



(CASE REPORT)



Ventilation tube (grommet) insertion in adult patients with stage III tympanic membrane atelectasis: A case report

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Abstract

Background: Effusion Otitis Media (OME) is a condition where there is an accumulation of fluid in the middle ear without signs of acute infection which can cause hearing loss and complications such as atelectasis. Even though it occurs more often in children, it does not rule out the possibility that OME can occur in adults, although it is less common, OME in adults can cause complaints such as decreased hearing, discomfort or a feeling of fullness in the ears. Management of OME includes conservative treatment with antibiotics, decongestants or topical corticosteroids as well as medic procedures such as installing grommet tubes as well as identifying underlying causative factors such as sinus infections or eustachian outflow disorders.

Objective: To report a case of ventilation tube (grommet) insertion in adult patients with stage III tympanic membrane atelectasis

Case Report: A 27 year old woman came with complaints of bilateral hearing loss, complaints accompanied by a feeling of fullness in the ears and tinnitus, especially in the left ear. From the results of the otoscopic examination, it was found that the tympanic membrane was retracted and tympanometry showed type B on both ears. Surgical procedure was then carried out for the installation of a ventilation pipe (grommet).

Clinical question: How is the management of and adult patients with stage III tympanic membrane atelectasis with ventilation tube (grommet) insertion?

Methods: Evidence-based literature study of ventilation tube (grommet) insertion in adult patients with stage III tympanic membrane atelectasis.

Result: Grommet tube placement improved hearing in the left ear, with audiometry showing a reduction in hearing threshold from 42 dB to 37 dB.

Conclusion: Installation of ventilation tubes (grommets) in adult patients with stage III tympanic membrane atelectasis has proven effective in reducing symptoms such as decreased hearing and a feeling of fullness in the ear and can prevent long-term complications. Grommet tube placement is an effective management option for adult patients with stage III tympanic membrane atelectasis who do not respond to conservative therapy.

Keywords: Effusion Otitis Media; Middle Ear Atelectasis; Tube Grommets; Hearing Loss; Tympanometry

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1. Introduction

OME is a condition where fluid builds up in the middle ear without signs of acute infection. OME itself can heal itself in two to four weeks.^(1,4) However, in some cases OME can last for months or even years. Chronic effusion in the ear often results in hearing loss. OME often attacks children aged 1 to 3 years, followed by school-going children aged 4 to 6 years. As many as 90% of children aged 10 years have experienced at least one episode of OME. Although rare, effusion otitis media can also affect adults. Cases of otitis media with effusion in adults usually occur after the patient experiences a severe upper respiratory tract infection such as sinusitis, severe allergic reactions, drastic changes in air pressure after flying or diving, or other etiologies that can cause eustachian tube dysfunction. Based on the WHO report regarding the epidemiology of otitis media, the prevalence of otitis media with effusion in Indonesia reaches 3.8%. Clinically, Effusion Otitis Media is characterized by a decrease in the function of the tympanic membrane and middle ear due to accumulation of fluid in the middle ear. This accumulation of fluid in the middle ear can be serous or mucoid and causes conductive hearing loss, ringing in the ears, a sensation of fullness in the ears, and can sometimes cause pain due to changes in pressure..^(1,4,5)

The diagnosis of OME is made through anamnesis, physical examination and supports such as audiometry and tympanometry. Main complaints include hearing loss, a feeling of fullness in the ear, and pain due to pressure differences. Otolaryngology examination shows a dull, retracted tympanic membrane, and reduced mobility. Audiometry revealed conductive hearing loss, while tympanometry showed a type B pattern. Management of OME begins with observation for three months. Medical treatment such as antibiotics, decongestants, and antihistamines are not recommended. For persistent cases or with persistent hearing loss, insertion of a tympanostomy tube is recommended. This helps ventilate the middle ear, improves hearing, and reduces chronic inflammation of the middle ear mucosa.^(2,3,4,6)

