Journal of Otology 13 (2018) 68–74

Contents lists available at ScienceDirect

Journal of Otology

journal homepage: www.journals.elsevier.com/journal-of-otology/

Does preoperative bacterial culture have bearing on healing of mastoid cavity: A prospective study☆

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ARTICLE INFO

Article history:
Received 10 January 2018
Received in revised form
7 March 2018
Accepted 8 March 2018

Keywords:
CSOM
Healing mastoid cavity
Bacteriology
Culture
Healed cavity

ABSTRACT

Objective: To study the bacteriological profile in a healing mastoid cavity.
Methods: This study was a single centre prospective study. Culture swabs from granulations in the mastoid cavity were sent in 40 consecutive patients with squamosal chronic otitis media undergoing mastoidectomy. Cultures were processed for both aerobic and anaerobic bacteria.
Results: Preoperatively: specimens from 26 out of 40 (60.5%) had growth on culture, with 22 (55%) showing only one organism while 4 showing multiple organisms. The commonest organism isolated was pseudomonas *aeruginosa* (n = 15).
At 1 month after mastoidctomy, 11 patients had sterile culture while 29 had growth, of which 26 had aerobic growth and 3 had anaerobic growth. Pseudomonas was seen in 22 patients and staphylococcus *aureus* in 2 patients. The mean Merchant score was 2.
At 3 months: 29 patients (72.5%) had sterile culture from mastoid cavity while 11 patients (27.5%) had growth on culture. All positive cultures were aerobic, including *pseudomonas* (n = 9) and *proteus* (n = 2). The mean Merchant score was 1.03. Of the 40 patients, 16 (40%) had a different organism cultured postoperatively compared to preoperative swabs.
Conclusion: Pseudomonas and proteus seem to be the most common organisms responsible for persistent otorrhea after mastoidectomy. Persistent sterile otorrhea was seen in 4 patients (10%) in this group at the end of 3 months. Sterile cultures of preoperative swab are more likely to remain sterile in the postoperative period.

1. Introduction

Surgery for chronic suppurative otitis media has always been challenging. New techniques and operative methods have evolved over the years to achieve permanent and satisfactory end results after ear surgery. A chronically discharging open mastoid cavity can be very frustrating for patients and can render patients to be more symptomatic than the primary condition for which surgery was done (Nadol, 1985). A discharging open mastoid cavity continues to discharge because of three main reasons (Guilford, 1960; Al Mayaly et al., 2007), i.e. residual diseases left in the cavity, unfavourable shape and size of the mastoid cavity like high facial ridge, large cavity and narrow meatoplasty, and biological microorganisms inhabiting the mastoid cavity.

Bacteriological examination of a healing mastoid cavity was considered nonessential in the past because it was thought that even if the cavity became infected, it was self-draining and would not impair the healing of the mastoid cavity (Palva and Hallstrom, 1965). With advent of newer generation of antibiotics, considerable importance has been attached to bacteriology of a post-operative mastoid cavity (Yeo et al., 2007). According to Kim et al., bacteriological analysis of post-operative otorrhea is important,

☆ This material has never been published and is not currently under evaluation in any other peer-reviewed publication.
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Peer review under responsibility of PLA General Hospital Department of Otolaryngology Head and Neck Surgery.

https://doi.org/10.1016/j.joto.2018.03.001

and failure to appropriately treat post-operative otorrhea prevents the cure of chronic otitis media (Kim et al., 2017). Persistent infection in the mastoid cavity hampers healing and is the leading cause of persistent otorrhea (Yeo et al., 2007).

This study was undertaken to analyse impact of microbiological profiles in the healing of an open mastoid cavity.

2. Material and methods

This study was a single centre prospective study. We included 40 consecutive cases of active/inactive squamosal chronic otitis media from Jan 2016 to June 2017. The study was approved by the institutional ethics committee. Active squamosal otitis media in our study was defined as presence of cholesteatoma with retraction of pars tensa/flaccida and retained squamous epithelium, debris and purulent discharge, while inactive (squamous) otitis media was retracted pars tensa/flaccida usually in the postero-superior quadrant with retained debris but no active purulent discharge although with the potential of becoming active at a later date.

Patients younger than 10 yrs or older than 60 yrs, immune compromised, with a history of antibiotic usage within 7 days before surgery, or demonstrating complications of chronic mastoiditis were excluded from the study.

All the patients underwent a detailed otolaryngological and microscopic examination, along with pure tone audiometry. A high resolution computed tomography scan was done in all the patients. Plans of surgery were discussed with patients in our otology clinic. Those planned for canal wall down mastoidectomy were included in the study. Informed consent was taken for participation in the study.

All patients underwent surgery under general/local anaesthesia by a single senior surgeon. Preoperative swab for bacterial culture was done in the operation theatre under a microscope following strict asepsis. Canal wall down mastoidectomy with or without ossicular reconstruction was done through a standard post auricular approach. Gel foam soaked with polymyxin B sulphate, neomycin sulphate and hydrocortisone was kept in the mastoid cavity. Postoperative prophylactic systemic antibiotics were not given in any patients.

