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Rare Case of High Voltage Electric Injury Resulting in Bowel Perforation: A Successful Management with Diversion Colostomy

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Abstract: Electrical injuries are categorized into low-voltage injuries (<1 kilovolt) and high-voltage injuries (>1 kilovolt). Electrical injuries usually present with an entry wound at the site of contact and an exit wound where the current leaves the body. Bowel perforation caused by an electric current is a rare but serious complication. We report a case of a high-voltage electric burn with entry wounds on both hands and an exit wound on the right foot, complicated by descending colon perforation, which presented late with peritonitis. The patient was successfully treated with a diversion colostomy and subsequent takedown. This case highlights the potential for significant internal injuries, such as bowel perforation, following high-voltage electrical injuries and emphasizes the importance of timely surgical intervention for such complications.

Keywords: Electric injury, descending colon perforation, diversion colostomy

1. Introduction

Electrical burns account for 2–5% of all burn admissions and may cause extensive internal damage despite minimal external injury (Williams et al., 2010). Based on voltage, electrical burns are classified as low-voltage (<1,000 volts) and high-voltage (>1,000 volts), with the latter more frequently resulting in deep tissue necrosis and systemic complications. Visceral involvement following electrocution is uncommon, and gastrointestinal perforation is an exceptionally rare but serious consequence. The underlying mechanisms include direct thermal injury, vascular thrombosis, and delayed ischemic necrosis of the bowel wall. Since clinical manifestations may appear several days after the initial injury, diagnosis is often delayed, necessitating a high index of suspicion (Lee, 1997). We present a rare case of descending colon perforation secondary to high-voltage electrical injury, successfully managed with a diversion colostomy, highlighting the importance of early surgical intervention to prevent catastrophic outcomes.

2. Case presentation

A 52-year-old construction worker sustained a high-tension electric current injury involving both hands and his right foot while using a crowbar that accidentally made contact with a high-tension electric wire. Physical examination revealed second-degree burns on the palmar aspects of both hands and third-degree burns affecting the great, second, and third toes of the right foot (Fig.1). There was no limitation in joint movement.

On clinical examination, he appeared dehydrated, with tachycardia (110/min), blood pressure of 100/60 mmHg, and a respiratory rate of 25/min. ECG findings were normal, and urine output was sufficient. He received intensive monitoring and treatment.

On the third day, he complained of left-sided abdominal pain and distension. Physical examination revealed a distended abdomen with tenderness, rebound tenderness, and absent bowel sounds, indicating peritonitis. Abdominal X-ray revealed pneumoperitoneum, and CT scan showed thickening of the descending colon with fat stranding, free fluid in the peritoneal cavity, and basal atelectasis.

An emergency exploratory laparotomy was conducted, revealing a large 2 cm perforation in the lower descending colon with peritonitis. A diversion colostomy with Hartmann's procedure was performed. He was initially cared for in the ICU and transferred to the ward on the fourth day.

Subsequently, his right foot developed gangrenous changes, and the vascular surgeon recommended amputation of the necrotic toes. He recovered well and was discharged on the 12th postoperative day.

Patients with injuries caused by high-voltage electrocution typically have both an entrance and an exit burn wound, each with different complications. The entrance burn wound generally occurs where electrical contact with the body first occurred, usually on the hands, arms, or feet. This wound may extend into deeper tissues, resulting in severe thermal burns, tissue necrosis, and damage to underlying muscles or bones.

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The exit burn wound or wounds are located where the electric current exited the body, typically affecting the feet or hands and often causing more severe, full thickness burns. Exit wounds can lead to extensive burns, deep tissue necrosis, fractures, and muscle injury.

High-voltage electrocution can also cause significant internal complications. Cardiac arrhythmias, neurological injuries, and bowel perforations are serious concerns, with bowel perforations potentially presenting later with peritonitis.

The intraoperative findings indicated perforation of the descending colon [Fig.2 (A)] and a congested intestine [Fig.2(B)], both of which were significant injuries resulting from electrocution. The perforation of the descending colon [Fig.2(A)] is particularly important, as it is a known complication that may arise due to the damaging effects of electric current on the bowel wall. Without prompt surgical intervention, this could lead to secondary complications such as peritonitis or sepsis.