2. Case report

A 27-year-old female patient (initials NWY) presented On December 11 2023 came to the ENT polyclinic at Prof Ngoerah Hospital Denpasar with complaints of decreased hearing in both ears accompanied by a feeling of fullness in the ears, especially the left ear. Complaints have been felt since about 10 months ago. Complaints are felt continuously and have gotten worse in the last 4 months. Complaints accompanied by ringing in the left ear intermittently and feeling fullness when the patient has a cold. The patient complains of sneezing accompanied by a runny nose with clear watery discharge and the patient feels there is phlegm in the throat. Complaints arise almost every day, especially when patients are at work. There were no complaints of fever, pain in the ears and no history of discharge from the ears and no history of trauma to the ears, no changes in nasal discharge and no complaints of pain or fullness in the face. The patient had previously visited a general practitioner and ENT specialist and was given medication but the complaints did not decrease. The patient works daily as a fresh flower arranger, works in a closed room with air conditioning and does not wear a mask when working. On physical examination, the general status was found to be in good general condition, compos mentis consciousness. Based on ENT examination, it is found in the left ear: there is no abnormality in the earlobe, there is no tragus tenderness, there is no pulling pain in the earlobe, there is no abnormality in the retroauricle, the ear canal is roomy, there is no discharge, the tympanic membrane is intact with the impression of retraction, colored yellowness and light reflexes are difficult to evaluate.

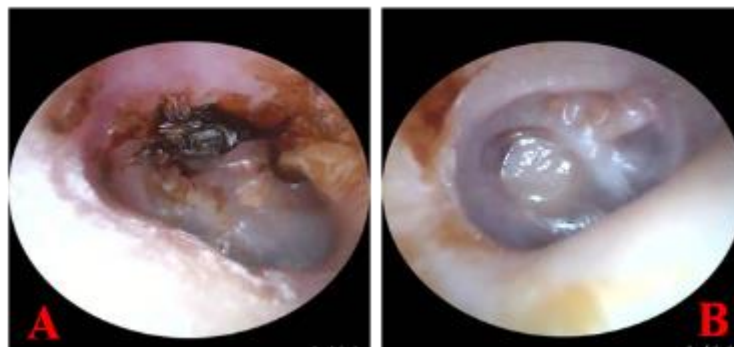


Figure 1 (A) Tympanic membrane of left ear; (B) Tympanic membrane of the right ear

In the right ear, there were no abnormalities in the earlobe, no abnormalities in the retroauricle, no secretions in the ear canal, the tympanic membrane was intact, it looked dull and the light reflex was difficult to evaluate. On examination of the right nose, it was found that the nasal cavity appeared narrow, the mucosa was pale, the concha was congested

with serous secretions, and the septum had no deviation. On examination of the left nose, it was found that the nasal cavity appeared narrow, the mucosa was pale, the concha was congested with serous secretions, the septum was not deviated and in the deep throat the T2/T2 crypt tonsils were found to appear widened. There were no enlarged lymph nodes found in the neck. On examination of the 512 Hertz frequency tuner, there was an impression of conductive deafness in the left ear. Then an audiometric and tympanometry examination was carried out, showing mild conductive deafness in the right ear and moderate conductive deafness in the left ear, accompanied by type B tympanometry results in both ears.

