The Z-Meatoplasty for Modified Radical Mastoidectomy in Children

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Objective: To determine the effectiveness of the Z-meatoplasty technique for enlargement of the external auditory meatus of children undergoing modified radical mastoidectomy.

Design: Case series.

Setting: Pediatric otolaryngology practice in an academic setting.

Patients: Consecutive sample of children (≤18 years old) who had undergone modified radical mastoidectomy performed by the author from 1995 to 2005.

Intervention: Z-meatoplasty technique used as part of modified radical mastoidectomy.

Main Outcome Measure: Development of postoperative stenosis of the external auditory meatus that required additional surgery.

Results: A total of 28 children and 29 ears were treated with modified radical mastoidectomy during the study period. The Z-meatoplasty was used in 24 ears, and 3 (12.5%) required revision meatoplasty for meatal stenosis. Twenty-one ears (87.5%) treated with Z-meatoplasty had excellent healing and cosmesis without stenosis, during a mean follow-up period of 40 months.

Conclusion: The Z-meatoplasty is an effective technique for use during modified radical mastoidectomy to treat children with cholesteatoma.


Modified radical mastoidectomy remains an effective procedure to remove or exteriorize cholesteatoma. Such “canal-wall down” procedures are usually used in patients who have extensive cholesteatoma or recurrence of cholesteatoma after intact canal-wall tympanomastoid surgery.1 Modified radical mastoidectomy is also used to treat ears with impending complications (lateral semicircular canal fistula or fallopian canal erosion) or anatomic issues that limit the intact canal-wall approach (eg, poor mastoid pneumatization, anteriorly placed lateral dural sinus, or low-lying middle fossa plate). Host factors, such as deafness in the contralateral ear, potential for poor postoperative follow-up, and ongoing eustachian tube dysfunction may favor the canal-wall down approach to treat cholesteatoma.2

Meatoplasty is a key part of the modified radical mastoidectomy procedure. A large external auditory canal meatus allows ventilation of the mastoid cavity as well as access for examination and debridement of the entire cavity. Removal of soft tissue and the cartilage of the external auditory canal and concha will enlarge the meatus, but meatoplasty procedures can be complicated by stenosis, infection, and pinna deformity.

I have used the Z-meatoplasty to enlarge the external auditory meatus of children undergoing modified radical mastoidectomy. This procedure uses an incision that runs in 3 dimensions to reduce the potential for stenosis. Two skin flaps are transposed after removal of cartilage and soft tissue to reduce the raw surface area and amount of exposed cartilage.

The technique is described, my results reported, and the advantages of this procedure are discussed.

METHODS

Medical records of children (age, ≤18 years) who had undergone mastoidectomy performed by the author from 1995 to 2005 were reviewed. Patients who had modified radical mastoidectomy were identified. Demographic information including age at surgery, sex, side of surgery, and duration of follow-up was recorded. The method of meatoplasty was recorded (Z-meatoplasty or other). Indications for surgery, and whether surgery was primary or revision, were also recorded.
Complications of Z-meatoplasty were analyzed, specifically the need for revision meatoplasty.

This study was reviewed by the institutional review board at Johns Hopkins University School of Medicine (Baltimore, Md) and was considered exempt under Department of Health and Human Services category 45CFR 46.404.

**SURGICAL TECHNIQUE**

The meatoplasty is performed after all mastoid dissection and tympanoplasty surgery has been completed. All procedures were performed through a postauricular incision. A skin incision is made along the posterior and inferior margin of concha, continued at the posterior ear canal meatus (Figure 1). A flap of conchal skin is lifted just above the perichondrial layer, based posterosuperiorly (Figure 2). The skin of the posterior cartilaginous ear canal is then dissected off underlying cartilage and soft tissue, and then this canal skin flap is released superi-

![Figure 1](image1.png)  
*Figure 1. The Z-meatoplasty combines a conchal incision with an incision into the superior ear canal. A, Schematic of skin incision that is made along posterior and inferior margin of concha, continued at the posterior ear canal meatus, and down into the superior cartilaginous ear canal. B, Incision planned for right ear.*

![Figure 2](image2.png)  
*Figure 2. Skin elevation and cartilage. A, Conchal skin flap is lifted. B, Exposing cartilage that is subsequently excised.*

Complications of Z-meatoplasty were analyzed, specifically the need for revision meatoplasty.

