Cochlear implants using the Ultracision® harmonic scalpel

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Abstract: We evaluated the usefulness, indications and disadvantages of the Ultracision® harmonic scalpel in cochlear implants as well as its advantages in relation to other systems of electrocoagulation. These aspects were analyzed in 50 cochlear implants carried out over the last few years. In conclusion, we established that the Ultracision® harmonic scalpel is most importantly indicated in the field of otology, in those cases in which the cochlear implant is inserted in the cochlea and it is necessary to use a system of electrocoagulation or incision. In this situation, the Ultracision® harmonic scalpel proved quick, efficient and safe and with obvious advantages over a traditional scalpel or bipolar electrocoagulation.

Key words: Cochlear implant. Harmonic scalpel.

INTRODUCTION

The Ultracision® harmonic scalpel (Ultracision®, from Ethicon Endo-surgery, Cincinnati, OH, United States) is an instrument that cuts and coagulates tissue by converting electric energy into mechanical energy. This mechanical energy is capable of cutting tissue and establishing complete hemostasis, with a minimal thermic lesion and without the use and disadvantages of monopolar electricity.

Furthermore, it has a superior hemostatic capacity to bipolar electricity.

This makes it an ideal instrument for those situations where it is necessary to incise or coagulate patients who have a cochlear implant, and where the conventional electric scalpel is contra-indicated.

This instrument has been fundamentally used in endoscopic surgery and its effectiveness has been acknowledged in many publications1. In conventional open surgery, it is used in thyroid2, parathyroid3, breast4, liver5 and colorectal6 surgery.

In our field, its use in surgery for rhinophyma7, tonsils8, soft palate9 and, even, in nasosinusal endoscopic surgery11 has been reported.

In the case of the cochlear implant, Laszig R et al, indicate this technique for implant revision surgery12.

In this paper, we describe the usefulness, indications and disadvantages of the Ultracision® harmonic scalpel in cochlear implantation, in our field, as well as its advantages and disadvantages in relation to other systems of electrocoagulation.

MATERIAL AND METHODS

We carried out 50 cochlear implants in the Autonomous Community of Aragon up to May 2004. In 45 cases, the cochlear implant process did not involve any incident that required the use of the Ultracision® system.

Nevertheless, in five cases we had to use a system for cutting or coagulation, subsequent to the introduction of the implant into the tympanic scala, as shown in Table 1.

In one case, the patient had such a thick cutaneous plane - despite the muscular plane having been removed - and such rigid hair, that the implant’s external mechanism was frequently disconnected, despite the use of the strongest magnets at our disposal on the market. Because of this, the patient had acquired the habit of pressing the external mechanism, which improved its performance. Following various therapies,
Table 1: Situations in which the Ultracision® harmonic scalpel has been used in cochlear implantation in our field

<table>
<thead>
<tr>
<th>Situation</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>45</td>
</tr>
<tr>
<td>Increase in skin thickness</td>
<td>1</td>
</tr>
<tr>
<td>Bad positioning of electrode</td>
<td>1</td>
</tr>
<tr>
<td>Implant substitution</td>
<td>2</td>
</tr>
<tr>
<td>Post-implantation bleeding</td>
<td>1</td>
</tr>
</tbody>
</table>

we opted for surgical reintervention with the aim of reducing the cutaneous plane.

Another of our patients was deaf-blind as a result of meningo-neuritis. Partial ossification of the cochlea, which made it difficult to insert the electrode guide, and a very scarce sensory population, which prevented us from carrying out an adequate NRT, explained the incorrect position of the electrode guide. The subsequent results advised us to operate again on the patient and re-insert the cochlear implant.

In another two cases, the patients had Laura implants, and for reasons of difficulty with maintenance, we decided to substitute these for other more up-to-date implants.

Lastly, in another case, a hemorrhage occurred during suture that couldn’t be controlled adequately with regular bipolar coagulation. In all these procedures, the Ultracision® system was used effectively.

The system has a graduation on the intensity monitor that can be used to choose a grade between 1 and 5. At its maximum power, the cut is quicker; however, the hemostatic capacity is lower.

The surgeon can also decide the field of contact between the terminal used and the tissue, to a greater size, greater time of cut and, consequently, a greater hemostatic capacity. The surgeon can also control the pressure that he exerts on the tissue with the terminal. Thus, the greater the pressure, the more quickly the cut is produced and the lower the hemostatic capacity.

Furthermore, their different forms and functions, with the field of the cut and the specific function of the equipment being combined, fundamentally distinguish the terminals from each other.

Lastly, as this type of mechanism converts electric energy into mechanical energy, we use protective glasses for this type of surgery, since a practically imperceptible fine spray is given off, corresponding to blood and other tissues of the patient, in the form of minute particles that could get into the surgeon’s eyes.