Figure 1. Entry and exit burn wound due to high voltage electrocution

Additionally, the congested intestine [Fig.2(B)] was indicative of ischemia and compromised blood flow, possibly due to the thermal effects of the electric current. These effects can lead to inflammation, vascular compromise, and swelling of the affected bowel segments. Immediate surgical treatment, such as a diversion colostomy, is required to manage the perforation and minimize the risk of further complications, including infection and organ failure.

The surgical procedure of a diversion colostomy [Fig.3] involves redirecting a portion of the colon to an external opening in the abdominal wall, resulting in a stoma (a small external opening) through which stool can pass into a colostomy bag. This procedure is generally performed to divert stool away from a diseased or damaged segment of the colon, allowing the affected area to heal or rest.

In cases of trauma, such as bowel perforation from electrocution, a diversion colostomy is commonly performed to manage contamination, prevent peritonitis, and avoid the passage of stool through the compromised bowel. The diversion colostomy may be temporary if the intent is to reverse the procedure once the injury has healed, or permanent, depending on the extent of bowel injury and overall patient condition (e.g., severe bowel ischemia).

3. Discussion

Electrical burns account for approximately 5% of hospital admissions in major burn centers. Electric current can cause internal injury through both direct and indirect mechanisms, with the severity influenced by several factors, including voltage, current intensity, the pathway of the current, duration of exposure, tissue resistance, contact surface, and the presence of underlying medical comorbidities.

During electrical burns, the electric current travels through underlying tissues, leading to coagulative necrosis and cell membrane rupture. The extent of injury varies based on individual susceptibility, the type of electrical source (AC vs. DC), and the quality of initial medical treatment. While external burns

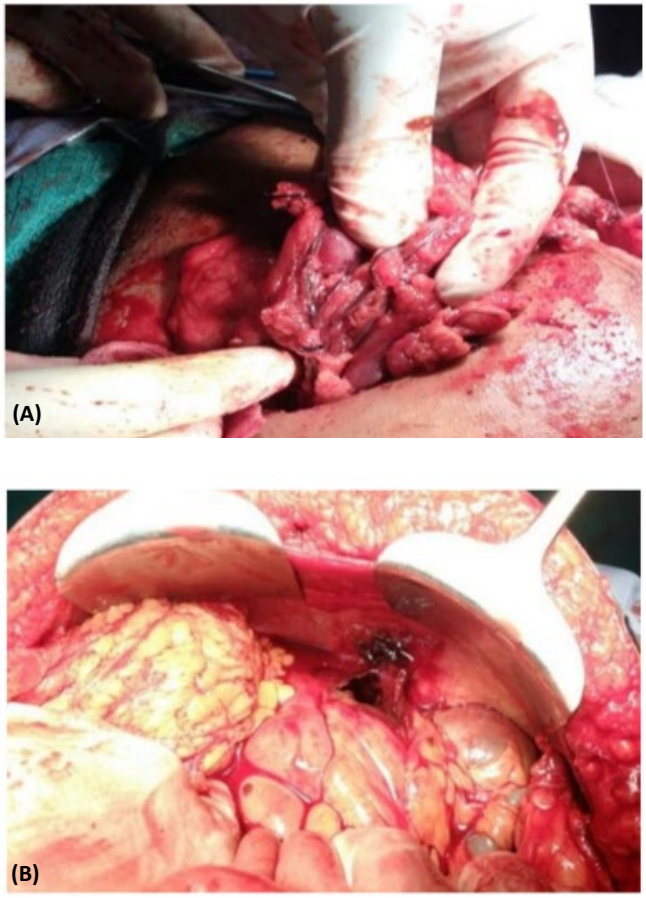

Figure 2. Intra op findings showing (A) perforation of descending colon and (B) the congested intestine

may be visible, internal injuries are often more severe and may progress insidiously, sometimes leading to delayed complications.

