Flap Coverage Following Cochlear Implant Explantation or Extrusion: A Systematic Review

Alexa N. Pearce, BA[1], Peter D.A. Eckard, MD[1], Alaina D. Baggett, BS[1], Carissa C. Saadi, BS[1], John L. Dornhoffer, MD, FACS[1], Robert A. Saadi, MD[1]

[1]Department of Otolaryngology - Head and Neck Surgery, University of Arkansas for Medical Sciences. Little Rock, AR

Introduction

- Major skin flap complications (MSFC) following cochlear implantation (CI) can occur as a result of including infection, swelling, surgical site trauma, seroma or hematoma; this subset of complications typically occurs at a rate of 1-2%
- In rare cases, MSFC is significant enough to elicit complete skin breakdown at the cochlear device site, resulting in device extrusion or requiring surgical explantation
- When medical management fails to solve skin flap complications following cochlear implantation (CI), wound coverage can be achieved with revision flaps that provide viable, vascularized tissue.

Objective

This systematic review aimed to assess long-term outcomes and complications of the most prevalent revision CI skin flaps

Methods

- Following the PRISMA* protocol, PubMed, Web of Science, and Embase were queried from database inception to present day (Dec. 2024) for articles describing revision surgery after CI skin flap failure
- Medical Subject Headings and keywords (variations of “wound healing”, “cochlear implantation”, “extrusion”, “explantation”, and “revision surgery”) were used to develop the comprehensive search strategy
- A qualitative synthesis of the patient demographics, co-morbidities, primary CI technique, reasons for flap failure, CI status at the time of revision flap, post-revision CI use, and long-term outcomes was employed to integrate study results; a quantitative synthesis was not possible due to data heterogeneity

Results

- Across the twelve studies included in the review, there were 69 revision CI flaps
- 38 of the flap revisions were performed in conjunction with ipsilateral re-implantation; 23 were performed with the primary CI left in situ
- Only two studies described comorbidities or additional risk factors found in their patient populations

