

## Otitis Media and Indigenous Australians

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*Otitis Media (OM) is a significant factor in the health of the indigenous population of Australia, and has the potential to affect the acquisition of language and literacy. Rates of OM in Indigenous Australians far exceed those in the non-Indigenous population, and the first episode of OM occurs early in life (Couzos, Metcalf & Murray, 2001). This paper reviews the literature regarding OM worldwide, and in the Indigenous Australian population, focusing on rates of occurrence and long-term outcomes for affected individuals. An extensive epidemiological investigation of OM in the Indigenous population of Western Australia is described.*

Children's development may be affected by a number of factors. One of these factors, frequently discussed in the literature, is otitis media (OM). OM is the most common disease of childhood (Casselbrant & Mandel, 1999; Kindig & Richards, 2000; Lindsay, Tomazic & Whitman, 1999; Miccio, Gallagher, Grossman, Yont & Vernon-Feagans, 2001) and is known to have occurred as early as 1900–800 BC (Bluestone & Klein, 2001). Evidence of middle ear disease has been found in skeletal remains from this time. Before the introduction of drugs capable of treating the infection, complications such as mastoiditis were common, and this is still the case for children whose access to medical care is limited (Bluestone & Klein, 2001).

Four major types of OM have been identified. These are:

- Acute OM without perforation: fluid in the middle ear, with signs or symptoms of suppurative infection. This is typically associated with a bulging tympanic membrane and positive pressure.
- Acute OM with perforation: this acute suppurative infection is associated with recent (within 7 days) discharge from the middle ear. If untreated, acute OM may progress to chronic suppurative OM (Couzos et al., 2001).
- OM with effusion (OME): the presence of middle ear fluid without overt signs or symptoms of infection. This is associated with a retracted or neutral position of the tympanic membrane and negative pressure. Chronic OME refers to persistent inflammation of the middle ear, with no perforation of the tympanic membrane.
- Chronic suppurative OM (CSOM): perforation of the tympanic membrane and continuing discharge from the middle ear. Coates et al. (2002) reported that CSOM is "very uncommon in first world countries and is best regarded as a disease of poverty" (p 177). An ongoing escalation of problems occurs in CSOM, and mastoiditis and permanent damage to hearing are a likely result.

(Adapted from Coates et al., 2002, Couzos et al., 2001, and Pichichero, 2000).

### Diagnosing OM

Although signs and symptoms (such as redness of the ears, irritability and pulling the ears) are often suggested as evidence of OM (The Come Hear Centre, n.d.), the condition is frequently asymptomatic (Pichichero, 2000). Diagnosis of OM is achieved through examination of the tympanic membrane using otoscopy (Couzos et al., 2001) and may be confirmed using pneumatic otoscopy or tympanometry. Diagnosis of acute OM is determined by the presence of a bulging tympanic membrane and signs of acute illness (e.g., fever, ear pain, lethargy or vomiting) (Pichichero, 2000). OME is characterised by a retracted or neutral position of the tympanic membrane (due to the presence of fluid in the middle ear) and the

absence of signs of infection (Pichichero, 2000). The presence of discharge from the ear for a period of at least 3 weeks results in a diagnosis of CSOM (Couzos et al., 2001).

### **Factors affecting estimates of incidence**

Differences in definition of the disease (acute OM or OME), methods of identifying cases, intervals between observations, timing of observations and population characteristics all affect the reported incidence of otitis media (Casselbrant & Mandel, 1999).

### **International estimates of prevalence**

OM is primarily a disease of childhood. In the US it is reported to be the second most common health problem (after the common cold) in preschool children (ASHA, n.d.; Bluestone & Klein, 2001; Paden, 1994), and it has been claimed that "OM in early childhood is almost universal" (Vernon-Feagans, 1999, p. 357).

