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ARTICLES

Diagnosis and treatment of ear disease among children in the Ellisras district

An outreach programme

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Audiologists and ENT registrars examined 2 036 children aged 10 years or younger by means of pure-tone audiometry, tympanometry and otoscopic examinations. Twenty per cent of these children had ear pathology and 7,5% had impaired hearing. Forty-three pus swabs taken from patients with suppurative otitis media most often cultured *Proteus mirabilis* and *Pseudomonas* species. The prevalence of otitis media with effusion was twice as high in white children as in black children, resulting in a much higher prevalence of hearing loss in the first group. The black children had 7 times more dry perforations of the tympanic membrane and 11 times more wet perforations. A hundred and thirty-six patients were treated by the team and 137 were referred for further treatment. Sixteen operations were performed at a later stage. Further programmes are needed to diagnose and treat ear disease in rural communities.

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According to the United Kingdom Impact Foundation there may be some 70 million people in the world with a disabling degree of hearing impairment.[1] The main reasons for childhood hearing loss are otitis media with effusion and suppurative otitis media. In addition at least 1- 2/1 000 children have bilateral sensorineural hearing loss (SNHL) of at least 50 dB.[2] This impairment of hearing results in impaired speech development, poor scholastic achievement and possible social, emotional and behavioural maladjustment.[3]

In the light of the above we found it necessary to launch an outreach programme to: (*i*) determine the prevalence of hearing impairment and ear disease among children in a rural community in South Africa; (*ii*) treat as many of these children as possible; (*iii*) educate local health personnel in diagnostic and treatment principles; (*iv*) increase awareness among the community of the importance of the early diagnosis and treatment of ear pathology; and (*v*) provide ongoing involvement in the community.

The programme consisted of 6 phases: (*i*) the target area was visited to investigate the need and feasibility of an outreach programme; (*ii*) the local health personnel were orientated and the schools and community informed of the details of the programme; (*iii*) a team of 10 audiologists, 3 ENT registrars, a programme manager and local health personnel visited various primary schools, créches and community clinics in and around Ellisras. They screened 2 077 persons; (*iv*) a team of 3 ENT surgeons operated on patients who were identified during phase III as being in need of surgery; 12 tympanomastoidectomies, 1 tympanoplasty, 1 bilateral myringotomy and 2 adenotonsillectomies were done. These patients were followed up postoperatively; (*v*) educational facilities for hearing-impaired children were established; and (*vi*) evaluation of the programme.

The findings of phase III are reported in this article.

Subjects and methods

Two thousand and thirty-six children of 10 years and younger were screened by an audiologist using Grason-Stadler portable tympanometers (GSI 28A Auto Tymp) and Maico MA 25 Pure Tone screening audiometers.

Each child was also examined by an ENT registrar using a standard Welch Allyn otoscope. The nose, mouth and external ear, external acoustic canal, tympanic membrane and middle-ear status were evaluated.

A data sheet was completed for each patient (Fig. 1). Forty-three pus swabs were obtained from patients with suppurative otitis media. Children who were found to have ear pathology were either treated with amoxycillin (Amoxil) and/or clioquinol and flumethasone pivalate eardrops (Locacorten-Vioform) or referred to their general practitioner or district surgeon. Children who required complete audiological assessment were referred to the Department of Audiology of the University of Pretoria for this purpose.

The difference in results between the black and white children were analysed using the chi-square test with Yates's correction or Fisher's exact test. A *P*-value less than 0,05 was taken to be indicative of a statistically significant difference in prevalence.

Results

The results are summarised in Tables I - IV.

Four thousand and seventy-two ears of children of 10 years old or younger were examined (Table I). Of these, 104 had impacted wax that the examiners were unable to remove. Of the remaining 3 968 ears examined otoscopically, 20,3% were abnormal, while 7,5% of ears (10% of children) had an impairment of hearing. The upper limit for normal hearing was taken to be between 25 dB and 30 dB, depending on the level of the background noise.