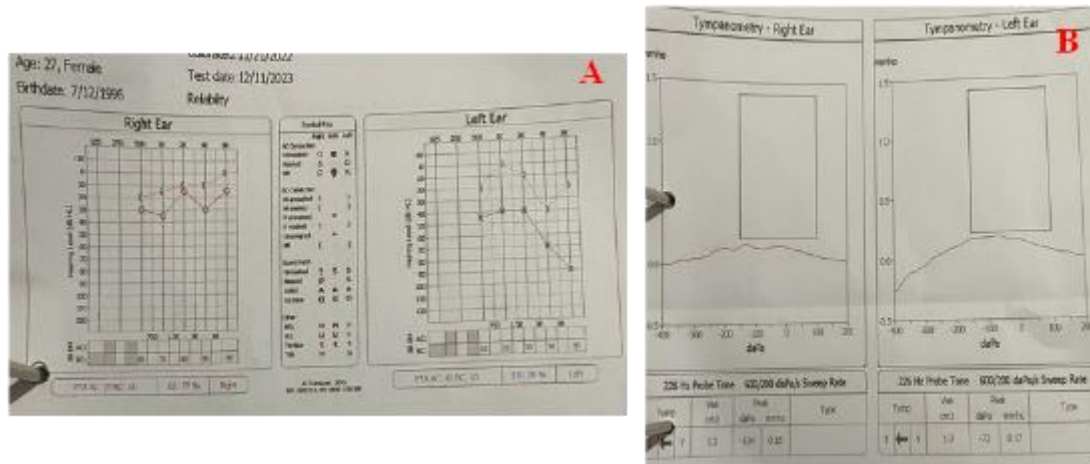


Figure 2 (A) Audiometry results before surgery; (B) Tympanometry results before surgery

The diagnosis is then made based on anamnesia, physical and supporting examination. Later, this patient was diagnosed with Dextra et Sinistra Effusion Otitis Media. Then the patient was planned to undergo surgery to install a left grommet pipe under general anesthesia on January 30 2024. In pre-operative preparation the patient underwent a routine blood test with the results of the examination being Hemoglobin 11.50 g/dL, Leukocytes $6.54 \times 10^3/\mu\text{L}$, Hematocrit 37.50%, Platelets $307 \times 10^3/\mu\text{L}$, PPT 10.5 seconds, APTT 27.1 seconds. A chest X-ray examination was carried out on December 11 2024 with the results: the core and pulmo showed no abnormalities. On examination of balance and facial nerve function, no abnormalities were found. On audiometric examination, the right ear was found to have a mild degree of conductive deafness with a hearing threshold of 27 dB, while the left ear was found to have a moderate degree of conductive deafness with a hearing threshold of 42 dB. Then on January 30, 2024, the patient underwent surgery with a physical status of ASA I. During the operation, the ear canal was cleaned, then the tympanic membrane was incised in the antero-inferior area using a myringotome, then the secretions that came out were sucked out, then a grommet tube was placed at the tympanic membrane incision site and then inserted into the hole. The operation time is 45 minutes.

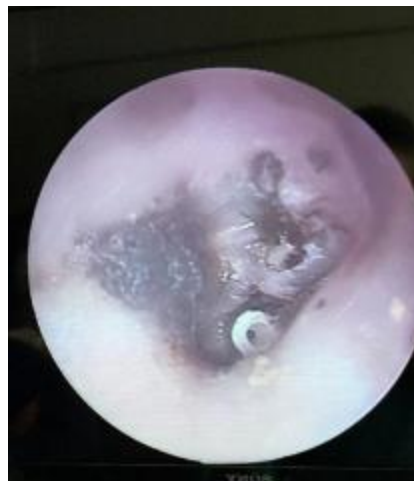


Figure 3 Left tympanic membrane after surgery

The post-operative diagnosis was stage III tympanic membrane atelectasis after grommet tube installation. The therapy given after surgery was cefixime 200 mg two times daily, methylprednisolone 8 mg two times daily and pseudoephedrine three times daily, all were given intra oral. One day after surgery, the patient's general condition was good and the patient may go home while continuing the intra oral therapy given.

On February 7 2024 the patient came back for post-operative control. The patient said that his hearing had improved, he felt that he felt less full of feeling in his ears than before, but occasionally his nose felt blocked and he had difficulty expelling phlegm. We added therapy for nasal complaints with intranasal corticosteroids and nasal irrigation with nasal saline, also education on wearing mask during working for suspicion of allergic to the pollen. Then on February 22 2024, the patient returned for control with complaints of hearing that were getting better, complaints of feeling full in the ears were reduced, complaints of feeling stuffy in the nose were also felt to be reduced. Then an audiometric evaluation examination was carried out with the result that the left ear had a moderate degree of deafness of 37 dB.

