SAFETY IN THE OPERATING ROOM

Flame burns during laparoscopic cholecystectomy: A hidden danger of diathermy?

KEYWORDS
Laparoscopy; Flame burns; Diathermy

Introduction

Surgical diathermy is an invaluable aid for achieving hemostasis with most contemporary electro-surgical units (ESU) considered safe. Technological advances have not entirely averted diathermy burns\(^1\)\(^{-4}\) and a good number of cases remain unpublished or are taken to consumer courts. Careful use of these resources is essential to avoid complications that could prove disastrous to the patient and a traumatic experience for the treating surgeon. After having encountered a case of extensive superficial flame burns of the back during laparoscopic cholecystectomy, we carefully analyzed the possible mechanisms of flame burns and advocate important preventive measures.

Case report

A 42-year-old, obese male underwent standard 4-port laparoscopic cholecystectomy for acute calculus cholecystitis. For hemostasis, a state of the art ESU with a reusable, insulated neutral plate placed under the left buttock was used. Forty-eight hours later, the patient complained of redness and burning sensation over the entire back; examination revealed extensive superficial burns of the back and buttocks (Fig. 1a). No specific active treatment was instituted except for local antiseptic cream application and the patient was discharged. Three weeks later, the burns had completely healed. The ESU was thoroughly examined and certified "OK" by the company appointed service engineer. A thorough under-a-lens inspection of the neutral plate revealed tiny crevices in the insulation not easily visible to the naked eye (Fig. 1b).

Discussion

Electrical burns constitute the most common electric accident in the operating room; most are deep and may need debridement and reconstructive procedures including skin grafting. Trivial or superficial burns also can occur and may often be overlooked. Most burns are rarely detected intraoperatively.

The presence of flammable substances, oxygen, nitrous oxide and sources of ignition within the operating theatres renders these areas potentially dangerous and explosion or fire prone. The use of alcohol-based prepping solutions is an additional hazard factor that needs consideration. The use of non-absorbent drapes in most theatres permits pooling of flammable liquids that could be ignited by stray sparks from leaking units or plates.

Stray electrical currents associated with insulation failure can be the cause of unintended burns to non-targeted tissues. Proper placement of conductive jelly coated neutral plates against areas of clean, dry skin to ensure uniform and large surface

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Contact is essential for safe return of the electrical current to the main unit. Alcohol-based solutions should not be allowed to pool and excess fluid should be allowed to dry before further draping of the patient.\textsuperscript{2–4} Alcohol or spirit-based disinfectants are preferably avoided. If reusable plates are used, one should on a daily basis, thoroughly check the surface for breach of insulation. Use of a hand lens helps in identification of these nearly invisible cracks; in addition, the use of an inexpensive electricity continuity tester (Fig. 1d) could avert potentially hazardous situations.

Appropriate settings and a thorough understanding of the capabilities of the ESUs should be an integral part of OR management (Fig. 2). Delegation of plate placement and setting of current ratings to juniors or staff not familiar with safe practice can prove dangerous. Sudhindra et al.\textsuperscript{5} recently pointed out that both consultants and juniors can be ignorant of the potential hazards of diathermy.

In our case, the spirit used for prepping the abdominal surface had possibly "pooled" over the dispersive electrode and caught fire from a spark emanating from a cracked insulation on the surface of the reusable, insulated neutral plate. The nature and disposition of burns over the back indicates such an event. In addition, the delay in the appearance of the injury is characteristic of diathermy related burns.

In a lab experiment, we found that alcohol tends to form a thin spread as the topmost layer over all other solutions and ignites with a thin blue, almost invisible flame (Fig. 1c) that spreads rapidly as a self-propagating deflagration. The centre of the flame has the highest temperature whilst the periphery has the least. The extent of burns is limited by the spread and nature of contact of the flame, and, whether the alcohol is pooled under the patient on the mattress or is still on the surface of the patient. This also means that the burns could be trivial enough to be overlooked or deep enough to necessitate plastic surgery.

To summarize, the safety precautions include

1. Awareness of the capabilities and drawbacks of the ESU. Use of lowest settings that achieves the desired result.
2. Use of disposable neutral plates with conductive gel coating. If reusable plates are used, the insulation should be checked daily with a magnifying glass and an electricity continuity tester.
3. Proper application of neutral plates in carefully located areas that are away from potential areas of pooling. Avoidance of metal contact with the patient’s body; placing hands and feet in plastic bags is an inexpensive solution.
4. Avoidance of spirit-based disinfectants and pooling of prepping solutions.

\textbf{Figure 1} Note the (a) extensive burns over the back; (b) cracks on the surface of the neutral plate; and (c) thin, almost invisible blue flame. (d) An inexpensive electricity continuity tester used to check for leaks.
5. Identifying risk managers in the OR and ensuring proper education of all staff in the OR about the ESU. Strict adherence to the manufacturer’s instructions is mandatory.

6. Most burns are not detected early. It is wise to inspect the patient prior to shifting from the OR.

References


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