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Electrocautery Skin Incision for Neurosurgery Procedures —Technical Note—

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Abstract

The reluctance to incise skin with electrocautery is partly attributable to concerns about excessive scarring and poor wound healing. However, recently no difference was reported in wound complications between the cold scalpel and electrocautery scalpel. We assessed the safety and efficacy of electrocautery skin incision in 22 scalp incisions, including 4 cases of reoperation. Electrocautery skin incisions were created using a sharp needle electrode. The generator unit was set on cutting mode, with power of 6 W and 330 kHz sinusoid waveform. Subcutaneous dissections also used the sharp needle electrode, set on coagulating mode, with power of 10 W and 1 MHz pulse-modulated waveform. Galea incisions used a standard blade tip, set on coagulating mode, with power of 20 W and 1 MHz pulse-modulated waveform. Skin incision with the sharp needle electrode caused no charring of the wound. Little bleeding or oozing were observed and skin clips were not necessary. No wound complication such as necrosis or infection occurred. Electrocautery skin incisions for re-operations were also performed safely without complications. Electrocautery skin incision is sufficiently safe procedure not only for first operation but also for re-operation. Electrocautery skin incision is efficacious, especially for extended operation times, because of little blood loss from the edges of skin incision and possible avoidance of skin edge necrosis or alopecia caused by skin clips.

Key words: electrocautery, skin incision, reoperation, skin clip, sharp needle electrode

Introduction

Skin incision is generally performed with a cold scalpel and skin clips are applied to the skin edges in neurosurgical operations in Japan. However, wound necrosis and scar formation sometimes occur after long operations, probably caused by ischemia of the skin edges. Therefore, hemorrhage from the skin edges should be controlled without skin clips. Recently, no difference was reported in wound complications between the cold scalpel and electrocautery scalpel, and blood loss during skin opening was

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three to five times less with the electrocautery scalpel.[7] However, the safety of electrocautery skin incision in re-operation was not described. Here we describe our method of scalp incision with a sharp needle electrocautery without skin clips, and show that electrocautery skin incision in neurosurgery is satisfactory for both first operation and re-operation.

Materials and Methods

Sharp needle electrocautery was used to perform 22 scalp incisions. Bipolar electrocautery was used for hemostasis. Diathermy skin incisions were created using a sharp needle electrode coated with polytetrafluoroethylene (0013 M; Megadyne, Draper, Utah, USA). The generator unit (ERBE, Marietta, Georgia, USA) was set on cutting mode, with power of 6 W (maximum power 10 W) and 330 kHz sinusoid waveform (Fig. 1A). Subcutaneous dissections also used the sharp needle electrode, set on coagulating mode, with power of 10 W (maximum power 10 W) and 1 MHz pulse-modulated waveform (Fig. 1B). Galea incisions used a standard blade tip, set on coagulating mode, with power of 20 W and 1 MHz pulse-modulated waveform (Fig. 1C). Diathermy incision used only the tip of the electrode to contact the skin, subcutaneous tissue, or galea. The sharp needle electrode was moved repeatedly in both directions along the incision line slowly increasing the depth of the incision. Consequently, the arteries and veins of the galea were usually identified before cutting, and could be coagulated using bipolar electrocautery. The standard blade tip was used to coagulate and cut the abundant vessels of the galea without bleeding. No local anesthesia was used because fluid prevents electrode contact with the tissues and disturbs diathermy incision. To avert the skin edges away during cutting, mild traction was applied to either side of the skin incision. Therefore, only the tip of the sharp needle electrode came in contact with the proposed incision line, and the needle sides did not touch the skin edges at any time, so preventing resultant charring of the tissues.

All patients received intravenous antibiotic prophylaxis using cefazolin sodium 1 g for both induction and four postoperative doses. The galea was closed with inverted 3.0 vicryl sutures and the skin edges were apposed with staples. All skin openings and closings were performed by the first or second author. The staples were removed 7 days after the operation. Wound complications occurring at any stage during the operation and the 1-month follow-up period were recorded for all patients. Wound infection was defined as the discharge of fluid pus.

