left side of abdomen. (c) Post-operative condition with recent stoma creation. (d) Patient's condition during last follow-up with closed ileostomy.

(25 %) [3]. It is suggested that every case of high-voltage electric injury which affects abdominal region, undergo diagnostic laparoscopy and/or contrast enhanced computed tomography (CECT) abdomen [2]. Laparoscopy may serve as evaluation examination for a non-enhanced GIT segment in CECT examination [2]. Surgical treatment depends on some factors such as extent of perforation, anatomical site of perforation, and presence of peritonitis. Primary perforation closure with or without stoma creation is one of the choices for surgical treatment [4]. In our case, the ileostomy was created at 90 cm from ileocaecal junction and located in left side of abdomen. The burn injury affected the right side of abdomen; hence the left side of abdomen is the proper choice for ileostomy location.

Early enteral feeding is suggested to provide nutrition and maintain gastrointestinal integrity. Enteral feeding may improve early nitrogen balance, gut barrier and immune function and decrease infection complications. Total parenteral nutrition (in suspected or confirmed perforation), inotropic support, and targeted antibiotic therapy should also be commenced early where appropriate [3]. In our case, we decided to create ileostomy instead of primary anastomosis repair due to risk of leakage from prolonged inflammation and hypermetabolic state from burn injury and sepsis.

Conclusion

Intestinal perforation may represent a late complication of electrical injury in abdominal region. Proper clinical evaluation and early surgical management may help significantly in morbidity and mortality reduction.

Funding

None.

Ethics

This study is inline with Declaration of Helsinki. Informed consent is obtained from patient before the study and approval from Institutional Review Board of Universitas Gadjah Mada is also obtained with letter number of KE/FK/1141/EC/2023.

CRediT authorship contribution statement

Adeodatus Yuda Handaya: Conceptualization, Formal analysis, Methodology, Supervision, Validation, Writing – original draft. **Muhammad Rosadi Seswandhana:** Conceptualization, Project administration, Resources. **Nurardhilah Vityadewi:** Conceptualization, Formal analysis, Investigation. **Naufal Caesario Jouhari Susilo:** Visualization, Writing – original draft, Writing – review & editing. **Polycarpus David Subroto:** Data curation, Writing – original draft, Writing – review & editing. **Azriel Farrel Krisna Aditya:** Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors have no conflict of interest to declare.

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