ABSTRACT

Objective: The outcomes of two patients with cochlear implants (CIs) who inadvertently underwent adenotonsillectomy (AT) with monopolar cautery are presented. Safety data regarding monopolar cautery use in CI recipients is also reviewed.

Methods: This is a case series of two CI recipients that underwent AT with monopolar cautery and literature review of electrocautery safety in the setting of CI.

Results: Two patients with CIs underwent AT with use of monopolar cautery inadvertently by surgeons that do not routinely perform cochlear implants as part of his/her clinical practice. Patient 1 was a 9-year-old female who had AT for obstructive sleep apnea (OSA) after undergoing unilateral CI for profound congenital sensorineural hearing loss (SNHL) 8 years ago. Patient 2 was a 7-year-old female who underwent AT for OSA 4 months after undergoing unilateral CI for congenital SNHL. Both patients had no immediate signs of complications with their CI postoperatively. Both patients demonstrated unchanged postoperative neural response telemetry and behavioral audiometric testing. Patient 1 continues to have no CI-related complications 3.5 years after the procedure. Patient 2 has been followed for at least 3 months with no CI-related complications.

Conclusion: Although animal and cadaveric studies suggest that monopolar cautery may be safely used in patients with cochlear implants, there have been no in-vivo human studies that have evaluated the risk to the patient or implant. We report a small experience with two patients, both of which exhibit no complications or changes to CI function thus far.

INTRODUCTION

Monopolar cautery use in patients with CI is contraindicated in the head and neck area due to the theoretical risk of CI malfunction or transduction of thermal injury to the cochlea. Therefore, alternative surgical techniques which avoid monopolar electrocautery are recommended, such as coagulation or bipolar cautery. While the consensus from CI manufacturers is that monopolar cautery should not be used in the head and neck region, there is no published data to substantiate this risk in in-vivo models. We present data on the unintentional use of monopolar electrocautery in two CI recipients and present a review of the literature regarding electrocautery safety.

METHODS AND MATERIALS

This is a retrospective case series of two CI recipients that underwent AT with use of monopolar cautery. The study was approved by the institutional review board. In one case, use of monopolar cautery was recognized immediately after surgery and in the second case, the surgery was done at outside institution and patient presented postoperatively. In both cases,

- Cochlear implant integrity was assessed:
  - Electrode impedances were measured across the electrode array.
  - Impedances were assessed across all active electrodes.
  - Review of impedances obtained using common ground stimulation mode were compared to previous audiology visits.
  - Neural response telemetry was performed to evaluate neural responsiveness to electrical stimulus and to monitor changes in the responsiveness.
  - Results were compared to intraoperative testing completed at time of device placement.

REFERENCES

2. Cochlear America Ltd - Warnings and Precautions.

RESULTS

Patient 1:
9-year-old female who underwent AT for obstructive sleep apnea (OSA) after undergoing unilateral CI for profound congenital sensorineural hearing loss (SNHL) 8 years prior to the procedure. Cautery settings were not available for review on this patient.

Patient 2:
7-year-old female who underwent AT for OSA 4 months after undergoing unilateral CI for syndromic congenital SNHL. Suction monopolar cautery set at 36 watts (W) was used to perform the adenoidectomy, and. Monopolar cautery set at 16 W and suction monopolar cautery set at 26 W was used to remove the bilateral tonsils in an extracapsular fashion.

Each case was uncomplicated. Both patients had no immediate signs of complications with their CI postoperatively. Both patients were evaluated by audiologist specialized in CI programming and their analysis demonstrated no changes in postoperative neural response telemetry and behavioral audiometric testing, compared to preoperative evaluation.

DISCUSSION

Monopolar cautery use in patients with CIs is contraindicated in the head and neck region due to the theoretical risk of CI malfunction or transduction of thermal injury to the cochlea [1]. It is recommended that the surgeon use alternative techniques to attain hemostasis, such as bipolar cautery, coagulation, or doing the surgery ‘cold’ to avoid cautery altogether. The risks to device or tissue, however, are theoretical; there are limited studies published, all of which have been in cadaveric models, and none of which substantiate the risk of electrocautery.

In a cadaveric pig model, unilateral CIs were placed and then adenoidectomy was simulated by subjecting the nasopharynx to 15 or 30 minutes of monopolar electrocautery set at 50 W versus Coblation, and the authors reported no changes to CI integrity [4]. A study in unembalmed, fresh human cadavers looked at monopolar cautery when applied to either the tongue or abdomen at coagulation settings of 10 W or 50 W for 30 minutes [5]. No change in impedance, integrity testing, or failure occurred at any cautery setting to either the oral cavity or abdomen. Cautery applied to the ipsilateral pectoralis major muscle or ipsilateral temporalis muscle at bipolar, monopolar coagulation, and monopolar cut settings of 50 to 100 W. They also showed no evidence of device damage [6].

Cadaveric studies would suggest that use of monopolar cautery does not have the damaging effects on the cochlea or device. Limits to these studies include their small numbers, and the possibility that cadaveric tissue may have different electrical conductive properties than live tissue. Additionally, in vivo implanted devices, particularly if they are older, may potentially have breaches to the implant casing or the electrode array as a result of wear or trauma. In theory, therefore, wear-and-tear may affect a CI’s susceptibility to electric damage and the current studies to date may not accurately reflect the real risk to the individual patient.

The two cases presented in this study had AT done with monopolar cautery in the head and neck region. Neither of these patients had any damages or changes in testing and this corroborates the findings demonstrated in cadaveric studies.

CONCLUSIONS

Monopolar cautery use in patients with CIs is currently contraindicated in the head and neck area due to manufacturer’s recommendations. This contraindication stems from the theoretical risk of CI malfunction or transduction of thermal injury to the cochlea. While cadaveric studies suggest that monopolar cautery poses no risk, there have been no randomized, controlled in vivo studies which have confirmed the safety of its use in patients. This case report highlights outcomes in two patients, both of which exhibit no complications or changes to CI function after monopolar cautery use in head and neck surgery.