

Cutaneous Burn Caused by Radiofrequency Ablation Probe During Shoulder Arthroscopy

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Abstract

It is common in shoulder surgery to perform an arthroscopic acromioplasty for patients with varying degrees of rotator cuff disease. One method for helping the surgeon stay oriented to the location of the arthroscopic instruments during this procedure is to place spinal needles into the subacromial space to demarcate bony landmarks. It is also common during arthroscopic partial acromioplasty to use an electrocautery device for hemostasis and tissue ablation.

Although many complications of using an electrothermal device have been described, this is the first published report of a skin burn from direct contact of the device with the spinal needle used for demarcation during acromioplasty. We report this case to highlight the need to take precautions to prevent the metal needles used in arthroscopic surgery from overheating by contact with an ablation device.

Cautery and radiofrequency ablation (RFA) devices are commonly used in shoulder arthroscopic surgery for hemostasis and ablation of soft tissue. Although these devices are easily used and applied, complications (eg, extensive release of deltoid muscle,¹ nerve damage,² tendon damage,³ cartilage damage from heat transfer⁴) can occur during arthroscopic surgery. Radiofrequency devices can elevate fluid temperatures to unsafe levels and directly or indirectly injure surrounding tissue.^{5,6} Skin complications from using these devices include direct burns to the subcutaneous tissues from the joint to the skin surface⁷ and skin burns related to overheated arthroscopic fluid.⁸

In our English-language literature review, however, we found no report of a skin burn secondary to contact between a RFA device and a spinal needle used in identifying structures during an arthroscopic acromioplasty. We report such a case here. The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A 51-year-old woman injured her left, nondominant shoulder when a descending garage door hit her directly on the superior aspect of the shoulder. She had immediate onset of pain on the top and lateral side of the shoulder and was evaluated by a primary care physician. Radiographs and magnetic resonance imaging (MRI) were normal. The patient was referred to an orthopedic surgeon for further evaluation.

The orthopedic surgeon found her to be in good health, with no history of diabetes, vascular conditions, or skin disorders. The initial diagnosis after history taking and physical examination was impingement syndrome with subacromial bursitis. The surgeon recommended nonoperative treatment: ice, nonsteroidal anti-inflammatory drugs, and physical therapy. After 3 months, the patient's examination was unchanged, and there was no improvement in pain. Cortisone injected into the subacromial space helped for a few weeks, but the pain returned. After 2 more cortisone injections over 9 months failed, repeat MRI showed no tears of the rotator cuff or any other salient abnormalities. The treatment options were discussed with the patient, and, because the physical examination findings were consistent with impingement syndrome and nonoperative measures had failed, she consented to arthroscopic evaluation of the shoulder and arthroscopic partial anterior-lateral acromioplasty.

The procedure was performed 8 months after initial injury. With the patient under general anesthesia and in a lateral decubitus position, her arm was placed in an arm holder. Before the partial acromioplasty, two 18-gauge spinal needles were inserted from the skin surface into the subacromial space to help localize the anterolateral acromion and the acromioclavicular joint. The procedure was performed with a pump using saline bags kept at room temperature. A bipolar radiofrequency device (Stryker Energy Radiofrequency Ablation System; Stryker, Mahwah, New Jersey) was used to débride the subacromial bursa and the periosteum of the undersurface of the acromion. While the bursa was being débrided, the radiofrequency device inadvertently touched the anterior lateral needle probe, and a small skin burn formed around the needle on the surface of the shoulder (**Figure**). The radiofrequency device did not directly contact the skin, and the deltoid fascia was intact. The

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Figure. Anterolateral view of skin burn 9 months after surgical procedure.

spinal needle was removed, and the skin around the burn was excised; the muscle beneath the skin was intact and showed no signs of thermal damage. The skin was mobilized and closed with interrupted simple sutures using a 4-0 nylon suture. The procedure was then completed with no other complications.

After surgery, the patient recovered without complications, and the skin lesion healed with no signs of infection and no skin or muscle defects. Some stiffness was treated with medication and physical therapy. Nine months after surgery, the patient reported mild shoulder stiffness and remained dissatisfied with the appearance of the skin in the area of the burn.

Discussion

Our patient's case is a reminder that contact between a radiofrequency device and metal needles can transfer heat to tissues and cause skin burns. When using a radiofrequency device around metal needles or cannulas, surgeons should be sure to avoid prolonged contact with the metal. Our patient's case is the first reported case of a thermal skin injury occurring when a spinal needle was heated by an arthroscopic ablater.

Other authors have reported indirect thermal skin injuries caused by radiofrequency devices during arthroscopic surgery, but the causes were postulated to be direct contact between device and skin⁷ and overheating of the arthroscopy fluid.^{5,6,8} Huang and colleagues⁸ reported that full-thickness skin burns occurred when normal saline used during routine knee arthroscopy overheated from use of a radiofrequency device. Burn lesions, noted on their patient's leg within 1 day after surgery, required subsequent débridement, a muscle flap, and split-skin grafting. Skin burns caused by overheated fluid have occurred irrespective of type of fluid used (eg, 1.5% glycine or lactated Ringer solution).⁶ There was no evidence that our patient's burn resulted from extravasated overheated fluid, as the lesion was localized to the area immediately around the needle and was not geographic, as was described by Huang and colleagues.⁸

Other possible causes of skin burns during arthroscopic surgery have been described, but none applies in our patient's case. Segami and colleagues⁷ described a burn resulting from direct transfer of heat from the radiofrequency device to the skin because of their proximity. This mechanism was not the cause in our patient's case; there was no evidence of a defect or burned deltoid muscle at time of surgery. Lau and Dao⁹ reported 2 small full-thickness skin burns caused by a fiber-optic-light cable tip placed on a patient's leg; in addition, the hot (>170°C) cables caused the paper drapes to combust.⁹ Skin burns secondary to use of skin antiseptics have been reported,¹⁰ but such lesions typically are located beneath tourniquets or in areas of friction from surgical drapes. In some cases, lesions described as skin burns may actually have been pressure lesions secondary to moist skin and friction.¹¹

Whether type of radiofrequency device contributes to the occurrence of heat-related lesions during arthroscopic surgery is unknown. Some investigators have suggested there is more potential for harm with bipolar RFA devices than with monopolar devices.^{12,13} Monopolar devices pass energy between a probe and a grounding plate, whereas bipolar devices pass energy through 2 points on the probe.¹⁴ Because the heat for the monopolar probe derives from the frictional resistance of tissues to each other rather than from the probe itself, the bipolar probe theoretically allows for better temperature control. In addition, bipolar probes require less current to achieve the same heating effect. However, recent studies have suggested that, compared with monopolar radiofrequency devices, bipolar radiofrequency devices are associated with larger increases in temperature at equal depths after an equal number of applications.^{12,13}

To our knowledge, no one has specifically investigated the type of bipolar device used in the present case. This case report, the first to describe a thermal skin injury caused by direct contact between a radiofrequency device and a metal needle inserted in the skin, is a reminder that contact between radiofrequency devices and spinal needles or other metal cannulas used in arthroscopic surgery should be avoided.

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