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CASE REPORT

Unexplained Intraoperative Hypertension and an Electrocautery Burn: A Case Report

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Abstract

Inadvertent electrocautery burns can occur in any patient under general anesthesia. Here we report on a 30-year-old man who underwent arthroscopic surgery on his hip under general anesthesia and experienced a deep second-degree burn from the grounding pad. Our aim is to increase awareness of this avoidable risk associated with electrocautery equipment among surgeons and anesthesiologists. Unexplained hypertension during surgery under general anesthesia may suggest an electrocautery burn.

Keywords

Burns, Electrocoagulation, Hypertension

Introduction

Over the past century, electrocautery has emerged as essential in surgery. Diathermy machines convert electricity to high-frequency current to minimize the risk of electric shock. In unipolar mode, diathermy enters the patient through an active electrode and exits via the grounding pad. In bipolar mode, current flows between the two prongs of an electrode without significant flow through the body, so a grounding pad is not required.

Bovie deserves recognition for his pioneering role in the design of the first surgical diathermy machine in 1928. Since then, diathermy has increasingly been used for cutting and coagulation in surgery and for efficient hemostasis during surgery [1,2]. It is also popular for skin incisions, providing effective hemostasis with less pain and minimal scarring. Most current diathermy machines are safe, although the electric fields they generate are still intrinsically dangerous to the patient, surgeon, and theater staff. They may result in burns, electrocution, fire, smoke inhalation, and genetic mutations [3,4]. New electrical medical devices such as laparoscopic diathermy and fiber-optic retractors pose the same risks as cauterization devices. Fire requires three elements: A heat source (electrocautery unit), fuel (body tissue), and an oxidizer (oxygen) [5,6]. Intraoperative iatrogenic cauterization burns may result from direct contact burns, grounding pad burns, and heating burns due to a pooled solution, such as alcohol [7-10].

Here we report on a patient who did not respond well to vasodilators used to treat hypertension that occurred during surgery. He suffered a full-thickness deep burn that required plastic surgery.

Case Presentation

A 30-year-old man (height 173 cm, weight 98 kg, body mass index 33 kg/m^2) was admitted for arthroscopic surgery on the left hip. He had had femoroacetabular impingement surgery 6 and 2 years previously. The operation lasted 3 h. For surgery, a disposable split grounding pad (Covidien Force FX Accessories, MA, USA) was attached to his right anterior thigh. After general anesthesia was induced with propofol 120 mg, remifentanil 100 µg, and rocuronium 60 mg, the patient was positioned and the surgical site was draped.

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Anesthesia was maintained with sevoflurane 1.5-3 vol% and remifentanil 0.5-1 mg/h according to the level of surgical stimulation and blood pressure; the bispectral index was maintained between 40 and 60. At the start of the operation, the patient experienced hypertension (170/124 mmHg) that was normalized with nicardipine 1 mg intravenous and remifentanil 100 µg bolus. The patient's blood pressure started to rise again 1h after the operation started. This time, labetalol 20 mg was also administered when the patient did not respond to nicardipine 1 mg and remifentanil 100 µg bolus intravenously. However, the patient's blood pressure remained high, so nicardipine was administered intravenously at 10 mg/h until the end of the operation. The surgeon asked for a lower blood pressure to improve the arthroscopic view, and the anesthesiologist said it was not well controlled. Despite continuous infusion of nicardipine (10 mg/h), the patient's systolic blood pressure was 150-160 mmHg, although it decreased to about 100 mmHg after 30 min.

After surgery, when the patient awoke and the grounding pad was removed, we found a burn (Figure 1). When he was transported to the ward, we requested a plastic surgery consultation. The patient was treated with Silvadene dressings and treated with a local flap 1 month later (Figure 2).