2.1. Clinical question

How is the management of and adult patients with stage III tympanic membrane atelectasis with ventilation tube (grommet) insertion?

3. Review method

A literature search was carried out using the keywords "Otitis Media Effusion" AND "Management" AND "Grommet Tube" through 4 search engines, namely PubMed, Google Scholar, Clinical Key and Cochrane. The selection of literature was based on inclusion criteria, namely 1) Effusion Otitis Media. 2) Tube Grommets. The exclusion criteria were not appropriate to the design of this study. A critical review was conducted on 13 pieces of literature before establishing inclusion and exclusion criteria.

4. Result

The literature search obtained the relevant scientific publications released in the last 10 years by providing comprehensive data to understand OME in general, more in-depth OME in adult patients and OME management approaches in children and adult patients.

Ilmyasri, Siti A (2020) stated that the risk factors for acute otitis media are young age, orofacial abnormalities, exposure to cigarette smoke and family history of OMA. In addition, acute rhinitis is also believed to increase the risk of acute otitis media due to bacterial invasion from the nasal cavity to the eustachian tube which can develop into OME.

Olusola A, S., Emmanuel A (2022) reported that 3.2% indicated that OME is not uncommon in adult patients where the risk factors in adult patients diagnosed with OME generally occur along with suspected allergies due to other inflammation in the upper respiratory tract. The focused management for these patients with OME is to manage comorbidities through conservative medical approaches first before performing a surgery.

Mackeith S, Mulvaney CA, et al. (2023) documented that the grommets procedure in patients with OME had improved hearing quality compared to patients who only received medical management, which in this study stated that grommets can reduce the incidence of perforation when compared to patients with non-surgical treatment.

5. Discussion

OME is an inflammatory condition of the middle ear which is characterized by the accumulation of fluid in the tympanic cavity but does not show any signs of acute infection. OME can occur at various ages but is more common in children. Globally, OME occurs in children aged 1 to 6 years with a higher prevalence in children aged 2 years. In adult patients, OME is often associated with risk factors such as upper respiratory tract infections, allergies, eustachian tube dysfunction or exposure to air pollution. Atelectasis can cause decreased ventilation capacity and affect airflow, potentially worsening symptoms of OME such as hearing loss and a feeling of fullness in the ear.⁽¹⁾ A study conducted by Olusola and Emmanuel in 2022 found that 3.2% of ear diseases were affected by OME with the number of young adult patients (age range 18-30 years) being 33.7% of cases with the average age affected by this disease being 37 years old and 55.4% of them are men. Generally, comorbidities in patients with OME are allergies (38.6%), infective rhinosinusitis (24.1%) and upper respiratory tract infections (14.5%).⁽⁵⁾ In research conducted by Siwi, Daniel, et al. stated that in Indonesia, the prevalence of OME in school children varies between urban and rural areas. In this study it was found that 2.5% of children suffered from OME, the prevalence of which was higher in rural areas (2.7%) compared

to urban areas (0.7%). In this study it is also said that OME contributes to 57% of all hearing loss in school children in Indonesia where the overall rate of hearing loss in children is 181 per 10,000 with the rate being higher in rural areas (273 per 100,000) than in cities (92.6 per 10,000).⁽⁷⁾ Otitis media that occurs in the pediatric population is associated with many factors, including adenoid hypertrophy, upper respiratory tract infections, palatoschisis, and exposure to cigarette smoke. OME in adults is less common but still causes considerable morbidity. OME in adult patients is influenced by several factors including upper respiratory tract infections, eustachian tube dysfunction which interferes with ear drainage, allergies which cause inflammation of the ear and environmental factors such as exposure to cigarette smoke and air pollution which increase the patient's susceptibility to OME.^(1,8) Chronic OME was defined as OME that persisted for 3 months or more on examination or tympanometry. Most OME patients do not experience tympanic membrane retraction and only a few chronic OME develop into atelectasis. If atelectasis occurs, the tympanic membrane will retract into the promontory and auditory ossicles in the middle ear, obliteration of part or all of the middle ear cavity, and the mucosa lining the middle ear is still intact. Middle ear atelectasis can be reversible with the placement of a ventilation tube (grommet tube).

