

Short Communication

Dr E Stapleton takes responsibility for the integrity of the content of the paper

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Common challenges in cochlear implant surgery performed under local anaesthesia and how to overcome them: the experience of UK surgeons

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Abstract

Background. Cochlear implantation performed under local anaesthesia is an increasingly accepted technique worldwide, though the literature to date includes only single-surgeon and single-centre experiences. This study explored the national experience of UK surgeons using this challenging surgical technique, with the goal of providing consensus recommendations.

Methods. A qualitative analysis was conducted of semi-structured interviews with 10 UK-based cochlear implantation surgeons, focusing on common challenges, how to overcome them and candidate selection.

Results. Cochlear implantation under local anaesthesia can potentially be offered to all eligible adult patients with favourable anatomy. A posterior tympanotomy and round window approach is recommended. Common challenges and recommendations are explored thematically: managing patient, surgeon and staff expectations; optimising communication; patient comfort and position; minimising pain and vertigo; and safe use of sedation.

Conclusion. This is the first study of national experience of cochlear implantation performed under local anaesthesia. Key themes, including refinements to surgical technique and optimising patient comfort and communication, have been explored in depth.

Introduction

Patients with severe or profound hearing loss have an increased risk of dementia, disability and depression.¹ Cochlear implant surgery is a transformative surgical intervention for patients with severe or profound hearing loss who do not gain sufficient benefit from hearing aids. In such patients, cochlear implants can significantly improve speech perception, communication, relationships and quality of life.²

Cochlear implant surgery is routinely performed under general anaesthesia (GA). In recent years, local anaesthesia (LA) with conscious sedation has been shown to be a safe and feasible alternative to GA,^{3–9} and is predominantly offered to those deemed medically unfit for a GA, or to older adult patients who are postulated to have a lower risk of post-operative cognitive decline with sedation or regional anaesthesia as compared to GA.¹⁰ Techniques for cochlear implant surgery performed under LA described in the literature vary in detail, and predominantly focus on case reports, and single-surgeon and single-centre experiences.^{11–17}

We explored the national experience of UK surgeons using this challenging surgical technique, with the goal of providing consensus recommendations. Our study aimed to summarise the UK experience of performing cochlear implant surgery under LA, with a focus on three key areas: common challenges encountered, recommendations on how to overcome these, and patient selection for cochlear implantation under LA.

Materials and methods

Cochlear implant surgeons from across the UK were invited to take part via e-mail invitations disseminated through the British Cochlear Implant Group network. Surgeons were asked whether they undertake cochlear implant surgery under LA, and those who did were subsequently invited to take part in our study.

The first author (RA) interviewed respondents virtually via the Zoom video communication platform, using a mix of open-ended and focused questions to explore each of the three key areas: common challenges encountered; recommendations on how to overcome these expected challenges, with tips for surgeons newly looking to incorporate cochlear implant surgery performed under LA in their practice; and which patients should be offered cochlear implant surgery under LA. Interviews were recorded, transcribed and thematically analysed.

Of note, for this project, we initially considered seeking data from anaesthetists and patients regarding their experiences of cochlear implantation performed under LA;

however, given the rich data gathered from surgeons alone, this study focused solely on presenting a nationwide UK surgeon experience of cochlear implantation performed under LA.

Results

Ten UK surgeons were interviewed virtually, with a mean interview duration of 25 minutes. The mean number of cochlear implantation procedures performed under LA by the surgeons interviewed in our study was 10 (range, 2–35 procedures).

All surgeons used a posterior tympanotomy approach and round window electrode insertion. Only two surgeons (20 per cent) used conscious sedation. The LA agents of choice included lidocaine with adrenaline, bupivacaine, and levobupivacaine with or without adrenaline. Nine surgeons (90 per cent) opted not to use a facial nerve monitor, citing reasons such as painful facial contractions when using the facial nerve stimulator or pain when inserting the facial electrodes.

