

Middle Ear Effusion in Children: Review of Recent Literature

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التهاب الأذن الوسطى الإنصباي لدى الأطفال

يعتبر التهاب الأذن الوسطى الإنصباي أكثر أمراض الأذن إنتشارا بين الأطفال صغار السن. وتصل أعلى نسبة لحدوث المرض عند سن الثانية من العمر. تتأثر نسبة الحدوث تبعا لجغرافية الموضع والجنس العرقي والمحيط والمستوى الاجتماعي والاقتصادي. يتمثل المرض في جمع مائي شبه معقم في الأذن الوسطى. يحدث المرض نتيجة خلل وظيفي في قناة أستاكيوس أو في وظيفة الغشاء المخاطي الشعري للأذن الوسطى أو كليهما معا.

وتتمثل أعراض وعلامات المرض في آلام الأذن المتكررة وضعف السمع التوصيلي البسيط الى المتوسط الحدة. ويلاحظ تدهور مستوى التحصيل العلمي للطالب. يعتمد التشخيص عادة على تاريخ المرض والكشف الأكلينيكي والفحوص التشخيصية. وهناك نوعان من العلاج غير الجراحي والجراحي. الفحص الأكلينيكي المبكر للمرض والتوعية الصحية هما أفضل وسيلة للاكتشاف المبكر.

Middle Ear Effusion (O.M.E.) is the commonest ear problem among children, with a peak at the age of 2 years. Incidence varies according to geographical location and race variation, environmental and socio-economic factors. The disease is characterized by accumulation of semi-sterile secretion in the middle ear. It is usually due to either a dysfunction of Eustachian tube or of the mucociliary system or both. The most common presenting symptoms are mild to moderate conductive hearing loss, attacks of earache, and deterioration in school. The diagnosis is based on history, clinical findings and hearing assessments. In general, treatment is classified as conservative and surgical. Early screening and health education are the recent concepts advocated for early detection.

Key Words: Glue Ear, Secretory otitis media.

INTRODUCTION

Middle ear effusion (O.M.E.) is the commonest ear problem among young children. It is characterized by accumulation of semisterile serous or mucoid secretion in the middle ear cleft. It results from either an alteration of the eustachian tube function or the mucociliary system or both. The disease is also known as secretory otitis media, middle ear effusion, middle ear catarrh, non suppurative otitis media and glue ear¹. The disease, which produces a conductive hearing loss, presents as an educational or behavioral problem. It may also present as speech and language delay. Treatment varies widely and is naturally dependent on the

duration and severity of the condition. It is accepted that mild forms of the disease resolve spontaneously. The remaining cases will be treated either conservatively or surgically. Medical treatment is the commonest form of treatment used, although no satisfactory studies support its use. Surgical treatment in the form of myringotomy, adenoidectomy and ventilation tubes insertion are the commonest surgical procedures performed during childhood².

NATURE OF THE DISEASE (EPIDEMIOLOGY)

Middle Ear Effusion is one of the commonest otological diseases of childhood with

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a peak at the age of 2 years³. Two thirds of children have had at least one episode of O.M.E. by the age of 3 years. One third of them will have the attack without notice, therefore it is called "silent" otitis media⁴. Incidence varies according to geographical and race variation. In general an incidence of 8-50% is acceptable. The incidence decreases with increasing age i.e. from 40% at two years to 1.4% at 11 years⁵. There appears, to be racial differences in incidence of O.M.E. - in America, black children are more affected than whites. In Kuwait, nationals are more affected than non-Kuwaiti children and males more than females^{3-5,7,8}.

These differences may be due to genetic and anatomical variations in the skull base and eustachian tube⁵. Environmental factors such as pollution and recurrent upper respiratory tract infections are usually associated with high incidence. Seasonal relationships are confirmed with a peak in winter^{3,5}.

Socio-economic factors that cause crowding, poor hygiene, poor education, inadequate nutrition, poor medical services and poor accommodation seem to increase the incidence and severity of the disease^{5,10}. The increase in the incidence of the disease in the last two decades is indeed not real. It seems to be due to improvement in health services, otological services, screening programs, awareness by parents and teachers and improvement in technical facilities⁵.

AETIOLOGY

The major underlying causes responsible for the formation of O.M.E. are either a dysfunction of eustachian tube or a dysfunction of mucociliary system or both. Multiple factors can contribute to this dysfunction. These are either congenital, mechanical or inflammatory in nature^{3,5,10-18,20}.

Other factors supporting the appearance or the prolongation of the disease are called "Risk factors". These include among others; recurrent upper respiratory tract infection, smoking,

mastoid pneumatization, insufficiency of velopharyngeal muscle, nutrition and immunity status of the patient^{10,11,21,23-27}.

PHYSIOLOGY AND PATHOPHYSIOLOGY OF O.M.E.

The eustachian tube has three physiologic functions with respect to the middle ear. These are protection of middle ear from nasopharyngeal secretion and pressure; clearance of middle ear contents and ventilation of middle ear. It opens involuntarily during swallowing and yawning and voluntarily with different manoeuvres. The result of any tubal dysfunction is a decrease in intratympanic pressure^{3,5}.