Estimates of the exact prevalence of the condition vary, due, no doubt, to the factors identified previously. Casselbrant and Mandel (1999) reported figures from studies of acute OM in a number of countries (Finland, Denmark, the US and Sweden) According to these studies, between 19% and 62% of children had one incident of acute OM by the time they reached their first birthday. The incidence climbed to 50–84% of children by 3 years of age, and then decreased with age until, at around 7 years, few children were subject to acute OM. Paden (1994) reported a study by Klein (1980) which suggested that between 75% and 95% of children were affected by OM. Epidemiological data from a national survey carried out in the US indicate that, in 1990, some 24.5 million diagnoses of OM were made. Examination of long-term records shows that the incidence of diagnoses of OM has been increasing steadily since 1975 (Bluestone & Klein, 2001).

Occurrence of OM has been estimated to peak in the 6–18 month age range (Paden, 1994) or between 1 and 2 years of age (Vernon-Feagans, 1999), and repeated incidents of the infection are common. Persisting middle ear difficulties are reported to be more common in children who experience their first incident prior to 6 or 12 months of age (Bluestone & Klein, 2001; Casselbrant & Mandel, 1999; Couzos et al., 2001).

Estimates of the incidence of CSOM are not readily available. This severe form of OM is uncommon in first world countries. Coates et al. (2002, p. 177) reported the World Health Organization (WHO) contention that "a prevalence rate of CSOM greater than 4% in a defined population of children is indicative of a massive public health problem requiring urgent attention."

### **Risk and protective factors**

Epidemiological studies have considered risk and protective factors associated with OM in the general population. Risk factors increase the likelihood of the condition, while protective factors reduce the likelihood.

Risk factors associated with OM may be endogenous (child-related) or exogenous (related to the environment, often factors which serve to increase the exposure to disease agents). The risk factors which have been studied are briefly outlined below.

#### *Endogenous factors*

- Age: OM occurs more frequently in younger children (Bluestone & Klein, 2001; Casselbrant & Mandel, 1999; Vernon-Feagans, 1999).

- Certain anatomical features: OM has been found to be common in children with cranio-facial abnormalities (including cleft palate) and in children with Down syndrome (Casselbrant & Mandel, 1999; Vernon-Feagans, 1999).
- Ethnic group: members of some ethnic groups (for example, Native Americans, Australian Aborigines) have been reported to be at increased risk of OM (Vernon-Feagans, 1999). It is suggested that this may be associated with anatomical differences in the structure (length, width and angle) of the eustachian tube (Bluestone & Klein, 2001).
- Gender: conflicting evidence exists for the relationship between gender and OM. According to Bluestone and Klein (2001), OM is more common in males. However, both Casselbrant and Mandel (1999) and Vernon-Feagans (1999) indicated that there is no clear difference between boys and girls in the incidence of OM.
- Prematurity: an increased risk of OM has been found in some studies of premature babies, but these findings are contradicted by findings of other studies (Casselbrant & Mandel, 1999).
- Allergy: there is some evidence to suggest that children who have allergy problems, or who have compromised immune systems, are at high risk for development of OM. A fourfold increased risk was found in one study, but in another study allergic manifestations did not increase the risk (Casselbrant & Mandel, 1999).

### *Exogenous factors*

- Crowded conditions, including crowded living conditions, day care attendance and large families. One study found that children in day care faced a four times greater risk of OM than children cared for at home (Vernon-Feagans, 1999). Greater risk was associated with larger numbers of children in the day care centre. Placement in day care is also likely to reduce the incidence of breast feeding, thus reducing the protective factors it provides (Bluestone & Klein, 2001).
- Smoke exposure. Increased risk of OM due to exposure to tobacco smoke has been reported in many studies, but still other studies have not found a link (Casselbrant & Mandel, 1999).
- Season. Risk of episodes of OM is increased in winter (Casselbrant & Mandel, 1999; Vernon-Feagans, 1999).
- Siblings. Some studies have reported a higher risk of OM in children with older siblings, while others have shown no association (Casselbrant & Mandel, 1999).
- Socioeconomic factors. Many studies have identified an association between low socioeconomic conditions and the likelihood of children experiencing OM (Vernon-Feagans, 1999). It has been suggested that this association is likely to be due to crowded living conditions, poor sanitation, poor nutrition, a lower incidence of breast feeding, and decreased access to medical care (Bluestone & Klein, 2001; Casselbrant & Mandel, 1999; Vernon-Feagans, 1999).
- Use of dummies (pacifiers). An increased incidence of OM has been associated with the use of dummies but not with thumb sucking (Casselbrant & Mandel, 1999).