Common challenges

Common pre-operative challenges encountered included patient, anaesthetist and nursing staff expectations as potential barriers to performing cochlear implantation under LA. Similarly, a lack of personal surgical experience and confidence contributed to surgeon hesitancy.

Intra-operatively, difficulty achieving co-operative sedation was a challenge for one surgeon, who described a patient moving suddenly whilst he drilled close to the facial nerve. Most surgeons interviewed did not use sedation, citing similar concerns. Several surgeons discussed the potential of dexmedetomidine, commonly used in the USA for cochlear implantation procedures under LA¹⁷ but limited to intensive care unit settings in the UK.

Managing intra-operative patient pain was a common challenge. One surgeon described how their patient experienced severe pain when drilling through bone that is normally insensate. Another struggled with managing their patient's pain as a result of the scrub nurse's unfamiliarity with using topical LA. Several surgeons sought advice from more experienced colleagues, and adopted the use of topical LA into the mastoid in their technique. Patient discomfort from vertigo was highlighted as a challenge, especially at the stage of irrigating the mastoid. Patient discomfort with the use of suction in the presence of good low-frequency hearing was also reported. Other challenges included difficulties of patients remaining still during the procedure.

A key challenge highlighted by all surgeons interviewed was establishing clear intra-operative communication with the patient. Operating on patients with visual impairment restricted the use of written communication during surgery. Maintaining communication with the patient also 'tied up' an extra member of staff during the procedure. The challenge of involving trainees was emphasised as a drawback to making cochlear implant surgery performed under LA the routine practice.

Tips on overcoming these challenges

All surgeons suggested methods they had utilised and developed in their practice to overcome the above-mentioned challenges. We present these tips and recommendations in [Table 1](#).

Patient selection

We explored surgeons' perspectives on the selection of patients for cochlear implant surgery performed under LA. Six surgeons (60 per cent) felt that cochlear implant surgery under LA should be routinely offered to all eligible candidates, emphasising the importance of ensuring favourable anatomy confirmed by computed tomography scans, rather than surgically complex cases. Others focused on choosing patients who would tolerate being awake through major surgery. It was also mentioned that patients who are significantly obese, or who have restricted neck mobility or significant kyphosis, may find intra-operative positioning uncomfortable and therefore might be better suited to having the surgery under GA.

All surgeons highlighted the advantages of performing cochlear implant surgery under LA, including the avoidance of: risks associated with GA and coronavirus disease 2019; the potential risk of post-operative cognitive decline in older adult patients; the risk of deep venous thrombosis; and longer post-operative hospital stay following GA. One surgeon performed cochlear implant surgery under LA on a pregnant patient, in her third trimester, to avoid any drug-induced complications; she would have been unsuitable for cochlear implant surgery under GA during pregnancy.

Despite these advantages, some surgeons expressed hesitancy regarding cochlear implant surgery performed under LA as the routine practice. Some surgeons felt that cochlear implant surgery performed under LA should be offered only to those deemed medically unfit for GA. Two surgeons felt that they would likely offer cochlear implant surgery under LA to adults above a certain age, to minimise the risk of post-operative cognitive decline. It was also emphasised that surgery performed under LA also carries risk. Therefore, a thorough pre-operative clinical and anaesthetic assessment of the patient was recommended, to guide the decision-making process for both the patient and surgeon.

Discussion

This work suggests that, in the hands of experienced surgeons, cochlear implant surgery performed under LA can potentially be offered to all patients eligible for a cochlear implant, with a preference for those with favourable anatomy. We suggest techniques and tips to optimise the patient and surgeon experience of cochlear implantation performed under LA, shedding light on common pitfalls and challenges.

Our cohort of UK surgeons provided advice on how to manage patient, personal and staff expectations pre-operatively, as well as providing recommendations to optimise intra-operative communication and patient comfort during surgery. This is the first time that these key aspects of cochlear implant surgery under LA have been explored and presented in depth ([Table 1](#)).

