**PlasmaKnife™ Dissection in Cochlear Implant Surgery**

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**ABSTRACT**

Objectives: Monopolar (MP) electro-surgery is frequently used in cochlear implant (CI) surgery but is contraindicated in bilateral or revision cases. For such cases, sharp dissection may result in more bleeding or prolonged surgery. The purpose of this study was to determine the safety and efficacy of a device that uses radiofrequency to create a gas plasma at the tissue surface (PlasmaKnife™, PK) with MP electro-surgery.

Study Design: Retrospective case control study

Methods: A retrospective chart review was completed of patients undergoing CI from 2009-2011 by a single surgeon. Indications for radiofrequency dissection included revision surgery and second sided CI. Rates of postoperative wound outcomes including wound edema, hematoma, infection, hypertrophic scar, and keloid were assessed. Costs associated with these and alternative techniques were compared.

Results: A total of 74 independent patients were identified. Radiofrequency PK was used in 32 cases and monopolar electro-surgery in 42 cases. There were 2 (6.25%) wound complications in the PK group and 9 (21.4%) in the control group. An additional 16 patients, each undergoing both PK and MP surgery for a total of 33 surgeries were identified during the study period and compared. Statistical analysis showed no significant differences in wound complication rates between the two surgical techniques.

Conclusions: Radiofrequency PK is a suitable option for revision and bilateral CI surgery when MP electro-surgery is not available. It appears to be as safe and effective as standard surgical techniques.

**INTRODUCTION**

Monopolar electro-surgery (MP) is frequently used in primary cases of cochlear implant (CI) surgery. However, secondary CI surgery, that is second sided or revision cases, is becoming increasingly common. In the presence of an existing CI or other electronic device, MP electro-surgery is contraindicated.

Existing techniques for this situation include the use of bipolar electro-surgery, the Shaw thermal scalpel, or Ultracision® technology. CI manufacturers have suggested against the use of MP and note that bipolar instrument use should be kept a safe distance away from implanted devices and their electrode arrays (3,4).

The PlasmaKnife™ (PK, Gyrus ACMI Southborough, MA) utilizes radiofrequency waves through a tripolar tip (Figure 1). A corona of energy is created around the central pole to cut, rapidly alternating with bipolar coagulation (5). In a porcine model of wound healing this method produced less collateral tissue damage in comparison to MP, Coblation® and Harmonic® tools. Although utilized in pediatric otolaryngology and head and neck surgery, no prior studies have investigated its use in CI surgery.

**METHODS**

A retrospective chart review was completed of patients undergoing CI from 2009-2011 by a single surgeon. Indications for radiofrequency dissection included revision surgery and second sided CI. Rates of postoperative wound complications including wound edema, hematoma, infection, hypertrophic scar, and keloid were assessed. The PK and MP surgical groups were compared using Fisher’s exact test. Patients undergoing two separate surgeries utilizing the two different techniques were compared to themselves as controls. The cost of PK and alternative techniques were compared.

**RESULTS**

A total of 90 patients were identified as having CI surgery at the single surgical center where PK instrumentation was available. Among these patients, 74 underwent a single procedure during the study period and 16 patients had both a MP primary surgery and PK secondary surgery. In the independent procedures group, PK was used in 32 cases and MP in 42 cases. The baseline characteristics of these patients did not significantly differ except for side of surgery (Table 1). Overall two (6.25%) wound complications were identified in PK cases and nine (21.4%) in the control MP cases (Table 2).

Statistical analysis showed no significant differences in wound complication rates between techniques. When analyzing all procedures (n=107), no difference was found between groups (Fisher’s Exact p = 0.11). Similarly, no difference was found when only the independent procedures were compared (n=74, p=0.28) nor when the patients undergoing both techniques were compared to themselves (n=33, p=0.23).

In addition to the fixed cost of a generator and foot pedal, the PC15 disposable tips of the PK have a quoted cost of $857 for a box of 6, or $142.83 per procedure. The Hemostatix thermal scalpel requires a controller box, and disposable costs of $76.79 per procedure ($322.13 for limited use handles and $1069.82 for 24 disposable blades). Ultracision® instruments require a console, and $299 per blade.

**DISCUSSION**

The presence of an existing device in secondary CI surgery contraindicates the use of MP electro-surgery. Radiofrequency PK is an alternative instrument that can be used for simultaneous dissection and hemostasis, with potentially reduced thermal injury to local tissues (6). The bloodless plane is particularly effective when using the temporalis pocket technique (7). Its cost is comparable to alternative technologies. Although used in other otolaryngologic procedures, no studies to date have reported experience in CI surgery. In this retrospective review this device appears as safe as MP electro-surgery in regards to wound outcomes. To be as comprehensive as possible, all wound related findings including hypertrophic scar and keloid formation were recorded. These particular outcomes may not reflect either PK or MP use, as skin incisions were all made with a scalpel. In addition to wound complications, no device malfunctions or significant programming changes were required for the existing CI devices. This technique appears to be as safe as other options and further study to directly compare operative techniques in secondary CI surgery is warranted.

**CONCLUSIONS**

Radiofrequency PK is a suitable option for revision and bilateral CI surgery when monopolar electro-surgery is not available. It appears to be as safe and effective as standard surgical techniques.

**REFERENCES**