# 600.645 HW1: Mastoidectomy Surgical Procedure Evaluation

Doran Walsten, collaborating with Ravindra Gaddipati

09/18/2016

## 1. Procedural Analysis

In this analysis, we review the current state of mastoidectomy procedure. We will identify problem areas with room for improvement.

### A. Evaluation Criterion

Below is a summary of the factors important to consider for this operation.

#### 1. Cost

*Definition* - This factor includes costs to both the patient as well as the hospital during the process of performing a cochlear implant. We must also consider whether the patient or a health insurance company is the payer for the procedure.

*Assessment* - This will simply be measured in dollars ($). This cost will be considered for the payer (patient/insurance) as well as the hospital.

*Relevance* - The cost of a procedure as well as reimbursement is very important to consider. From the patient perspective, greater costs can disincentivize receiving care. From the hospital's perspective, reimbursement differences between different treatment options can affect the decision on which technique to use. Costs of materials used to operate are also important to consider.

#### 2. Complications

*Definition* - Any surgical procedure has the risk of complications which can affect the quality of life of the patient after the procedure.

*Assessment* - Complications will be assessed based on frequency (%) and severity. Major complications require additional surgical operation and/or extremely poor quality of life. Minor complications require conservative treatment.

*Relevance* - Patient quality of life is important to every stakeholder involved. The risk of complications affects the population of patients that can be safely treated.

#### 3. Effectiveness of the Procedure

*Definition* - The role of a mastoidectomy is to either remove infected bone tissue or to clear a path to reach the middle/inner ear to treat conditions there.

*Assessment* - Recurrence rates (for infection) and either operating time or operation success for procedures which are dependent on the cavity generated by the mastoidectomy.

*Relevance* - If the procedure does not lead to the desired outcomes, this becomes a waste to the hospital, surgeon, and patient.

#### 4. Operating time

*Definition* - This is the amount of time that the actual cochlear implantation procedure takes.

*Assessment* - This will be measured in minutes.

*Relevance* - Time is money, even in a hospital. The more efficient a surgeon can be in the operating room, the greater the number of procedures he/she is able to perform. In addition, the less amount of time the patient can be under anesthesia, the better for the patient.

## B. Evaluation

*Steps* - Summary of the steps of the procedure [1,2]

- An incision is made behind the ear. The surgeon generates tissue flaps until the temporal bone is exposed
- A microscope is used as the surgeon begins to drill into the porous mastoid to clear a path to reach the middle ear
- During the drilling, the surgeon is using constant suction irrigation to both simultaneously clear any bone dust generated by the drill as well as keep the bone cool (prevent thermal damage).
- This drilling continues until the middle ear is reached via the facial recess, which is a space bounded by the facial nerve and chorda tympani.
- Once the middle ear is visualized, the surgeon will operate on the middle ear based on the procedure being performed as a whole. As an example, the surgeon would perform a cochleostomy (drill a small hole into the cochlea) if he/she was about to place a cochlear implant.
- Average operating time of 15 - 30 minutes (Trinidade)

*Complications* - The following are the main complications of this procedure as well as their cause and impact.

| Complication | Description | Causes | Rate (if found) |
|---|---|---|---|
| Facial Nerve Paralysis | If the facial nerve is damaged, the patient will lose their ability to control facial movement | Heat generated by drilling, actual drill | 0.6% - 3.6% |
| Damage to middle ear | Damage to bones/structures in middle ear could cause permanent hearing loss | Narrow access channel to middle ear, difficult to manipulate instruments<br>Limited feedback during drilling | |
| Vertigo/Dizziness (Kutz Jr.) | After surgery, the patient fells vertigo and dizziness. Usually short-term minor complication | Common issue with otologic surgery. Can be chronic if drill damages the semicircular canals | Severe issues rare |

It is difficult to assess the cost of just a mastoidectomy as it is often performed as a step within a larger procedure, such as a cochlear implant or cholesteatoma. However, according to HCUP, the average charge to patient is $72,532 with costs of $20,642. Based on some preliminary research, it appears that private insurance/Medicare do cover a significant portion of these costs. Thus, although the cost of these procedures is steep, it is not a significant issue.

The procedure itself is technically challenging and it takes an expert surgeon to perform without complication. As discussed above, the significant risks to the patient include facial nerve palsy and damage to the structure of the middle ear (depending on the operation being performed). The facial nerve lies beneath the layers of bone obliterated during the mastoidectomy. It also acts as a boundary of the facial recess, which is the path that provides access to the middle ear. This nerve is sensitive to both mechanical and thermal damage from the drill. It takes experience for the surgeon to identify the correct point at which to stop advancing given the individual patient's anatomy.

Once the middle ear is reached, operating within the middle ear itself is challenging. The space is extremely small. For example, when operating on toddlers for cochlear implants, the diameter of the facial recess can be between 1 and 2 mm. This is a very small window to operate on sensitive structure. Consequently, the effectiveness of this procedure is highly dependent on the surgeon's ability to operate in this small space.

Currently, the operating time to complete the actual step of mastoidectomy is 15 - 30 minutes. However, operations such as cochlear implants last up to 132 minutes. Although this step may not take a significant amount of time, the design of the cavity can affect the ability of the surgeon to continue the operation.

## References


1. "Mastoidectomy." *Medscape*. Jul 28 2015, http://emedicine.medscape.com/article/1890933-overview#a3
2. Greg Artz. "Cochlear Implant Surgery Thomas Jefferson." Online video clip. Youtube. Youtube, Apr 26 2013. https://www.youtube.com/watch?v=I8eHquhr52s