

## BACTERIAL MENINGITIS AND HEARING IMPAIRMENT: A PROSPECTIVE STUDY

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تهدف هذه الدراسة إلى تباين معدل وقوع الصمم ونمطه في أعقاب التهاب السحايا. أجريت دراسة استطلاعية على ٦٨ مصاب بالتهاب السحايا. جرى تقييم السمع لدى المرضى بعد المرض الحاد مباشرة ثم بصفة دورية على مدى سنتين. بلغت نسبة وقوع الصمم الأولي الحسي العصبي والتوصيلي ٢٦,٤% و ٢٠,٦% على التوالي. عانى مريضان من صمم مختلط. لم نعثر على نمط مطرد لتخفيف السمع في حالات الصمم الحسي العصبي. أظهر تقييم السمع المتعاقب تعاقباً تاماً في جميع حالات الصمم التوصيلي وتحسناً ضئيلاً فقط في النغمات المنخفضة لدى واحد من المصابين بصمم حسي عصبي. لم تحدث حالات ظهور متأخر للصمم الحسي العصبي.

The purpose of this study is to demonstrate the incidence and the pattern of post-meningitis hearing impairment. A prospective study of 68 meningitis patients was performed. The patients' hearing was evaluated immediately following acute illness and periodically checked for two years. The incidences of the initial sensorineural and conductive deafness were 26.4% and 20.6%, respectively. Two patients (3%) suffered from mixed deafness. No consistent audiometric pattern was found in the cases of sensorineural hearing loss. Serial hearing evaluations demonstrated complete recovery of all cases of conductive hearing loss with only a slight improvement in the low tones noted in one patient with sensorineural hearing loss. No late development of sensorineural loss has occurred.

Meningitis is a leading cause of acquired sensorineural hearing loss in infancy and childhood [1]. Several studies of school-age children have shown that bacterial meningitis is the cause of 8% to 24% of all cases of severe deafness [2].

The exact Incidence of sensorineural hearing impairment as a sequels of meningitis has not been established. The published studies indicate that approximately 5% to 30% of patients with meningitis develop significant hearing impairment [3].

This report concerns the assessment of hearing in a relatively long-term prospective study of the survivors of acute meningitis.

### Material and Methods

Sixty-eight infants and children between two months and ten years of age treated for meningitis at Sulaimania Children's Hospital and King Khalid University Hospital, Riyadh, were entered into the study. At the time of admission, complete histories of all patients were obtained and physical examinations performed. Clinical and laboratory studies were carried out during the acute illness. The patients were treated with ampicillin, chloramphenicol or cefuroxime according to the causative organism and/or the results of the cerebrospinal fluid culture and sensitivity.

At, or prior to hospital discharge, the patients were subjected to otologic and audiological evaluations. The protocol called for repeating the procedure every three months for a period of two years. The hearing evaluation was performed by pure tone audiometry or brain stem auditory evoked potential (BAEP) depending on the age of the patient. In addition, impedance tympanometry

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was performed on all the patients to assess middle ear function. Consents from the parents were obtained after explaining the purpose and procedures of the study.

### Results

The number of acute meningitis patients entered into the study was 68; 44 (64.7%) were males and 24 (35.3%) were females. The age distribution of the patients is shown in Table 1. *Haemophilus influenzae* accounted for 40 cases (64%), *Streptococcus pneumoniae* for 12 (17.7%), *Neisseria meningitidis* nine cases (13.2%), and *Beta haemolytic streptococcus* for one case (1.5%). In six patients (8.8%), no organism was identified; however, these patients all had symptoms and signs of meningitis and cerebrospinal fluid pleocytosis with a predominance of polymorphonuclear leukocytes. The histories of children obtained on admission showed that none had a hearing problem prior to the acute illness. On hospital discharge, 16 patients (23.2%) were judged clinically to have middle ear effusion and the diagnosis was confirmed by impedance tympanometry measurement. The results of hearing assessment prior to hospital discharge of all patients are shown in Table 2. All the cases of con-

ductive and mixed hearing impairment were bilateral. On the other hand, sensorineural hearing loss was bilateral in 24 patients (70%) including the two patients with mixed deafness; while being unilateral in six patients (30%). No consistent audiometric pattern was observed among the cases of sensorineural impairment.

Within three to six months, follow-up serial hearing evaluations showed recovery of all the cases with **conductive** hearing loss which was due to resolution of the middle ear effusion. Of the sensorineural hearing loss cases, only one showed some improvement in the evaluation performed three months following initial assessment. Improvement was 15 to 25 db occurring bilaterally in the low tones (500–2,000 Hz). No cases of delayed hearing impairment occurred in the series. All patients with hearing impairment were followed up for a minimum of two years, and only six patients of the normal hearing children have not completed the designated period.

### Discussion

The number of patients in this study is limited. Nevertheless, this shows that sensorineural hearing loss occurred in 29.4% among 68 survivors of acute septic meningitis. Other reports indicated that this incidence varied from 5% to 35% [2]. Dodge et al. believed that this wide range in the reported incidence of deafness complicating meningitis in various series is probably explained, in part, by the selection of patients, especially age distribution and percentage of cases caused by particular organisms [3]. Nadoj stated that the higher figure may be closer to the actual incidence **because of** the difficulties in detecting hearing loss, even severe in nature, in retrospective studies especially during the acute illness; and also because partial and temporary hearing loss may go undetected even during careful follow-up [2].

Post-meningitis sensorineural hearing loss may be unilateral or bilateral and may be partial or complete. In this study, the sensorineural hearing loss was unilateral in 30% of the cases. Other investigators found 20% to 60% of the sensorineural hearing loss to be unilateral [2–5]. On the other hand, the incidence of partial hearing loss in this series was 95% of the total number suffering sensorineural impairment. This is com-

TABLE 1. The age distribution of the patients.

Age	No. of patients	Percentage
<— 2 months	4	5.9
2— 12 "	31	45.6
13— 24 "	11	16.2
25— 48 "	12	17.6
49— 72 "	3	4.4
73—120 "	7	10.3
Total	68	100.0

TABLE 2. Results of the hearing assessment of post-meningitis patients prior to the hospital discharge.

Hearing Assessment	No. of patients	Percentage
Normal hearing	34	50.0
Conductive hearing loss	14	20.6
Partial S.N.H.L.	17	25.0
Mixed hearing loss	2	3.0
Complete hearing loss	1	1.4
Total	68	100.0

ampicillin was responsible for the hearing loss [13]. However, more recent studies showed no differences of the incidence of post-meningitis deafness and the various forms of antimicrobial therapy [4,5,12]

At our present level of knowledge about post-meningitis deafness, no specific therapy can be recommended. Even early diagnosis and treatment of meningitis may not be enough to diminish the frequency of post-meningitis hearing loss. Prevention of meningitis is the only means of reducing this complication. Vaccination against the three most common causes of bacterial meningitis are now available and in use for children and adults. Early recognition of the hearing impairment is important in order to start appropriate speech and language therapy to facilitate optimal development. Hearing assessment should be done on all meningitis patients immediately following the acute illness with adequate follow-up.

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