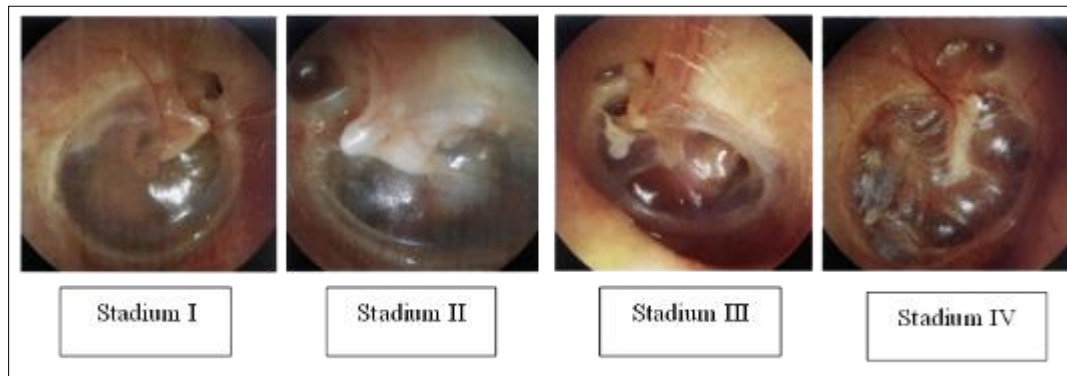


Figure 4 Classification of Atelectasis

The pathophysiology of OME is multifactorial, including viral or bacterial infections, impaired Eustachian tube function, immunological status, allergies, environmental and social factors. There are several theories that state the cause of otitis media with effusion, the first of which is Eustachian tube dysfunction. The eustachian tube has three functions, namely regulatory function, protective function, and secretion. Conditions that can cause disruption of tubal function are classified into two, namely functional and mechanical factors. Mechanical factors are caused by pressure from enlarged adenoids or neoplasms, inflammatory processes caused by infection, allergies or trauma. Impaired tubal function causes the aeration mechanism to the middle ear cavity to be disrupted, drainage from the middle ear cavity to the nasopharyngeal cavity is disrupted and the protection mechanism for the middle ear cavity against reflux from the nasopharyngeal cavity is disrupted. As a result of this disturbance, the middle ear cavity will experience negative pressure. Negative pressure in the middle ear causes increased capillary permeability and subsequent transudation. In addition, there is infiltration of the inflammatory cell population and glandular secretions. Due to the accumulation of secretions in the middle ear cavity. Chronic inflammation in the middle ear will cause the formation of granulation tissue, fibrosis, and bone destruction.^(1,4,9)

Another theory that causes OME is anatomical disorders of the face and throat such as Down syndrome or cleft lip which affect the structure of the middle face and larynx. In children with cleft lip, there is an abnormality in the insertion of the tensor veli palatini muscle in the soft palate, which interferes with the opening of the eustachian tube when swallowing or opening the mouth.⁽¹⁰⁾ The third theory that can cause OME is the sequelae of acute otitis media (OMA), where as many as 45% of children with AOM can experience OME within 1 month, and 10% last up to 3 months. This is thought to be due to pepsin in the middle ear effusion which stimulates mucin genes, increasing mucin secretion which supports the growth of upper respiratory tract bacteria. Bacterial infections also play a role in the development of OME because pepsin found in middle ear effusions increases mucin secretion, cytokines, and the presence of positive bacteria.^(11,12) Another theory that causes OME is gastroesophageal reflux, where the pepsin in middle ear effusion comes from reflux.⁽⁹⁾