Clearly, there may be interactions between these risk factors. For example, crowded living conditions, low socioeconomic status and exposure to passive smoking may all be associated. Interactions of this type may serve to multiply the risk for OM in individual children or population groups.

Protective factors are associated with a decreased risk of OM. The inverse of many of the risk factors constitute protective factors. For example, spending the early years of life in the home rather than in day care will decrease the likelihood of OM, as will less crowded conditions in the home, or first-born status. One factor which is reported to provide protection against middle ear disease is breast feeding. A reduction in recurrence of acute OM has been reported for children who were breast fed for prolonged periods of time. There is, however, some question about the duration of breast feeding needed to reduce the incidence (Casselbrant & Mandel, 1999).

### **Prevalence in the Indigenous Australian population**

In 2001, the Office for Aboriginal and Torres Strait Islander Health published a significant work, "Systematic review of existing evidence and primary care guidelines on the management of otitis media (middle ear infection) in Aboriginal and Torres Strait Islander populations" (Couzos et al., 2001). This review "aimed to address the primary health care prevention, diagnosis and management of otitis media in Aboriginal populations" (ibid., p. 16). The authors gathered several types of information, including primary research, integrative summaries which considered narrow clinical questions, narrative summaries written by experts and guidelines for the treatment of OM developed by national and international health services.

Only the major findings of the review are considered here. For detailed information, and information regarding specific studies, the reader is referred to the original document.

The review showed:

- The rate of occurrence of OM in the Australian Indigenous population far exceeds that in the non-Indigenous population.
- Middle ear disease in Indigenous Australians is associated with high rates of permanent hearing loss and damage to the tympanic membrane. For example, in one Western Australian study which surveyed approximately 90% of school-aged Aboriginal children in one location, 41% had an average hearing loss of more than 25dB in at least one ear. Most of these children also had perforations of the tympanic membrane.
- CSOM is common. Coates et al. (2002) reported that the rate of CSOM is up to ten times the 4% considered by the WHO as a serious health problem. A 1984 study (cited by Couzos et al., 2001) carried out in the Kimberley area of Western Australia showed that, of the 2,092 Aboriginal children surveyed, 57.5% had either active ear disease, or evidence of damage to the tympanic membrane.
- OME and conductive hearing loss occur early in the life of Aboriginal children. One study reported that 95% of 6–8 week old Aboriginal babies had OME. In comparison, only 30% of non-Aboriginal children were affected.
- Ear infections persist in Aboriginal children for longer than is the case in non-Aboriginal children. One study showed that Aboriginal infants were three times more likely than non-Aboriginal children to develop OME, and four times more likely to develop acute OM. In addition, the likelihood of their returning to normal ear health was 22 times less than was the case for non-Aboriginal children.
- In the Indigenous Australian population, OM and its effects continue into adulthood. A Northern Territory study of 438 Aboriginal adults above the age of 20 showed that only 17% had two unscarred, intact ear drums. Only 30% of the sample had at least one normal ear drum.

### **Risk factors in the Indigenous Australian population**

Couzos et al. (2001) considered the evidence pertaining to risk factors for OM in the Aboriginal population. They concluded that there are four risk factors which affect the Indigenous population. These are:

- Early bacterial colonisation. Aboriginal children have been shown to have bacterial colonisation of the nasopharynx early in life, and this is correlated with the early onset of OM, which longitudinal studies have shown is a risk factor for recurrent middle ear infections.
- OM is often asymptomatic in Aboriginal children, a factor which is seen to contribute to the increased incidence of tympanic perforation.
- Overcrowded housing conditions and poor living conditions (including poor nutrition) constitute a major risk factor for early OM in Aboriginal infants. These overcrowded conditions bring children into close contact with family members who may have acute OM.

- The high rate of smoking in the Aboriginal population may contribute to the incidence of OM among Aboriginal children.

The review found no clear evidence to suggest that viral infections or allergic rhinitis are a risk factor for OM in Aboriginal children. Bottle feeding rather than breast feeding was recognised a possible contributory factor, but there was no direct evidence from studies which considered this factor in the Aboriginal population.

