

The use of an illuminated retractor in cochlear implantation: a comparative retrospective study

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BACKGROUND: Minimal access surgery has been promoted to reduce the surgical duration and complications of cochlear implant (CI) surgery. A requirement of minimal access surgery is adequate visualization of the surgical cavities.

OBJECTIVE: The aim of this study was to evaluate whether a new light-integrated surgical retractor reduced CI surgical time.

DESIGN: A retrospective comparative study.

SETTING: Tertiary referral otolaryngology clinic.

PATIENTS AND METHODS: We reviewed the records of all patients who received implants between January 2013 to May 2014 at King Abdul-Aziz University Hospital before and after use of the illuminated retractor.

MAIN OUTCOME MEASURE(S): Duration of surgery before and after the use of the illuminated retractor.

RESULTS: There were no statistically significant differences in the surgical duration of CI relating to use of the illuminated retractor in 117 patients. The mean (SD) surgery duration in the unilateral cases was 132.7 (45.5) minutes before and 125.32 (42.76) minutes after use of the illuminated retractor ($P=.479$). For the bilateral cases, the mean (SD) surgical time was 213.6 (45.7) minutes before and 206.5 (45.5) minutes after use of the retractor ($P=.702$). There were no adverse events with use of the new tool.

CONCLUSION: The similar duration and lack of adverse events suggest that the illuminated retractor is safe to use when drilling the bony recess for the receiver-stimulator package within the subperiosteal pocket.

LIMITATIONS: The method used to calculate surgical duration may explain why no reduction in duration was shown.

Cochlear implantation (CI) has become a routine procedure for managing individuals with bilateral severe to profound sensorineural hearing loss. In the last decade, there have been significant advancements in the surgical techniques for CI. These advancements allow the use of smaller incisions with smaller skin flaps (minimal access surgery). Minimal access surgery has been advocated to reduce the surgical time and the associated rate of CI surgery complications.^{1,2} It has been further suggested that minimal access surgery may reduce soft tissue complications such as skin flap necrosis and scarring,³⁻⁶ which may allow earlier device activation.⁷

Minimal access surgery requires adequate visualization of the surgical cavities. Drilling in the bony recess within the subperiosteal pocket with poor lighting can pose a significant challenge for the surgical team.⁸ Therefore, several instruments have been used to overcome this issue. Some instruments described as self-retaining retractors were found to significantly facilitate the procedure.⁴ Others were integrated with suction and a light supply to reduce the need for further assistance.¹ However, the illumination and the view provided by these instruments are not ideal.

Therefore, it is important to continue devising tools that aim at improving the efficiency of the surgical pro-

cess while avoiding undue discomfort to the surgeon. A new model of illuminated retractor has been devised in our CI center. The aim of this study was to evaluate the use of this tool in improving the efficiency of the surgical process of CI by reducing the surgical time.

PATIENTS AND METHODS

We retrospectively reviewed the charts of all patients who received implants at King Abdul-Aziz University Hospital between the period of January 2013 to May 2014. We compared patients who underwent the CI before and after establishing the use of the illuminated retractor. Charts that included revision CI surgery or insufficient data were excluded from this study. All procedures used in this study conformed to the ethical principles contained in the declaration of Helsinki and the study was approved by the IRB committee of King Abdul-Aziz University Hospital (Research No. E-16-1802).

All surgeries were performed by the same surgeon using the same operating theatre and the same techniques that were described in a previous study from our center.⁷ All surgeries were performed under general anesthesia. Generally, the surgical techniques were the same for adult and pediatric cases. Surgery was by the mastoidectomy with posterior tympanotomy approach was used followed by drilling the receiver-stimulator bed. The postauricular area was prepared with povidone-based solution and a local anesthetic 1% lidocaine with epinephrine 1:100 000 units was injected. Intraoperative facial nerve monitoring was used during surgery in all cases. No shaving was performed in this study given that the postauricular incision was limited to 3-4 cm in length and 1 cm below the hairline midway between the sulcus and the hair. The postero-superior flap was elevated to make a pocket that can house the receiver-stimulator. The security of the CI device was provided by the pressure of the periosteum tight pocket without using a suture. Soft tissue retraction during the drilling was achieved for some of the cases reported in this study by using the surgical retractor as typically used in implantation surgery. The new surgical tool used in retracting the soft tissue is shown in **Figure 1**, and the illuminated surgical cavity is shown in **Figure 2**. The instrument is a handheld device manufactured by Surgical Tools, Inc., Bedford, VA, United States.

To compare the differences in duration of surgery before and after use of the illuminated retractor within groups (unilateral and bilateral), independent *t* tests were performed with the level of statistical significance set at .05. Continuous data are presented as mean and standard deviation. Data were analyzed using SPSS v16.0 statistical software.