The most common pathology seen in the children examined by us was otitis media with effusion in 5,2% of ears and retracted tympanic membranes in 4,4% of ears;

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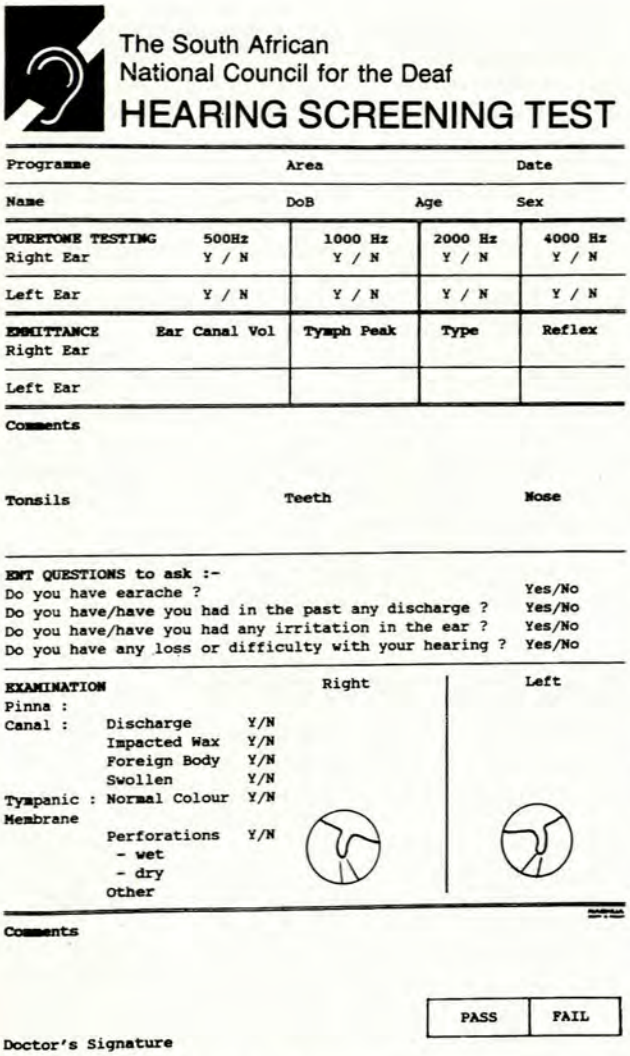

The South African
National Council for the Deaf
HEARING SCREENING TEST

Programme | Area | Date

Name | DoB | Age | Sex

PURETONE TESTING	500Hz	1000 Hz	2000 Hz	4000 Hz
Right Ear	Y / N	Y / N	Y / N	Y / N
Left Ear	Y / N	Y / N	Y / N	Y / N

EMMITTANCE	Ear Canal Vol	Tymph Peak	Type	Reflex
Right Ear				
Left Ear				

Comments

Tonsils | Teeth | Nose

ENT QUESTIONS to ask :-

Do you have earache ? Yes/No
Do you have/have you had in the past any discharge ? Yes/No
Do you have/have you had any irritation in the ear ? Yes/No
Do you have any loss or difficulty with your hearing ? Yes/No

EXAMINATION — Right | Left

Pinna :
Canal : Discharge Y/N
Impacted Wax Y/N
Foreign Body Y/N
Swollen Y/N
Tympanic Membrane : Normal Colour Y/N
Perforations Y/N
- wet
- dry
Other

Comments

PASS | FAIL

Doctor's Signature

Fig. 1. Sample of the data sheet completed for each child.

0,9% of ears had a dry perforation of the tympanic membrane and 1,3% of ears a wet perforation, the latter diagnostic of suppurative otitis media.

In 0,7% of ears there were signs of acute otitis media, 2,2% of tympanic membranes showed signs of tympanosclerosis and in 1,8% of ears a grommet was *in situ* (Table I).

Table I. Otoscopic examination results (%)

	Patients <10 years (*N* = 3 968 ears)
Normal	79,7
Abnormal	20,3
Hearing impairment	7,5
Otitis media with effusion	5,2
Retracted TM	4,4
Perforation TM	
Dry	0,9
Wet	1,3
Acute otitis media	0,7
Otitis externa	0,3
Tympanosclerosis	2,2
Grommets	1,8

TM = tympanic membrane.