Visceral injuries are among the most severe consequences of high-voltage electrical burns and often require surgical intervention (Haberal et al., 1996). The most frequently affected organs are the colon and small intestine, while less commonly involved organs include the heart, esophagus, stomach, pancreas, liver, gallbladder, lungs, and kidneys. According to the literature,

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most bowel perforations caused by electric current involve the colon, particularly the descending or sigmoid colon, although the exact mechanism for this predilection remains poorly understood (Sharma et al., 2015). Some theories suggest that these regions may be more vulnerable due to their vascular supply, direct electrical conduction pathways, or proximity to sites of electrical grounding.

Delayed bowel perforation is a well-documented but common complication of electrical injuries, sometimes occurring days after the initial trauma. In one study, a patient developed bowel perforation despite hospitalization following an upper arm electrical injury (Goyal et al., 2020). Research conducted by Handaya et al. (2024) has emphasized intestinal perforation as a rare but important late complication of electrical injuries, necessitating high clinical suspicion for timely diagnosis and management (Handaya et al., 2024).

In one study, a 42-year-old male with a history of electric shock developed an ulcer in the right iliac fossa, which expanded and began extruding fecal matter. A CT scan revealed a full-thickness abdominal wall defect with prolapsed ileum, indicating evisceration, perforation, and bowel gangrene. An emergency laparotomy was performed, followed by bowel resection and end-to-end anastomosis (Reddy et al., 2023).

Figure 3. Diversion colostomy

Colonic perforation following burns was most frequently observed in middle-aged male patients, many of whom had a history of mental health conditions. These perforations primarily occurred on the right side of the colon, typically after the second week of hospitalization. Right-sided perforations were linked with a higher mortality rate compared to left-sided ones (Fadel et al., 2021).

Abdominal pain is one of the most significant features of post-burn gastrointestinal complications (Lopez et al., 2018). Many studies indicate that abdominal complications resulting from electrical injuries are uncommon; however, they should be considered if digestive symptoms appear (Buja et al., 2010).

A study conducted in Yemen reported that lightning strike injuries are relatively common natural events. However, cases of lightning-induced perforation of hollow viscera are extremely rare. Further tests confirmed bowel injury, requiring surgical repair of the small bowel perforation and removal of a hematoma from the omentum (Nasr et al., 2025).

A retrospective study in China (2020–2023) documented six male patients with penetrating high-voltage electrical burns to the thoracoabdominal wall. One patient had defects involving the gastric wall and diaphragm, two had gastric wall perforations, and three had small intestinal perforations. Three patients with gastric perforations underwent subtotal gastrectomy and anastomosis, with one additionally requiring diaphragmatic repair. The three patients with small intestinal perforations underwent resection and anastomosis (Ai et al., 2024).

According to the literature, the mortality rate for electrical injuries ranges from 2.7% to 5.3% (Butler & Gant, 1977; Kasana et al., 2016). Causes of death may include the electrical injury itself (such as cardiac arrest), wound-related complications, or systemic complications (Sokhal et al., 2017).

The treatment of intestinal perforation depends on factors such as the extent of injury (localized versus diffuse), anatomical site, and presence of peritonitis. In this case, an exploratory laparotomy revealed a descending colon perforation, which was managed with a diversion colostomy and Hartmann's procedure. Early recognition and prompt surgical intervention are essential to reducing morbidity and improving patient outcomes in such cases.

4. Conclusion

Electric injury can cause intestinal perforation through direct thermal damage and secondary effects on tissue viability. High-voltage electric currents (above 1,000 volts) produce intense heat, leading to immediate tissue coagulation and necrosis. Although the gastrointestinal tract is less frequently affected, it can sustain substantial injury when the current path involves the abdomen.

Electric burns disrupt blood flow, resulting in ischemia and delayed perforation. Symptoms frequently present late and include abdominal pain, fever, and peritonitis. Diagnosis typically involves imaging techniques such as X-rays or CT scans, which may reveal free air suggestive of perforation.

Prompt diagnosis and active treatments are crucial. Electrical burns presenting with colonic perforation within 12 hours can often be effectively managed with primary repair. However, a diversion colostomy followed by a subsequent takedown is the preferred management strategy in delayed presentations.

Multidisciplinary care involving surgeons, intensivists, and burn specialists is essential for improving outcomes in patients with electric injury-induced intestinal perforation.

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