**RESULTS**

Twenty-eight children and 29 ears underwent modified radical mastoidectomy during the study period. Twenty patients were male, and 8 were female. Surgery was performed on 17 left ears and 12 right ears. The median age of the patients at surgery was 10 years (range, 2.5-16 years).

All modified radical mastoidectomy procedures were performed for cholesteatoma. Eight were primary procedures for cholesteatoma, with extensive disease or anatomic factors dictating the need for canal-wall down surgery. Twenty-one procedures were revision procedures (either second or third operations), and canal-wall down surgery was performed for recurrence or persistence of cholesteatoma. The mean length of follow-up was 40...
months (range, 5-78 months), but 2 patients were lost to follow-up approximately 2 years after surgery.

Twenty-four (83%) of these 29 ears had Z-meatoplasty performed. Five ears had been previously treated with other methods of meatoplasty, all of which had left the conchal anatomy unsuitable for Z-meatoplasty. Three (12.5%) of the 24 ears that were treated with Z-meatoplasty required additional surgery to revise the meatus during the follow-up period. One of these ears had a postoperative perichondritis that resolved with local care and oral antibiotics, and 1 developed a keloid at the meatus. All 3 ears that required revision developed stenosis within 2 months of surgery. Aside from the 1 patient with postoperative infection and the other with hypertrophic scar formation, no other factors were identified to predict failure of the Z-meatoplasty technique.

The appearance of the meatus and pinna after Z-meatoplasty is shown in Figure 7. These ears are easy to examine and debride with the use of simple otologic tools and an operating microscope.

**COMMENT**

Successful control of cholesteatoma and chronic infection with open cavity mastoid procedures requires a well-ventilated, accessible mastoid cavity. Creation of a large meatus is a key component of such surgery. Meatoplasty requires removal of soft tissue and cartilage while avoiding raw tissue surfaces that may lead to granulation tissue and stenosis. Techniques of meatoplasty have included some combination of transposed skin flaps, removal of conchal cartilage, removal of cartilage from the tragus or the floor of the ear canal, and use of conchomastoid su-

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Figure 4. The conchal cartilage has been removed and underlying soft tissue excised.

Figure 5. The conchal skin flap is rotated into the meatus and sutured to raw undersurface of the pinna. The flap of posterior canal skin is rotated 90° and sutured to the edge of the conchal cut.

Figure 6. Completed meatoplasty; the mastoid cavity is filled with antibiotic ointment.
The Z-meatoplasty has been described as a method to enlarge the external auditory meatus by rotating 2 skin flaps after removal of conchal cartilage and soft tissue. This technique reduces the amount of raw surface by primary closure of the rotated flaps. The need for packing is reduced, and conchomastoid sutures are unnecessary because the large meatus is tension-free. Murray et al describe the use of this technique in 32 patients, after canal-wall down mastoidectomy that was performed using an endaural incision. There was no stenosis seen in this series, although 1 patient required revision of a hypertrophic scar.

The success rate for meatoplasty of any method, specifically with regard to restenosis, is not well documented in the literature. The wide variety of techniques described to enlarge the external auditory meatus suggests that restenosis may be more common than the literature suggests. One series of patients who had undergone canal-wall down mastoidectomy in New Guinea, where postoperative follow-up is minimal, reports a 12% to 20% rate of revision meatoplasty. Aggressive postoperative treatment of granulation may reduce the rate of stenosis after meatoplasty.

To my knowledge, the series reported herein is the first series of children treated with Z-meatoplasty and the first series that reports the use of Z-meatoplasty with the postauricular mastoid approach. The 88% success rate and excellent cosmesis are comparable with or perhaps better than other techniques of meatoplasty. This technique should be considered for use in children who require canal-wall down mastoid surgery to control cholesteatoma.

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REFERENCES