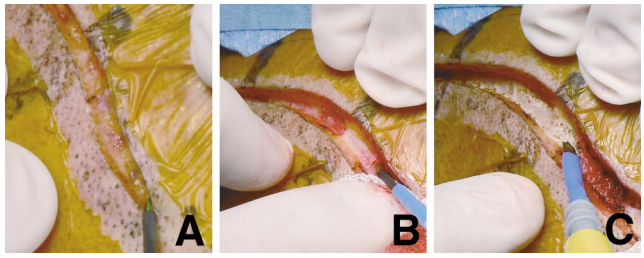

Fig. 1 Photographs showing diathermy skin incision (A) and subcutaneous dissection (B) with a sharp needle electrode, and galea incision with a standard blade tip (C), with minimal charring of the skin and subcutaneous edges, and little bleeding or oozing. Photograph (A) shows the second incision and (B) shows the fourth incision, illustrating the process of multistep skin and subcutaneous tissue incision with electrocautery using the sharp needle electrode.

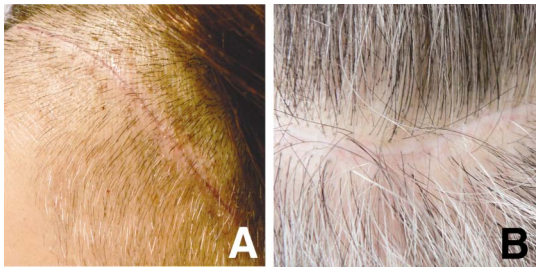

Fig. 2 Photographs of a fronto-temporal incision 2 weeks after the first operation (A) and coronal skin incision 8 months after the second operation (B) showing minimum wound scar and alopecia around the wound.

Results

The 22 cranial skin incisions are described in Table 1. The patients were aged 28–86 years (mean 48 years). The operation time ranged from 161 to 627 minutes (mean 343 minutes). Skin incision with the sharp needle electrode caused minimal charring on skin or subcutaneous edges (Fig. 1). After additional hemostasis was completed with monopolar and bipolar cautery for the subcutaneous and galea incisions, little bleeding and oozing were observed, and application of skin clips was not necessary (Fig. 1C). In particular, little bleeding occurred during skin closing and further hemostasis was not necessary. Three skin incisions were second operations (first skin incision with cold scalpel in one case and with sharp needle electrocautery in two cases), and one skin incision was the fourth operation (previous three skin incisions with cold scalpel), but no wound complication was observed in all four cases after the

Table 1 Summary of cases of electrocautery skin incision

Case No.	Age (yrs)/Sex	Operation	Operation time (min)
1	38/F	rt frontal craniotomy	363
2	80/M	lt fronto-temporal craniotomy	161
3	49/M	rt fronto-temporal craniotomy	225
4	79/F	lt fronto-temporo-parietal craniotomy	573
5	62/M	second rt fronto-parietal craniotomy	335
6	35/M	rt fronto-temporal craniotomy	252
7	35/F	lt fronto-temporal craniotomy	344
8	30/F	first rt temporo-suboccipital craniotomy with mastoidectomy	293
9	30/F	second rt temporo-suboccipital craniotomy with mastoidectomy	280
10	35/F	fourth rt fronto-temporal craniotomy	596
11	86/M	lt fronto-temporo-parietal craniotomy	193
12	48/F	bifrontal craniotomy	458
13	66/F	rt fronto-temporal craniotomy	345
14	78/F	lt fronto-temporal craniotomy	187
15	39/F	lt fronto-temporal craniotomy	437
16	28/F	first rt fronto-temporo-parietal craniotomy	627
17	28/F	second rt fronto-temporo-parietal craniotomy	330
18	58/F	lt fronto-temporal craniotomy	366
19	31/M	lt fronto-parietal craniotomy	353
20	35/M	lt fronto-temporo-parietal craniotomy	393
21	34/F	rt parieto-occipital craniotomy	205
22	52/M	rt fronto-temporo-parietal craniotomy	237