It is interesting to note that of the 2 492 tympanograms done on clinically normal ears, 83% had a type A tympanogram. The results of tympanograms done on ears diagnosed as abnormal on otoscopic examination are clearly shown in Table II. Forty-three pus swabs taken of the latter group cultured *P. mirabilis* in 24%, *Pseudomonas aeruginosa* in 14%, and other *Pseudomonas* species in another 14% (Table III). *Staphylococcus aureus* was cultured in 10% of cases.

Table II. Tympanometry

Tympanogram		Clinically normal ears (*N* = 2 492)		Abnormal ears (*N* = 617)	
Type	Interpretation	No.	%	No.	%
A	Normal middle ear	2 068	83	240	38,9
As	Eardrum or ossicular stiffness	191	7,7	51	8,3
Ad	Flaccid eardrum/ ossicular discontinuity	37	1,5	13	2,1
B	Fluid-filled middle ear	15	0,6	115	18,6
C	Negative middle-ear pressure	165	6,6	194	31,4
E	Possible ossicular discontinuity	16	0,6	4	0,6

Table III. Bacteriology

No. of swabs taken	43
No growth	1
Single isolate	38
Multiple isolates	4
Organisms	
P. mirabilis	10
P. aeruginosa	6
Pseudomonas species	6
S. aureus	4
Klebsiella pneumoniae	3
K. oxytoxa	3
Providencia stuarti	2
E. coli	2
Corynebacterium	2
Acinetobacter	2
S. epidermidis	2
Streptococcus pneumoniae	1
Alcaligenes species	1
Bacillus species	1
Haemophilus influenzae	1

Table IV. Racial group comparison (%)

	Ears of black children (*N* = 2 184)	Ears of white children (*N* = 1 784)	*P*-value
Normal	84,1	74,4	
Abnormal	15,9	25,6	
Hearing impairment	5,7	9,6	0,7396(Y)*
Otitis media with effusion	3,5	7,3	0,0365(Y)
Retracted TM	3,4	5,5	0,9538 (Y)
Perforated TM			
Dry	1,4	0,2	< 0,001(F)**
Wet	2,2	0,2	< 0,001(F)
Otitis externa	0,4	0,2	0,0461(F)
Acute otitis media	0,8	0,6	0,0467 (F)
Tympanosclerosis	0,5	4,3	< 0,001(Y)
Grommets	0	3,9	< 0,001(Y)

* Y = Yates's corrected chi-square test.
** F = Fisher's exact test.

Discussion

In our study 7,5% of ears (10% of children) had an impairment of hearing. Other studies done in South Africa reported the following prevalences of hearing impairment: 27,7% of 119 black urban preschool children;[4] 22,6% of white children between 6 and 8 years old;[5] 17% of 309 black children between 5 and 11 years;[6] and 2,1% of 146 black urban children in grade I.[7]

In our study 5,2% of children had serous otitis media. Casselbrandt *et al.*[8] in his study of otitis media in preschool children in Pittsburgh, Pennsylvania, showed that the point prevalence may vary between 5% and 35%, depending on the season. Since our study was done in the summer a higher point prevalence than 5,2% may be expected during winter.

In our study, 6,6% of ears that were clinically normal had in fact a type C tympanogram, indicating a negative middle-ear pressure of less than –100 mm H_20 (Table II). Grimsing and Bergholtz[9] performed tympanometry on 690 ears which were considered to be clinically normal. The middle-ear pressure was however less than –100 mm H_20 in 3,8% of these ears. The differences between the otoscopic and tympanometric results reflect the recognised sensitivity and specificity of each investigation.

Of the 2 036 children, 1 117 were black (2 234 ears) and 919 were white (1 838 ears) (Table IV). If those with impacted wax are excluded, 15,9% of black children's ears were abnormal compared with 25,6% of white children's ears. The white children also had a higher prevalence of hearing impairment (9,6%) than the black children (5,7%) ($P < 0,05$). The higher prevalence of hearing loss among white children can be explained by the higher prevalence of otitis media with effusion (7,3%) and retracted tympanic membranes (5,5%) — almost twice as many as in black children. This is in agreement with a study of Kessner *et al.*,[10] who found the frequency of middle-ear disease and hearing impairment to be almost twice as high in Caucasian children as in black children. According to Maw in the 5th edition of Scott-Brown's *Otolaryngology,*[11] variations in prevalence of otitis media with effusion between the black and white children may be due to anatomical differences in the skull base and eustachian tubes between these two groups and possibly also due to the more widespread use of antibiotics by white children.