All patients were followed up on postoperative day 1 and weeks 4, 8 and 12.

Examination on day 1 was focused on wound site hematoma. At weeks 4, 8 and 12, oto-endoscopy was done by independent observers and mastoid cavity condition was assessed using the Adapted Merchant score (Merchant et al., 1997).

Bacteriological swabs from mastoid cavity were sent for culture.

Pure tone audiometry was done at week 12 to asses hearing improvement.

Statistical analysis: all parametric data were subjected to normality test (Kolmogorov Smirnov test) for distribution assessment. Data with normal distribution were compared using paired T test, while skewed data were tested for significance with Mann Whitney U test. All categorical and classified data were tested with chi square test.

2.1. Adapted Merchant score

0	No complaints, no pus or granulation tissue on examination
1	No otorrhea but subjective feeling of wetness of ear
2	Otorrhea and otologic examination showing pus
3	Localized granulation tissue
4	Extensive granulation tissue

3. Results

A total of 40 patients with attico-antral type of chronic otitis media who fulfilled inclusion and exclusion criteria were enrolled in the study, including 22 males and 18 females with a mean age of 23.85 (10–55) years.

Of the 40 patients, 26 (65%) had a positive growth on preoperative aural swab culture, while swab in 14 (35%) was sterile. Culture showed aerobic growth in 22 patients, anaerobic growth in 15 patients and both aerobic and anaerobic growth in 3 patients (Fig. 1). Single bacterial strain infection was seen in 22 patients while multiple organisms were cultured from preoperative aural swab in 4 patients. The commonest organism isolated was pseudomonas *aeruginosa* (15/40, 37.5%) (Table 1). Proteus was present in 4 patients, klebsiella in 2 patients, escherichia *coli* in 2 patients and staphylococcus *aureus* in 2 patients. One patient had growth of Leuconostoc *mesenteroides* (Table 1).

Adapted mean Merchant score of the healing of mastoid cavity during follow up was determined by independent observers using 0 and 30° endoscopes. Mean Merchant score was 1.3 (1–4) at day 8, 2.3 (1–4) at 4 weeks, 1.8 (1–4) at 2 months and 1.04 (0–3) at 3 months. The mastoid cavity was dry in 25 (62.5%) patients at the end of 3 months with a Merchant score of 0, although the cavity had persistent granulations with discharge in 15 patients (37.5%) with a Mean merchant score of 2.1.

Postoperative culture swab on day 8 showed sterile culture in 14 patients (35%) but growth on culture in 26 patients (65%), including aerobic growth in 19 patients and both aerobic and anaerobic growth in 6 patients. When compared with preoperative culture, we found that out of the 14 patients showing sterile culture, 8 remained sterile while 6 developed new infection; whereas among the 26 patients with preoperative bacterial growth, 6 became sterile while 20 continued to have growth. The mean Merchant score for those with sterile culture was 1.5 (0–2) and 1.8 (0–3) for those with positive culture ($P > 0.05$) (Figs. 2 and 3) (Table 2).

Postoperative culture results at 1 month showed growth in 29 patients (72.5%), of whom 26 had aerobic growth and 3 had both aerobic and anaerobic growth. Of the 14 patients with sterile culture on day 8, 8 continued to show sterile culture while 6 developed infection. Among the 26 patients who had growth on day 8, 3 became sterile while 23 continued to have growth on culture. The mean Merchant score for patients with sterile culture was 1.4 (0–3) and 2.1(0–4) for those with positive culture (Fig. 4).

Postoperative culture results at 2 month showed that 17 patients had sterile culture from the mastoid cavity while 23 patients had positive growth on culture, of whom 22 had aerobic growth while 1 had both aerobic and anaerobic growth. Out of the 11 patients with sterile culture at 1 month, 10 continued to show sterile culture while 1 developed new growth. Out of the 29 patients showing bacterial growth at 1 month, 7 became sterile while 22 continued to show growth. The mean adapted Merchant score at 2 months was 1.2 (0–2) for those with sterile culture and 2 (1–4) for those with positive culture ($P < 0.05$)

Postoperative culture from mastoid cavity at 3 months showed sterile culture in 29 patients and bacterial growth in 11 patients (all aerobic), including pseudomonas ($n = 9$) and proteus ($n = 2$). All 17 patients with sterile culture at 2 months continued to show sterile culture while culture in 12 of the 23 patients who showed growth at 2 months became sterile with the remaining 11 continued to show growth. Mean Merchant score for those with sterile culture was 1.2 (0–4) and 2.1 (1–4) for ears with positive culture ($P < 0.05$).

At 3 months, 25 patients had dry cavity (i.e. adapted Merchant score = 0). The mean Merchant score was 2.1 (1–4) in the