The formation of O.M.E. could be explained by two hypotheses :

1. The "Ex vacou" mechanism postulates that the created negative pressure causes retraction of tympanic membrane, sub epithelial edema, vasodilation, secretion (serous, mucous), stimulates proliferation of mucous glands and goblet cells and cell proliferation^{3,5,10,27,28}.
2. The "Neuro-mechanical" hypothesis which assumes the presence of pressure receptors in the middle ear mucosa. Once there is negative pressure in the middle ear, they are stimulated and their message is conveyed via afferent reflexes to a central mechanism. The response in the form of secretion, stimulation of mucous glands etc. is conveyed through an efferent reflex. Once the negative pressure in the middle ear subsides, the process is completely stopped²⁹.

SYMPTOMATOLOGY

The most frequent presenting symptom is mild to moderate conductive hearing loss. Attacks of episodes of pain in the ear often co-incide with an upper respiratory infection. Elderly children and adults are usually aware if their hearing is impaired.

Often children with O.M.E. increase the sound of radio and T.V. to compensate their hearing, disturbing the others. They may become lazy, dreamy, nervous. Their speech, language and cognitive functions may be affected. They may show deterioration in their school, because they cannot follow the teacher^{3,5,30-32,38}.

DIAGNOSIS AND SCREENING

There is not a single mechanism or procedure by which a diagnosis of O.M.E. could be made with accuracy. History, clinical, radiological, audiometric and tympanometric assessment are the most relevant and reliable means used in most centers to reach a diagnosis.

HISTORY

About 25-30% of children with O.M.E. have no significant medical history and the disease could be identified only through regular screening. The remaining approximately 70%, have more or less vague symptoms such as episodes of earache and conductive hearing loss detected by parents, they rarely show abnormal behavior or scholastic deterioration detected by teacher and educator^{3,5,28}.

PHYSICAL EXAMINATION

This is usually done using either headlight with ear speculum, otoscopes, Ziegler otoscope or Ear microscope. The following changes could be noted at the tympanic membrane²⁸:

- a. An opaque amber or yellow color of the drum head, the cone of the light is missing, increased vascularity of the drum head.
- b. Chalky appearing malleus handle.
- c. Retraction of the tympanic membrane, shortening of malleus handle, retraction pocket at pars flaccida, (attic retraction), atrophic transparent tympanic membrane.
- d. Fluid level with air bubbles over it.
- e. Blue tympanic membrane specially in mucous otitis media^{3,5,10}.

HEARING SCREENING

Tuning fork test: (TFT) has no application due to the young age, and if used, it is unreliable⁵.

Tympanometry: is the most reliable objective test used in children with OME at any age not only for diagnosis but also for screening purposes and monitoring the progress of treatment. The obtained tympanogram (the pressure-compliance-curve) is classified according to Jerger in three types A, B, and C. Whereby type A is normal and type B and C are abnormal. The commonest type obtained is type C^{3-5,8 28,30,33-35}.

PURE TONE AUDIOGRAM

It is of limited diagnostic value for identification of O.M.E, as it is applicable after the age of 4 years, needs a predesigned sound proofing area, is time consuming and not objective. It does, however, provide some assessment of the severity of the disease, hence it can be used to monitor progress and effect of treatment. The mean hearing loss for mild O.M.E., is 23 dB, for moderate 29 dB and for severe 34dB. In over 80% of ear tests the mean hearing threshold averaged 23dB. There is no relationship between hearing level and type of tympanogram^{3-5,28,36}.

MANAGEMENT

It is accepted that there is not a single exclusive treatment modality available for O.M.E., but instead numerous forms of treatment. It depends always on the causative agent, the duration of the disease, the severity of the hearing loss and the degrees of the affect of the hearing loss on the child. Hence the modality of treatment should be individualized. We know that the majority of cases resolve spontaneously without treatment, yet they need observation and follow up^{3,5,8}. On the other hand cases with long duration (chronic) or recurrent episodes and severe hearing loss affecting the language and speech of a child, need immediate surgical treatment. In general, treatment could be classified into conservative and surgical^{3,5,28}.

CONSERVATIVE TREATMENT

Controversies are still governing the effectiveness of medical treatment in O.M.E. But an attempt at conservative therapy should always be made before surgical intervention. Cases of O.M.E. after an U.R.I. or associated with viral or bacterial URI, infected adenoids, tonsils or sinuses respond very well to medical treatment in the form of antibiotics, local or systemic decongestants, or antiallergic medications^{3,5,28}.

Long term antibiotics are claimed to be of benefit in longstanding mucoid O.M.E. Antihistamines and decongestants either alone or in combination are still among the most popular medication for the treatment of recent O.M.E. The rationale is to reduce congestion of the eustachian tube, as well as induce regional shrinkage of mucosa in the nose and sinuses^{3,5,37-39}.