### **The Aboriginal child health survey**

Since April 2000, the Channel 7 Institute for Child Health Research (Western Australia), in partnership with the Australian Bureau of Statistics, has been involved in a population-based survey of Aboriginal child health. Over 130 staff (60% of whom are Aboriginal) have been trained to carry out screening and interviews. By December 2001, they had randomly sampled 2,288 Aboriginal families with children under 18 years, from 761 census districts across Western Australia. Just over 88% of families contacted agreed to participate in the survey, and information was gathered on 5,298 children. Interviews of 1,070 young people aged 12–17, and 3,157 carers were also carried out. Analysis of the data and a clinical and cultural validation study are under way. The question of ear health forms a part of the study. The results of the survey will first be communicated, in a culturally appropriate way, to the Aboriginal communities involved in the project. The findings will be published by the Institute for Child Health Research in the course of 2003, and will include a monograph containing a newly developed epidemiological framework which may be used in determining the burden and impact of childhood disorders.

A second study, *Qualitative and quantitative studies of otitis media to improve ear health*, being carried under the auspices of the Institute for Child Health Research, aims to investigate the factors which put some children at risk of OM. This study is located in the Kalgoorlie-Boulder area, and follows both Aboriginal and non-Aboriginal children from birth to 24 months of age. Preliminary results show that 53% of Aboriginal infants and 24% of non-Aboriginal infants have OM and a concomitant hearing loss by the age of 4 months (Coates, personal communication, 30/4/03). In terms of risk factors, the study to date indicates that Aboriginal parents have a limited understanding of middle ear disease, and that maternal smoking is associated with early OM. The study has also determined that exclusive breast feeding is of limited duration, a significant finding in light of research which indicates that breast feeding is a protective factor for OM.

### **Issues**

Epidemiological studies of OM provide us with some information about the incidence of the disease. However, a number of factors affect the value of this information. Some of these factors (differences in definition of the disease, methods of identifying cases, intervals between observations, timing of observations and population characteristics) were outlined above. Other factors which need to be considered include the age at onset of middle ear disease, the frequency of episodes and the degree of associated hearing loss.

The medical condition OM brings with it varying degrees of conductive hearing loss, and it is the possible effects of this hearing loss which are of particular interest to the speech pathologist. The extensive literature which addresses these effects is, however, equivocal.

Some studies have suggested that the occurrence of OM, peaking as it does in the critical language learning years, has the potential to adversely affect the development of speech and language (ASHA, n.d.; Klausen, Moller, Holmefjord, Reisæ ter & Asbjørnsen, 2000; Shriberg, Friel-Patti, Flipsen & Brown, 2000), attention (Feagans, 1994), academic outcomes (Webster, Bamford, Thyer & Ayles, 1989), phonological representations and working memory (Mody, Schwartz, Gravel & Ruben, 1999), and development of phonology and morphology (Petinou, Schwartz, Gravel & Raphael, 2001). Other studies

show no relationship between OM and language ability (Grievink, Peters, van Bon & Schilder, 1993), or behaviour (Paradise et al., 1999). One study showed no increased risk for speech disorder in a mainstream group with a history of OME, but an increased risk for a minority group (Native American children) with a similar history (Shriberg, Flipsen et al., 2000).

This lack of agreement in the research literature may be attributed to various methodological differences between the studies. These include differences in subject recruitment, procedures for documenting OME and the attendant hearing loss, differences in the measures of speech and language investigated, the age of the child when language measures were taken, and the confounding factors of other variables (such as socioeconomic status) (Paradise et al., 2000; Roberts & Schuele, 1990).

The poor literacy outcomes of Indigenous Australian children are well documented (Department of Employment, Education and Training, 1994; Education Department of Western Australia, 1997; Rose, Grey & Cowey, 1999). There is no clear evidence that the incidence of OM is the cause of these problems with literacy. Indeed, it seems most likely that their cause lies, not in one factor, but in a complex interaction of factors. It would, however, be premature to discount the possibility that the incidence of OM, the long term nature of the disease in this population, and the extent of the accompanying hearing loss may constitute one of those factors.

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