A limitation of this work is that several of the surgeons were on the learning curve; however, this also meant they were able to provide invaluable insight from recent experiences.

Most UK cochlear implant surgeons prefer not to use sedation when performing cochlear implant surgery under LA. This contrasts with protocols described in the world literature, with US surgeons using dexmedetomidine^{11,15,17} and those in the EU using propofol and/or midazolam for conscious sedation.^{4,14} Concerns raised by our UK cohort of surgeons primarily surrounded the risk of unpredictable sedation.

Table 1. Tips and recommendations by UK surgeons to overcome common challenges encountered in CI surgery performed under LA

Managing patient expectations
<ul style="list-style-type: none"> - Explore patient concerns in your pre-operative consultation – you can use the analogy of drilling under LA during ‘dental treatment’ to introduce how CI surgery under LA may feel to the patient - Similarly, asking the patient ‘How do you find going to the dentist?’ may guide whether they are likely to tolerate the procedure under LA - You can also ask the patient to lie on a microscope couch, to check their neck mobility & explain how it may feel lying in this position during surgery
Managing personal (surgeon) expectations
<ul style="list-style-type: none"> - Perform your first few cases with an experienced colleague where possible - Recognise & develop your personal learning curve through discussion with colleagues & learning from their experiences - Choose ‘routine’ cases with favourable anatomy to perform CI surgery under LA - Be prepared with an ‘exit strategy’, i.e. stopping or converting to a GA, if a patient does not tolerate the procedure or unexpected surgical difficulties arise during the procedure
Managing staff expectations
<ul style="list-style-type: none"> - Perform surgery with an anaesthetist you are familiar working with - Ensure the rest of the operating theatre staff have previously assisted in major ear cases before, to aid efficiency & smooth-running of CI under LA surgery
Safe use of intra-operative sedation
<ul style="list-style-type: none"> - Liaise with your anaesthetist colleagues closely, as the level of ‘co-operative’ intra-operative sedation, if required, is dependent on anaesthetist expertise - Be aware that certain sedatives such as propofol may be associated with patients suddenly ‘waking up’ from sleep or ‘jolting’ - If an anaesthetist is present during the procedure, they may administer their medication of choice to help settle the patient if uncomfortable
Minimising intra-operative pain
<ul style="list-style-type: none"> - Ensure adequate LA is infiltrated at the start of the procedure in: skin along the post-auricular incision, skin of the posterior external auditory canal, area of the lesser occipital nerve, & in the subperiosteal plane in the anticipated location of the receiver–stimulator package - You can use topical LA with pledgets, or ‘dribble’ topical LA over the mastoid, if the patient experiences pain - In addition, the anaesthetist can administer intravenous analgesia such as fentanyl, as required - Be conscious of the patient experiencing pain when you least expect it, e.g. when drilling through insensate bone due to abnormal patient anatomy. Therefore, regularly monitor the patient for signs of pain, with a designated member of staff, using pre-written cards or hand squeezes for pain to guide you - Be mindful when using suction close to the middle ear in patients with residual hearing, as this may trigger discomfort & head movement
Minimising intra-operative vertigo
<ul style="list-style-type: none"> - Ensure irrigation liquid is close to body temperature or use warm saline to reduce the caloric effect - You can also utilise intravenous anti-emetics intra-operatively, as required - Using dexamethasone & a slow insertion technique can also minimise intra-operative vertigo - Warn the patient when opening the round window that they may feel dizzy - Avoid suction around the round window
Optimising intra-operative communication
<ul style="list-style-type: none"> - Explain all surgical steps to the patient in detail in the pre-operative consultation, so they are aware of what to expect during the procedure; a pre-operative briefing with a nurse from the operating theatre team may also be helpful here - Ensure your draping technique allows the patient’s face to be uncovered at all times – you can create a ‘tent’ over the patient’s face, or, if using a square draping technique, you can replace the fourth towel with a large 12 × 12 cm damp swab - Prepare a collection of pre-written cards in a range of fonts to signpost each stage of the procedure to the patient during surgery, to ask if they feel pain, or need to pause to adjust position, etc. - Use a designated scrub nurse or patient carer to hold the patient’s hand, whilst being face to face throughout the procedure. This will enable immediate feedback via hand squeezes without the patient needing to talk or shake their head. This will also allow the scrub nurse to monitor for any abnormal facial twitching, as a facial monitor is not commonly used for CI surgery under LA - If the patient normally wears glasses & you are using pre-written cards, ensure the cards are readable without glasses; otherwise, adjust the frame of the glasses by removing one arm of the frame & gently taping them onto the patient’s nose, to allow the patient to read the cards whilst on the table during surgery - If the patient is visually impaired, you can invite their carer or relative to be present during the procedure, to enhance communication
Optimising patient position & comfort during surgery
<ul style="list-style-type: none"> - You can use gel pads, knee & leg supports, & a regular pillow instead of a ‘horseshoe’ support cushion, if required, to enhance patient comfort during the procedure - To optimise neck angulation for surgery, you can rotate the bed rather than the patient’s head, to maximise comfort - Minimise the time that the patient needs to lie still on the table by only asking them to lie down when you are completely ready to start, i.e. scrub team’s trays are ready, WHO checklist completed, etc - You can schedule a mini ‘wiggle’ break between steps if required, & use pre-written cards to ask the patient if they need a time-out during the procedure