However, the black children had a significantly higher prevalence ($P < 0,001$) of dry perforations (1,4%) and wet perforations (2,2%) of the tympanic membranes, compared with 0,2% of dry and 0,2% of wet perforations in whites. This can be explained by the following factors prevailing among most of the black children in this specific community: a generally low socio-economic status with inadequate nutrition, overcrowding, inadequate medical services in rural areas and a lack of transport to these facilities. In this community there was also a lack of awareness of medical services that are available, of the possible complications of ear disease and of the necessity for early treatment.

The higher prevalence of otitis externa in black children (0,4%) compared with 0,2% in white children may be secondary to the higher prevalence of active otitis media resulting in a chronic mucopurulent otorrhoea among the black children.

None of the black children had any grommets *in situ* and only 0,5% of them had tympanosclerosis, while 3,9% of whites had grommets *in situ* and 4,3% had signs of tympanosclerosis. This high prevalence of tympanosclerosis in white children may be a sequela of both the otitis media with effusion and the subsequent insertion of ventilation tubes in these children.[11]

Conclusions

The programme was considered to be a success because it was able to determine the prevalence of ear disease in this selected district — 1 out of 5 children under 10 years — while 276 patients were treated or referred for treatment. Local health personnel learned diagnostic skills and treatment principles and are now better equipped to manage ear disease in future.

Members of the community are now more aware of the importance of seeking early treatment for ear disease and of the facilities available to them. Educational facilities are being established for hearing-impaired children in this district.

The authors gained valuable experience in and information on the establishment of cost-effective screening and treatment programmes in South Africa. The urgent need for such programmes was identified.

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REFERENCES

1. Wilson J. Hearing impairment in developing countries. *J Otolaryngol* 1990; **19:** 368-372.
2. Davidson J, Hyde ML, Alberti PW. Epidemiologic patterns in childhood hearing loss: a review. *Int J Pediatr Otorhinolaryngol* 1989; **17:** 239-266.
3. Horwitz FD, Leake H. Effects of otitis media on cognitive development. *Ann Otol* 1980; suppl **68:** 264-267.
4. Petrocchi L. Hearing screening in pre-school children. B.A. thesis, Department of Speech Pathology and Audiology, University of the Witwatersrand, Johannesburg, 1988.
5. Celliers C. Die aard en voorkoms van middeloorpatologieë in laerskole vir normaalhorende blanke kinders. B. Log. thesis, Department of Speech Pathology and Audiology, University of Pretoria, 1987.
6. Oosthuizen JI. Die aard en voorkoms van gehoorpatologieë in laerskole vir normaalhorende Vendakinders. B. Log. thesis, Department of Speech Pathology and Audiology, University of Pretoria, 1986.
7. Nel M. Die voorkoms en aard van gehoorprobleme en middeloorpatologieë by 'n groep negroïede stedelike kinders in Graad I. B.Log. thesis, Department of Speech Pathology and Audiology, University of Pretoria, 1987.
8. Casselbrandt ML, Brostoff LM, Flaherty MR, *et al.* Otitis media with effusion in pre-school children *Laryngoscope* 1985; **95:** 428-436.
9. Grimsing S, Bergholtz LM. Otoscopy compared with tympanometry. *J Laryngol Otol* 1983; **92:** 587-591.
10. Kessner DM, Snow CK, Singer J. *Assessment of Medical Care for Children: Contrasts in Health Status.* Vol. 3. Washington, DC: National Academy of Sciences, Institute of Medicine, 1974.
11. Maw AR. Otitis media with effusion (glue ear). In: Kerr AG. *Scott-Brown's Otolaryngology.* Vol. 5. 5th ed. London: Butterworths, 1987: 172.

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