Figure 1. The illuminated retractor manufactured by Surgical Tools, Inc.

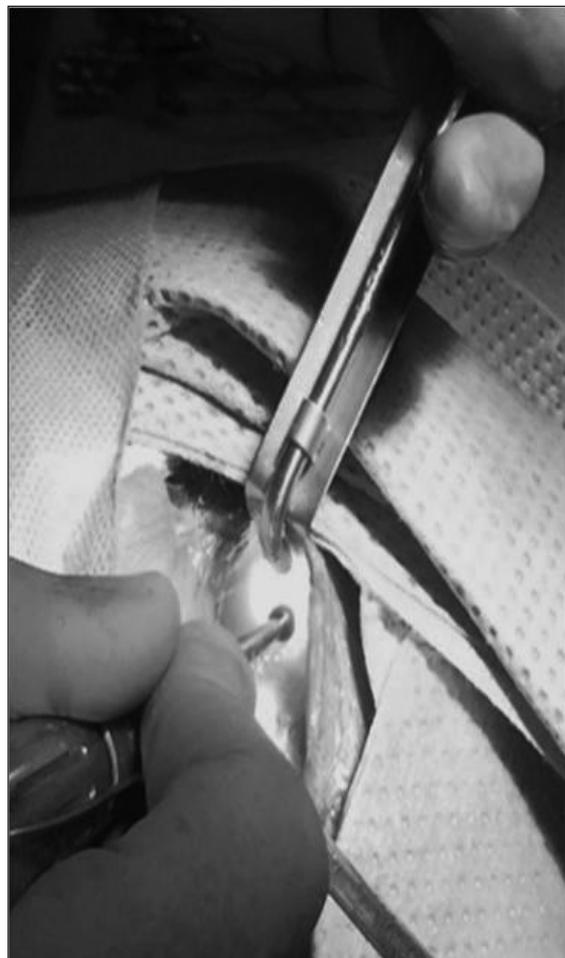


Figure 2. Intra-operative use of the illuminated retractor after connecting it with a light source.

RESULTS

The duration of surgery was reviewed for 117 implant cases. The duration was recorded from the time of making the incision to complete closure of the skin flap. Other variables such as age, gender, date of implant, type of device implanted, and other significant findings or complications during surgery were summarized. The majority of devices implanted were Concerto (MedEl Corporation, Austria), which constituted 88% of the cases (Table 1). The Cochlear Nucleus (Cochlear Ltd, Australia) constituted 9.4% of other cases and Advanced Bionics (USA, a division of Sonova) the remaining 2.6%. Charts were split into two groups before and after starting use of the illuminated retractor. Each group was additionally divided into two subgroups (unilateral and bilateral). There were a total of 60 (51.3%) charts that were identified before use of the illuminated retractor and 57 (48.7%) after use of the illuminated retractor. There was a relatively equal distribution of males and females. The age range was 1 to 60 years with a mean (SD) age of 8 (12) years.

Surgical time before and after use of the illuminator was not different for either the unilateral or bilateral groups (Figure 3). The average surgery duration in the unilateral cases was 132.7 (45.5) minutes before use of the illuminated retractor and 125.3 (42.8) minutes during use of the illuminated retractor ($P=.479$). For the bilateral cases, the mean surgical time was 213.6 (45.7)

minutes before use of the illuminated retractor and 206.5 (45.5) minutes during use of the new retractor ($P=.702$). The longer surgical time for the bilateral cases than that for the unilateral cases was expected because the bilateral cases necessitate implanting two CI devices simultaneously. There was wide variation in the duration of surgery within each group, which could be due differences in issues encountered during electrode insertion, differences in skull thickness, or difficulty in identifying the anatomical landmark.

DISCUSSION

Minimal access surgery for CI has been widely established as it results in fewer complications and faster wound healing,^{8,9} which may allow earlier device activation.⁷ However, with minimal access surgery, drilling in the bony recess within the subperiosteal pocket is considered a difficult step in CI surgery.^{1,2} In addition to

Table 1. Clinical and demographic characteristics of 118 patients who underwent cochlear implant.