CI = cochlear implant; LA = local anaesthesia; GA = general anaesthesia; WHO = World Health Organization

Dexmedetomidine, not currently licensed for operating theatre use in the UK, has been shown to achieve co-operative sedation,¹⁸ with better arousable sedation compared to propofol,¹⁹ and associated with better analgesia and post-operative pain scores²⁰ and fewer respiratory adverse events.²¹

Our cohort of surgeons recommended various techniques to control intra-operative pain, including advice on achieving adequate LA at the start of the procedure with a wide range of possible LA agents. Various methods to control pain during surgery were also recommended. Most correlate

with techniques mentioned in the literature, such as the use of pledgets saturated with lidocaine and the use of intravenous analgesia.^{6,7,17} Other recommended techniques include introducing topical LA through the posterior tympanotomy into the middle ear, being mindful of potentially precipitating nystagmus and vertigo. One surgeon noted significant discomfort for a patient when using suction in the middle ear, postulating whether residual hearing played a role in the patient’s experience of cochlear implantation under LA. This has not been previously explored in the literature.

All surgeons extolled the advantages of performing surgery under LA. As well as avoiding the risks associated with GA, other benefits include decreased surgery and anaesthesia time, reduced drug costs and shorter length of hospital stay.⁷

- Cochlear implantation performed under local anaesthesia (LA) is an increasingly accepted technique worldwide
- The literature to date includes only single-surgeon and single-centre experiences
- Cochlear implantation under LA can potentially be offered to all eligible adult patients with favourable anatomy, not just those for whom general anaesthesia is a risk
- Common challenges include: managing patient, surgeon, and staff expectations; optimising communication; patient comfort and position; and minimising pain and vertigo
- There is reluctance to use conscious sedation because of potential unpredictability, but this could be circumvented using dexmedetomidine
- A perceived disadvantage of cochlear implantation under LA is the limited role of trainee input

The main drawback to cochlear implantation performed under LA was the challenge of involving trainees; in contrast, cochlear implantation performed under GA is a useful training case in the presence of healthy temporal bones and normal middle- and inner-ear anatomy.

Conclusion

This is the first time that a national experience of cochlear implantation under LA has been studied, and key aspects to improve surgeon and patient experience have been explored in depth. We hope this work is useful for surgeons newly looking to incorporate cochlear implant surgery under LA in their practice.

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Data availability statement. The data are available from the first author on request.

Competing interests. None declared.

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