

Safety in Mines Research Advisory Committee

Project Summary :

Project Title:	Evaluation of immittance testing for the identification of middle ear pathology in South African mineworkers. (67 pages)		
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Middle ear pathology constitutes a significant public health problem in many countries, with middle ear diseases and their sequelae imposing substantial economic and social costs. It should be recognized that mineworkers can be subjected to the risk of middle ear disease with one important contributing factor the sudden changes in atmospheric pressure (WCC 2001) that they are subjected to.

A review of recent audiological research has indicated that identification programmes that incorporate history-taking, otoscopy, pure-tone screening and acoustic immittance tests provide the best means of identifying individuals in need of audiological and/or otological intervention for middle ear pathology (ASLHA 1993). Pure-tone screening audiometry is a component of current medical surveillance procedures for NIHL.

The Mine Health and Safety Act (1996) requires the employer to establish and maintain a system of medical surveillance for all employees exposed to known health hazards, in order to identify and respond to the risk of occupational diseases and injuries. The identification of individual workers in need of audiological or otological intervention has traditionally relied on pure-tone testing and otoscopic examinations. If the purpose of screening is also to identify persons with middle-ear pathology, acoustic immittance screening (tympanometry and acoustic reflex testing) should be considered, along with otoscopic examinations and medical histories for otological abnormalities, in accordance with recommendations by ASLHA (1993).

The present study evaluated immittance measures for the identification of middle ear pathology among South African mineworkers. The outcomes of medical history reviews, otoscopy, tympanometry, acoustic reflex testing and pure-tone screening audiometry were considered for 181 gold mine workers. Tympanometry is not a test of hearing but of middle ear function, as it measures middle ear impedance to acoustic energy and thus provides quantitative information on the mobility of the tympanic membrane and middle ear structures. In contrast, acoustic reflex measures provide an indirect indication of middle-ear status.

Acoustic reflexes were found to be too sensitive for use in this population. Otoscopy identified workers with active or previous middle ear problems in 10.5%-11.6% of cases while tympanometry identified 27.1 per cent of workers. The workers all had normal hearing and would not have been identified by normal audiometric screening procedures.

Otosopic examinations identified retracted tympanic membranes as the most common type of middle ear pathology, followed by scarred, inflamed and dull tympanic membranes, all of which corresponded with tympanometry findings. Otoscopy requires considerable experience and interpretational skill which may account for its lack of sensitivity in comparison with immittance measures.

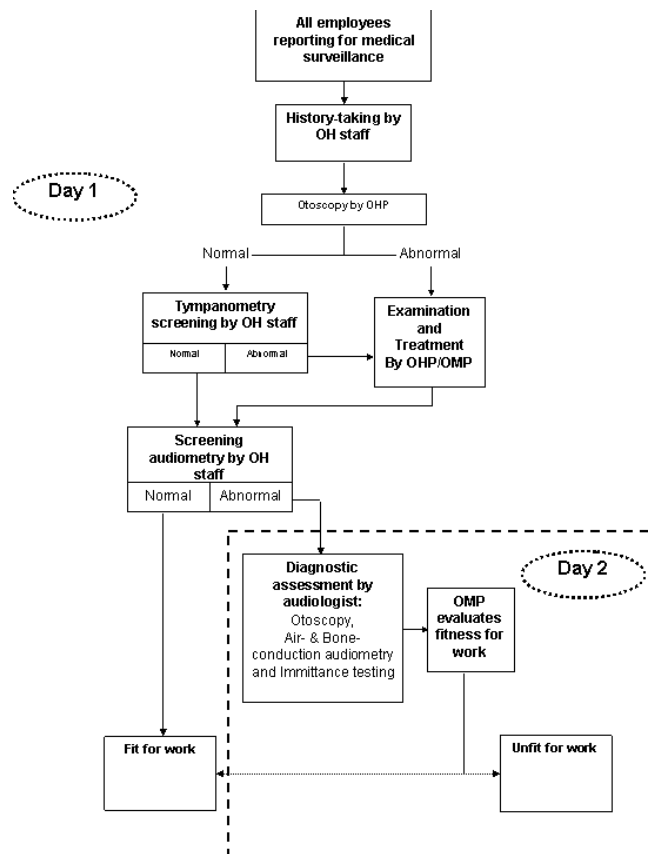
In addition to a possible need to improve their otological skills, mine Occupational Health personnel were found to be insufficiently familiar with middle ear barotrauma, which may have negative impact on the appropriateness of decisions regarding referral and further assessment of susceptible individuals.

Despite the fact that middle ear pathology dramatically increases the risk of barotrauma during vertical conveyance, mineworkers were generally unaware of the need to report middle ear problems and, hence, often continued with their underground work despite the presence of such conditions.

The risks to underground workers posed by middle ear pathology and the greater sensitivity of immittance measures, particularly tympanometry, in identifying it, indicate that employers and employees would benefit from the incorporation of this procedure

into medical surveillance programmes. Benefits would include earlier identification of such conditions and individuals susceptible to them, thereby reducing treatment and recovery periods and limiting the consequential occurrence of barotrauma during vertical conveyance. Instrumentation costs and training requirements for technicians are both minimal, and the proposed additional measures should not entail any need for additional staff members as the time required for testing is minimal.

A proposal for the incorporation of tympanometry into mines' medical surveillance programmes is offered in the figure below:



Conclusions and recommendations:

The clinical evaluation of immittance methods indicated:

- ? tympanometry offers potential benefits for employers' medical surveillance by identifying middle ear abnormalities that might otherwise go undetected
- ? Acoustic reflex measurements were too sensitive for use
- ? Tympanometry was an easy, short, objective and cost effective procedure

The implementation of tympanometry testing is recommended to:

- ? Enhance the effectiveness of screening protocols
- ? Enable earlier identification of middle ear conditions
- ? Limit recovery periods and cost of specialist referrals

? Introduce an objective screening procedure