Variable		n (%)
Gender	Male	59 (50)
	Female	59 (50)
Type of implant	Concerto	104 (88)
	Nucleus	10 (9)
	Advanced bionics	4 (3)
Unilateral cases	Before use of illuminated retractor	45 (58)
	Use of the illuminated retractor	33 (42)
Bilateral cases	Before use of illuminated retractor	15 (38)
	Use of the illuminated retractor	25 (63)

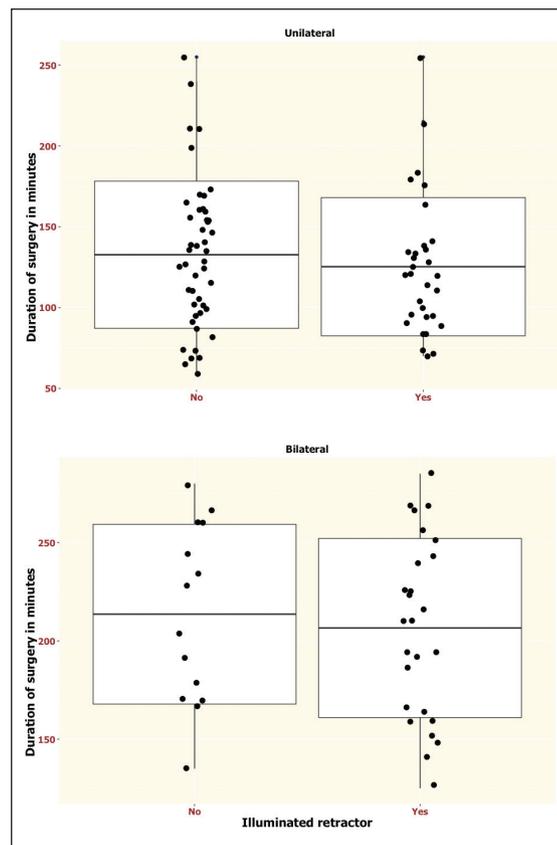


Figure 3. Duration of cochlear implant surgery in minutes before and after use of illuminated retractor in patients who underwent unilateral (above) and bilateral (below) cochlear implants. Mean is horizontal line in box. Edges of box are standard deviation. Independent t tests before vs after (unilateral: $P=.479$, 95% CI -13.33 to 28.14; bilateral: $P=.702$, 95%CI -46.15 to 31.38)

adequate access, adequate visualization of the surgical site is needed. The use of a surgical headlight by the surgeon to illuminate the surgical cavity may lead to an awkward posture. Specifically, it can force the surgeon to lower his head and maintain it at a certain angle to line the light beam with the drill at the surgical cavity. However, prolonged improper posture can cause headache and neck pain leading in some cases to chronic cervical and back problems, which may cause disability in some cases.¹⁰ Consequently, using the headlight to illuminate the surgical cavity may not be optimal and may rather limit the mobility of the surgical team and further provide limited illumination in cases of minimal access surgery.

Several suggestions have been made as to what constitutes an ideal surgical light.^{11,12} Two criteria are that light must penetrate into the surgical cavity or under the flap and it should not hinder the surgeon's mobility. Therefore, several surgical instruments have been modified to ensure adequate lighting during surgery.³ One of these tools is the illuminated retractor. Since a retractor with integrated lighting could lead to a shorter surgical time, the focus of this study was to determine whether the use of an illuminated retractor could reduce the duration of CI surgery. A reduction in surgical time could be facilitated by eliminating the need to use additional tools such as the surgical headlight or need for additional assistance from the surgical staff. However, we found no significant differences in the surgical time as a result of using the illuminated retractor. These results are contrary to a previous study that demonstrated that up to 70% of the bone drilling time was saved using a retractor that was integrated with light and suction.¹ The different results could be related to differences in the surgical procedure such as the flap design or the depth of the receiver-stimulator bed. Additionally, the experience of the surgical team could have contributed to differences. Alternatively, the lack of statistically significant difference in the surgical duration before and after use of the illuminated retractor

could be attributed to the wide variation in the duration of surgery within each group. Several factors could contribute to this variation among patients, such as issues encountered during electrode insertion, differences in skull thickness, or difficulty in identifying the anatomical landmark.

Furthermore, a reduction in surgical duration might have been better established in this study by restricting the start of the surgical duration to the point in time when the illuminated retractor was used. For example, this would exclude the time used in making the surgical incision; this needs to be further investigated. However, the current results imply that this new tool could be helpful in making the surgical process more convenient for surgeons by allowing them to illuminate the surgical site without the discomfort associated with the surgical headlight. Discomfort could potentially influence the duration or the success of the surgery. In summary, the current study evaluated the effect of using a new surgical retractor with an integrated light on the duration of CI surgery. There were no adverse events or any soft tissue complications observed in relation to the use of the new surgical tool, which is in line with a previous study where there were no adverse effects or surgical complications during use of an illuminated retractor in cases that required dural dissection.³ Additionally, there were no significant differences in the duration of surgery due to the use of the illuminated retractor. However, this new tool could safely facilitate the surgical process by improving the lighting of the surgical cavity.

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Conflict of interest

The authors reported no conflict of interest.

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