In case of mucoid O.M.E. mucolytics are of great benefit to facilitate clearance of secretion through the Eustachian tube^{3,5,20,28,40}.

The use of different types of antiallergic treatment including steroids are indicated when definite allergy is demonstrated^{3,5,26-28}. The introduction of palatal exercise in the form of "Chewing gum" and "Balloon Blowing" in the absence of URI is of great benefit to facilitate eustachian tube opening and accordingly speed middle ear aeration and clearance of secretion^{3,5,28}.

SURGICAL TREATMENT

Generally surgical treatment is indicated where conservative treatment failed to work, in long standing disease (chronic), in cases of recurrent attacks of OME or when the affect of hearing loss on the child is severe. Different forms of surgical treatment are available. These include myringotomy, adenoidectomy, insertion of ventilation tube, or a combination of the three^{3,5,28}. Myringotomy alone has been proven to be of minimal therapeutic benefit as the incision area will close very soon postoperatively^{3,5,41,42}. On the other hand its

diagnostic value is still in practise. Although the therapeutic effect of adenoidectomy in OME is not well established, it is widely practised. Its beneficial effect is attributed to the infectious and obstructive role of adenoids in OME. Hence in persistent cases, in recurrent attacks or in chronic cases of OME, adenoidectomy alone or in combination with ventilation tube insertion or myringotomy showed impressive results on middle ear condition and on hearing improvement of the child. While it is not a major procedure, adenoidectomy is nevertheless more complicated than insertion of ventilation tubes. Hence the decision to operate demands careful consideration on the part of physician^{28,43-46}. Ventilation tube insertion is the most effective surgical treatment for OME. Its major indication is chronicity and failure of conservative treatment. Its main function is ventilation of middle ear and consequently cessation of secretion in the middle ear^{3,5,28,42,43,47,48}. But ventilation tubes are not without complication. It is usually associated with serious complications and therefore it should not be used without due consideration. There are different types and sizes of ventilation tubes depending on the age of the patient, condition of the middle ear and habit of the surgeon^{3,5,28}.

The procedure is usually done under general anesthesia in the anterior superior or inferior quadrant of the tympanic membrane. If inserted correctly, they will usually stay in place for about 6–12 months before being expelled spontaneously^{3,5,28}. Antibiotics are usually not required. If there is evidence of adenoid hypertrophy or focal infections, adenoidectomy is considered to be as the most effective. A certain proportion of patients may however require reinsertion of the tube, in this case a special long term tube is needed such as a T-tube^{28,44,45,48}. Other surgical procedures such as repair of cleft palate, antral wash out in case of infected sinuses, or cortical mastoidectomy in stubborn cases, should be considered to reach a smooth recovery^{3,5,24,28,49}. In stubborn cases when all treatment

modalities have failed, a suitable hearing aid is the remaining treatment of choice to equip the patient with reasonable hearing^{5,28}.

COMPLICATIONS OF VENTILATION

TUBE

Insertion of ventilation tubes in OME is not without problems. Therefore, it should not be introduced unless it is absolutely indicated. Because of these complications it is advisable in the case of bilateral O.M.E. to ventilate only one side. The commonest complications known are post operative infection, permanent perforation, atrophic membrane and middle ear cholesteatoma^{3,5,28,42,43,50,50-53}.

SEQUEALAE OF OME

Chronic OME may lead to various developmental and behavioral sequelae. Delays in speech and language development, learning disabilities, reading disorders and educational difficulties as well as behavioral problems. Longstanding effusion and recurrent infection will develop atrophic membrane, ossicular erosion, tympanosclerosis with ossicle fixation, cholesterol granuloma, cholesteatoma and sensorineural hearing loss^{3,5,30-32}.

SCREENING

Screening for hearing loss in children at infancy, kindergarten and school level is a relatively recent concept and widely practised. Indeed, such routine screening is considered as an indication of progress and commitment to public health. The problem in small children has been to devise methods of obtaining reliable and respectable results and to minimize subjective errors. Screening for hearing in infancy is best done in well baby clinics and Mother & child health care centers using the Ewing-Stykar Test^{5,4}. At school and kindergarten tympanometry and audiometry have been proven to be very effective although they carry a relatively high incidence of false positive results. However, since a large proportion of children at one time or another suffer OME episodes, which in most cases are mild and transient, the

question arises of how important it is to detect them all.

Thus screening for hearing loss in OME or other otitis media may result in "over diagnosis" with unnecessary referrals and possible overtreatment²⁸. One way to avoid this or to reduce it, is to educate parents, and teachers and make them aware of signs and symptoms of the disease. This so called "Health Education" will not replace screening, but it will make it more effective^{28,54,55}.

CONCLUSION

In conclusion, Middle Ear Effusion is a very common childhood disease, affecting the child's hearing at the most critical age (2 years), the child's speech and language development and its education. Hence the problem has to be treated with special consideration. Early detection through screening programs and health education followed by immediate proper treatment are the best known effective measures to fight this disease.

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