Cases 8 and 9, and Cases 16 and 17 occurred in the same patients. lt: left, rt: right.

procedures. Wound scars were narrow and alopecia around the wound was not discernible after both first operation and re-operation (Fig. 2). Patient age and long operation time were not associated with postoperative wound complication.

Discussion

The present study indicates that electrocautery skin incision is safe and efficacious, especially for procedures with long operation times, because of the minimal blood loss from the edges of skin incision and the possible avoidance of skin edge necrosis or alopecia caused by skin clips. Furthermore, our findings indicate that skin incision at re-operation can also be performed safely with electrocautery.

Micro-needle electrocautery causes less necrosis than standard needle electrocautery, and the histological response is close to that of the cold scalpel.[1,3] The risks of delayed wound healing, keloid formation, and high infection rates are low in general surgery after electrocautery skin incision.[2,5] Minimal alopecia occurred on the side incised with the micro-needle electrocautery scalpel (Colorado micro dissection needle; Stryker, Wien, Austria), and the rate of wound infection and dehiscence was 1.12% after electrocautery skin incision, which is within the acceptable range for neurosurgical wound infection.[7] Time taken during skin opening was significantly shorter and blood loss was three to five times less using the micro-needle electrocautery scalpel.[7] Electrocautery skin incision with the Colorado micro dissection needle is also safe and reduces hemorrhage.[4] The present study used another needle tip that is a little thicker and much less expensive than the Colorado micro dissection needle. This needle tip coated with polytetrafluoroethylene is designed to further minimize potential thermal injuries during electrosurgery. In fact, little bleeding and minimal charring were observed on the skin edges with no wound complication like necrosis or infection. We suggest that minimal electrical contact, low power setting, and polytetrafluoroethylene-coated tip allow smooth skin incision possible with minimal charring. The previous and our present results indicate that electrocautery skin incision is safe and very efficacious, and can be recommended for extended neurosurgical procedures, such as removal of large tumor or arteriovenous malformation.

Furthermore, this study indicates that electrocautery skin incision is safe for re-operation. Although the previous skin incision cicatrix was opened in four patients, no patient had wound complications. Use of skin clips in the re-opening of scalp is sometimes associated with failure of wound healing, part-

ly because compression of the skin vessels with skin clips causes ischemia of the skin edges and surrounding areas. In contrast, electrocautery skin incision results in persistent hemostasis during operation without ischemia.

Electrocautery increases the incidence of indurated margins, infection, and weakness of the wound cut compared with the cold scalpel.[8] Portions of the incision completed with the micro-needle demonstrated wider area of peri-incisional alopecia than that produced by the cold scalpel.[6] We also consider that electrocautery caused indurated margins, infection, weakness of the wound, and alopecia. However, the micro-needle causes less necrosis and improved wound healing compared with the standard electrode, indicating that, with higher power density, tissue separation is more rapid and can be accomplished with less energy delivered to the tissue.[1,3] However, higher power causes sparkling and charring, contributing to delayed wound healing. Therefore, we contacted only the tip of the sharp electrode with the skin, subcutaneous tissues, or galea, making shallow cuts with low power, and applying mild traction to either side of the skin incision. This technique could cut the tissues rapidly without charring. Furthermore, we were able to identify the vessels without bleeding because our technique gradually dissected the subcutaneous tissues. Therefore, we were able to coagulate the vessels with minimal charring and bleeding with bipolar electrocautery before cutting. We suggest that this ''minimal electrical contact'' technique results in minimal wound damage, minimal scarring, excellent wound healing, and minimal alopecia.

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