Tympanometry examination, which is an additional supporting examination, is one of the examinations to determine the condition of the middle ear, where this examination can determine the presence of fluid in the middle ear, stiffness of the auditory bones and negative ear pressure. In previous studies, it was stated that tympanometry can be used to confirm the diagnosis of OME, where if the results show type B results, it is concluded that the movement of the tympanic membrane is limited due to the presence of fluid or adhesions in the tympanic cavity. Other supporting examinations

such as audiometry can also be an option for examining patients suspected of having OME, especially over a period of 3 months or more with complaints of significant hearing loss. In previous studies, it was found that >80% of cases with conduction type hearing loss (CHL) in OME were due to the presence of fluid in the tympanic cavity. However, in several other studies it was also found that around 15% of cases had SNHL and 3% had MHL. Where research conducted by Dewi B., and research conducted by Ilmyasri stated that biochemical alterations affect the cochlea around the round window, resulting in the emergence of SNHL in sufferers with OME.^(1,4)

Treatment of patients with OME includes medical treatment and surgery. The effectiveness of medical treatments such as decongestants, antihistamines, corticosteroids, and antibiotics is still debated, with many studies showing results that do not support their use. Decongestants and antihistamines, for example, have not been proven to be effective based on the results of various clinical trials and meta-analyses. A study states that decongestants are not recommended because they do not provide significant benefits and can cause side effects such as rhinitis medicamentosa. However, desloratadine has shown positive results in children with OME who have a history of allergies, helping to speed up the resolution of effusions and reducing the need for ventilation tube placement. The American Academy of Otolaryngology-Head and Neck Surgery does not recommend oral or intranasal corticosteroids. This is similar to Berkman et al's administration of oral steroids for 2 months with the results of no benefit as OME therapy. The same thing was also said by Sharon et al. Short-term use of oral steroids accelerates the resolution of OME but is not beneficial in the long term and does not improve hearing function. The use of antibiotics in OME cases is also still controversial. Although studies show the presence of bacteria and biofilm in middle ear effusion fluid, which supports the use of amoxicillin as a first-line antibiotic, its routine use is not recommended due to the risk of bacterial resistance. Some studies even report that the effectiveness of antibiotics is only slightly higher than placebo.^(2,4,13)

In addition to medical management, operative management for OME includes myringotomy and installation of a ventilation tube (grommet). Research conducted by Dogan S, states that the act of installing a tympanostomy tube can reduce OME and can improve hearing compared to observation with medication or myringotomy.⁽²⁾ MacKeith S, et al. his study found that a quarter of cases required a myringotomy with ventilation tube placement within 2 years. For cases of unilateral OME with normal hearing in the contralateral ear, a ventilation tube is recommended after 6 months. In addition, it is also necessary to pay attention to complications in OME such as hearing loss, tympanosclerosis, tympanic membrane atrophy and middle ear atelectasis, ossicular necrosis, retraction pockets. Berkman et al said that complications of tympanosclerosis and otorrhea occurred more often in the ears of patients who had tympanostomy tubes installed. Most OME patients do not experience tympanic membrane retraction and only a few chronic OME develop into atelectasis. If atelectasis occurs, the tympanic membrane will retract into the promontory and ossicles in the middle ear, obliteration of part or all of the middle ear cavity, and the mucosa lining the middle ear is still intact. Middle ear atelectasis can be reversible with the placement of a ventilation tube (grommet tube).^(3,6)

6. Conclusion

OME is a condition where there is an accumulation of fluid in the middle ear without any signs of acute infection which can cause hearing problems and serious complications such as atelectasis. OME can be confirmed through history taking, physical examination, and supports such as audiometry and tympanometry. Management of OME consists of administering medication and operative measures. The medications that can be given include decongestants, antihistamines, corticosteroids and antibiotics, the effectiveness of which is still being debated due to the lack of studies showing the benefits of this treatment. On the other hand, operative measures such as installing ventilation tubes (grommets) have been proven to be highly effective in improving hearing function, reducing effusion, and preventing further complications, especially in persistent or chronic cases. Complications that must be anticipated include hearing loss, tympanosclerosis, tympanic membrane atrophy, middle ear atelectasis, and ossicular necrosis. However, ventilation tube placement can overcome most of these complications and improve the patient's clinical condition, making it the primary choice in the management of OME that is unresponsive to conservative therapy.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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