DISCUSSION

Cochlear implantation currently represents one of the greatest advances in the treatment of profound deafness.

Although the idea to implant an electrode that emits electric impulses provoked by acoustic stimulation in the interior of the cochlea is not new, modern technology has shown encouraging results that have resulted in the cochlear implant being considered an essential surgical technique in the treatment of profound hypoacusis.

Currently, the insertion of electro-acoustic cochlear devices plays a routine part in the daily practice of our field. During the time in which this type of technique has been carried out, various problematic situations have arisen that that have had to be resolved with corresponding technical advances.

In the usual approach, we performed the incision and the electrocoagulation in the surgical procedure of a cochlear implant using the Colorado micro-dissection needle. These electro-dissection needles have a highly precise, tungsten micro-terminal, which allows us to carry out an incision of the skin and of the rest of the musculo-cutaneous layers with great exactitude, minimal bleeding and with the same or better esthetic results as a cold cut.

Nevertheless, this system uses monopolar electricity, for which reason it is formally contra-indicated in those situations where a cochlear implant is already inserted.

Because of this, if a cochlear implant is inserted, we use bipolar electricity as the system of electrocoagulation during the closure of the surgical lesion. However, this bipolar system can only be used for electrocoagulation and not in incision or dissection. Furthermore, it is slow and, on occasion, not particularly efficient.

As a result, in those cases where an incision, the dissection of the musculo-cutaneous layers, or coagulation close to a cochlear implant are necessary, we use the Ultracision® harmonic scalpel, from Ethicon Endosurgery.
As we have pointed out, it is an instrument that cuts and coagulates the tissues by converting electrical energy into mechanical energy. The mechanism produces, in its different commercialized terminals, vibrations of 55,000 Hz capable of cutting the tissue and producing complete hemostasis, rapidly and effectively. Furthermore, it lacks relevant thermic effects or, in any case, these are perfectly controllable and, as it doesn’t use monopolar electricity, it can’t harm the cochlear substratum in contact with the metallic terminals of the implant nor affect the technical parts of the same.

However, it must be pointed out that the incision capacity of the ultrasonic scalpel can potentially affect the cable system of the implant. For this reason, if they accidentally come into contact during the dissection, especially in the cases of implants already inserted that must be removed, the UltraCision® cleanly cuts off both the intra-cochlear and extra-cochlear electrode terminals. As a result, when implants need to be preserved, it is necessary to avoid frontal contact.

However, this system doesn’t damage the cranial bone, for which reason it can be used, resting on the same, to lift the superficial layers.

In addition, the reduction in healing time has been described in various publications, perhaps as a consequence of the smaller thermic lesion that is produced in the surrounding tissues which gives a lower incidence of edema and local inflammation.

In our case, we have had to use it on five occasions in 50 cochlear implant cases. In each case, the UltraCision® harmonic scalpel permitted rapid, effective and definitive incision, dissection and coagulation.

Further to the situations in which we used it, the UltraCision® harmonic scalpel could have other uses in cochlear implant surgery, such as bilateral cochlear implant surgery. The various advantages of a second cochlear implant have been increasingly and successfully argued. However, surgery with systems of incision and monopolar electro-coagulation can harm the electronic components of the original cochlear implant and even definitively injure the nerve endings of the tympanic scala. For this reason, this surgery should only be carried out with systems of bipolar electrocoagulation or other systems, such as the UltraCision® scalpel.

In some cases, the failure of the implanted mechanism makes it necessary to replace the cochlear implant. Although in our cohort we have not suffered any implant failures until now, other authors refer to different incidents of this nature. Thus, Luetje CM and Jackson K report the failure of the mechanism in 10.9% (5/46) of implanted children. Buchman CA et al surgically reviewed the cases in which a malformation of the electrode was suspected and confirmed that, of 33 cases of revision surgery, eight cases (24%) showed a failure in the processor.

Furthermore, there are possible indications that we have not experienced, such as surgery for a secondary cholesteatoma, for secondary facial paralysis and for infectious processes and/or extrusion. Thus, Kempf HG et al, reviewed the complications suffered by 697 patients with cochlear implants and, apart from several intra-operative complications, secondary cholesteatomas were observed in 18 adults (5.4%).

CONCLUSIONS

The use of the UltraCision® harmonic scalpel allows safe and effective incision, dissection and hemostasis in those cases in which the patient has an existing cochlear implant. In the case of the surgery of the implantation itself, the indications are the hemostasis of the surgical field, once the implant has been inserted into the cochlea; the substitution of the cochlear implant; bilateral implantation; and surgery for complications, such as facial paralysis and secondary cholesteatoma.

References
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