***Preferred Reporting Items for Systematic Reviews and Meta-Analyses**

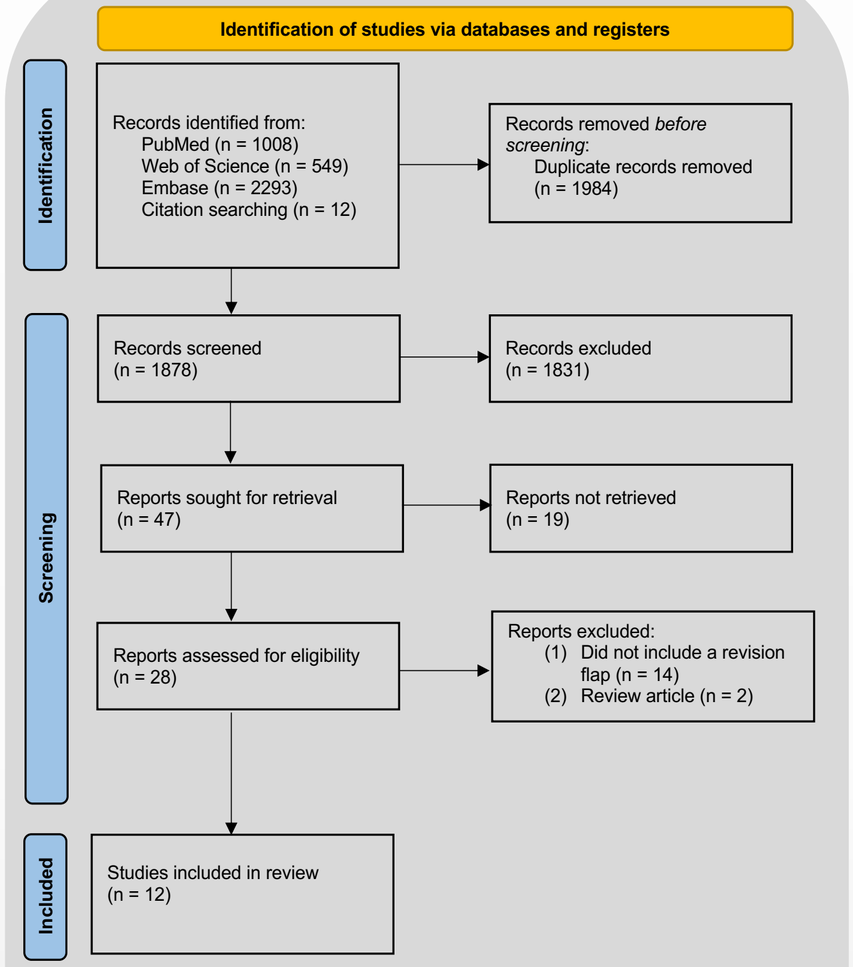

Figure 1: PRISMA* Flowchart

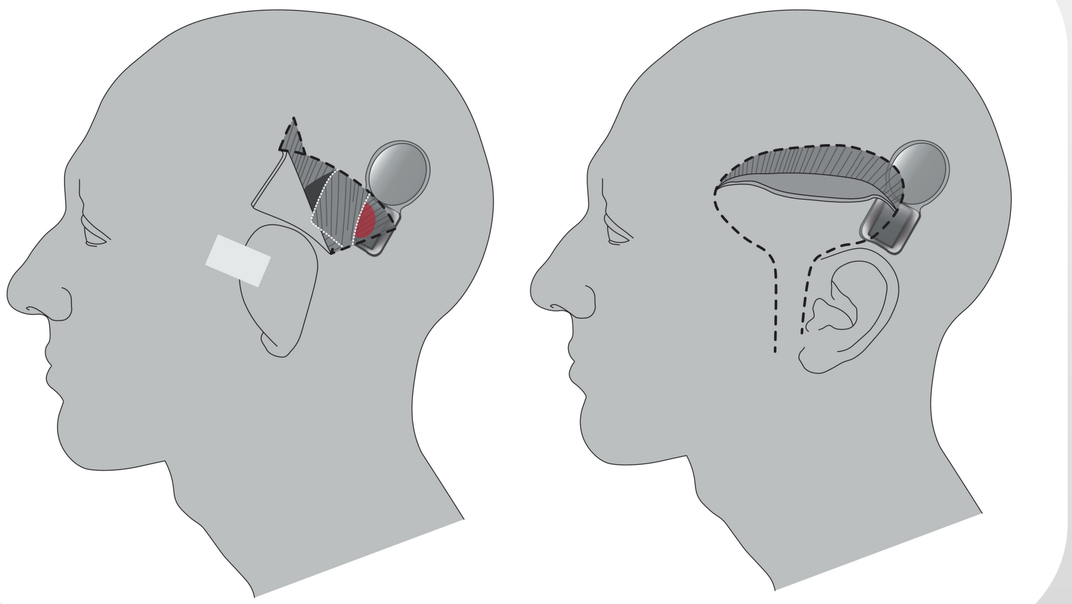

Figure 2 (left): An example of the two-layer method when applied to the temporo-parietal fascia flap; rotation of temporalis muscle for coverage of soft tissue defect (in red)
Figure 3 (right): Second possible skin incision for temporo-parietal fascia flap; this pre-auricular incision can be T- or Y-shaped

Illustrations by Alexa Pearce

Results Continued

- Thirty-four revisions (49%) were performed after wound breakdown or skin necrosis at the implant site, typically due to infection
- Other reasons for revision surgery included electronic failure (n=28, 41%), trauma (n=3, 4%), seroma (n=1, 1%), allergy (n=1, 1%), and keloid scarring (n=1, 1%)
- Among the seven studies that reported primary incision shape for their cohort, five used C-shaped, one used inverted U, and one used lazy S
- Of the eleven articles that described their revision flap technique, eight used a rotational flap; three of these studies also used temporoparietal fascia flaps (TPFF)
- There were nine revision flap failures (13.4%)
- Successful techniques included the rotational flap with either TPFF or free flap supplementation when required for coverage
- Successful versions of the TPFF:
  - **Two-layer method**

    (Figure 2) → Superficial temporal and posterior auricular arteries provide blood supply to muscle and cutaneous layers; entails dissecting subcutaneous tissue layer away from muscle/fascia layer, which allows for easing of tension on incision
  - **Pre-auricular method**

    (Figure 3) → Pliability allows this flap to be draped over irregular surfaces, and it can also accept skin grafts when cutaneous coverage is limited

Conclusion

- Although improved CI techniques have decreased concern for MSFC, the astute otologist must be prepared to treat flap failure swiftly
- The present review has shown that there are several viable options for creating a new skin flap in CI revision, but surgeons should be weary that co-morbidities and prior infection will play a role in the success or failure of the revision flap