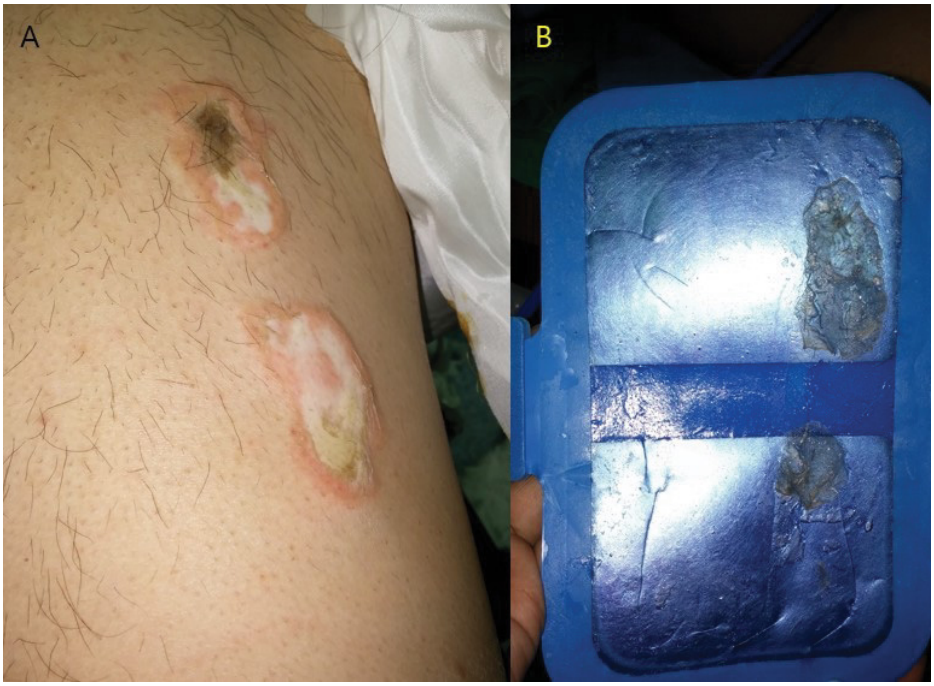

Figure 1: Burns on the right thigh found after surgery: (A) Patient site; (B) grounding pad attachment site.

Figure 2: Wound 1 month after the burn: (A) Patient site; (B) Resected wound; (C) After successful plastic surgery.

Discussion

If the grounding pad does not adhere properly under monopolar cautery, foreign substances such as water or disinfectant may flow into the space and cause burns. Our patient had a lot of hair at the attachment site and was also large (173 cm tall and 98 kg). The use of a single grounding pad size for all adults might need to be reconsidered. The burn occurred because the grounding pad was not properly attached to the patient's skin. If the pad is loose, the current cannot pass safely, and heat and sparks are generated. Therefore, it is important to examine the skin where the pad is to be attached before surgery and to attach it safely. Pads should never be reused. An area of at least 70 cm^2 of firm contact between the skin and the pad should be ensured. Saaiq, et al. reported three cases of burns due to grounding pads [10].

Before the surgical site is draped, the skin should be shaved to prevent solution from pooling in the hair. The surgeon must wait at least 3 min for any alcohol solution to evaporate and wipe the skin with a cotton swab. The patient should be draped with a clear plastic adhesive drape to prevent the collection of flammable vapors beneath the drapes. The best policy is to avoid flammable substances and use the much safer povidone-iodine and chlorhexidine solutions. Patel, et al. reported burns caused by alcohol preparations [11].

In this case, the patient's blood pressure began to rise during the operation for no obvious reason, and hypertension continued for 30 min before it subsided as a result of an increase in sevoflurane and remifentanil and continuous infusion of nicardipine. We think that as the superficial burn set in, hypertension was caused by sympathetic hyperactivity due to burning pain, and the hypertension resolved as the depth of the burn increased, as patients may not feel pain with deep burns [12,13]. As burn pain can be problematic after healing and treatment, the patient may not remember the pain level at the time of the skin damage, although in this case it must have been very severe [13]. If there are signs of sympathetic hyperactivity of unknown cause during surgery, check for unexpected injuries. Cases of burns from anesthesia equipment and arthroscopic devices have also been reported, so caution is required [14,15].

Conclusion

When conventional monopolar electrocautery is used, the possibility of patients becoming burned should be considered, in particular in the area of the grounding pad. Surgeons must be aware of the risks involved and actively work to ensure patient safety. Anesthesiologists should also notify the surgeon when there is unexplained hypertension during surgery and check for any damage due to malposition or burns.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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