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Auditory function in early syphilis

A follow up study

by

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Abstract

Twenty-six patients with secondary or early latent syphilis were examined by auditory brainstem response (ABR) audiometry and by pure tone audiometry before and after treatment. Normalization was registered in four of seven patients with pathological ABR before treatment, while in three patients the ABR abnormalities remained after treatment. Thirteen patients exhibited a sensori-neural hearing-loss before treatment. In two patients this hearing-loss improved after treatment and a syphilitic etiology seems plausible. The reversible lesions in the auditory system may be related to asymptomatic syphilitic meningitis. Permanent ABR abnormalities might reflect syphilitic vascular involvement in the brainstem.

Introduction

The incidence of syphilis has not shown any tendency to decrease during the two last decades (WHO, 1981). Physicians of different disciplines should be aware of this multi-faceted disease which is increasing among homosexual men. Recent reports (Centers for Disease Control, 1982) concerning acquired immune deficiency syndrome (AIDS) in homosexual men with multiple sexually transmitted diseases have further increased the current interest in syphilis.

Sensori-neural hearing-loss is a well-known complication of congenital syphilis (Kerr *et al.*, 1973; Karmody and Schuknecht, 1966), but isolated cases of syphilitic hearing-loss in early syphilis have also been reported (Alergant, 1968; Willcox and Goodwin, 1971; Schneider and Bolte, 1972; Balkany and Dans, 1978).

In two recent studies, abnormal auditory brainstem responses (ABR) indicating subclinical lesions in the brainstem were demonstrated in cases of secondary and early latent syphilis (Rosenhall and Roupe 1981; Löwhagen *et al.*, 1983b). In connection with the latter investigation of 26 patients, a follow-up study of those who had hearing loss and/or abnormal ABR before treatment has been performed. The aims were to evaluate the frequency of hearing loss, especially of reversible type, and to

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investigate whether or not ABR abnormality tends to normalize after treatment of patients with early syphilis.

Patients

The study group comprised 26 patients, 24 men (20–69 years, mean 39 years) and two women (18 and 42 years) seen at the Department of Dermatology, Sahlgrenska sjukhuset, Göteborg from November 1980 to October 1982. Seventeen patients had clinical manifestations and serology consistent with secondary syphilis (King *et al.*, 1980) and nine patients were diagnosed as early latent syphilis, based on serology and history. Sixteen patients were treated with procaine penicillin 600,000 IU intramuscularly for 17 days, nine patients were given benzyl penicillin 10 million IU (6 g) intravenously three times a day for ten days and one patient doxycyklin orally 0.1 g twice a day for 20 days.

Serological tests included the Venereal Disease Research Laboratory (VDRL) test and Wassermann reaction (WR) and, for confirmation, the fluorescent treponemal antibody absorption (FTA-ABS) test and/or the Treponema pallidum immobilization (TPI) test.

Controls

The ABR results in the patients were compared with those from several control groups. Each patient was compared with a control group of individuals of matching sex, age and hearing. For details, see Löwhagen *et al.* (1983b).

Methods

ABR-audiometry was performed according to principles already described. For details, see Rosenhall (1981) and Löwhagen *et al.* (1983b).

Pure tone audiometry was performed in a sound-proof test room by a trained audiologist. A Madsen Electronics OB-70 audiometer with TDH-39 earphones was used. The equipment was calibrated according to ISO standards.

Results

ABR-audiometry

Seven of 26 patients had abnormal ABR before treatment. All of them were retested between four and 24 months after the initial testing. The results of the two test sessions are presented in Table I.

In three instances the ABR-abnormalities remained (Case 18) or even increased (Cases 3 and 17) (Fig. 1). In four patients (Cases 5, 10, 12 and 19) the second ABR was within normal limits. In case 12 the only abnormality in the initial test was bilaterally decreased amplitudes of wave V and in the second test these amplitudes were normal. In two other patients the wave V amplitude was

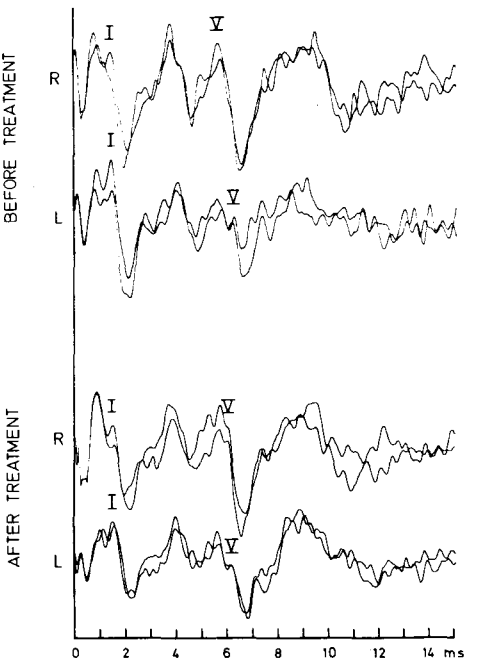


FIG. 1

ABR-recordings from Case 3, a 34-year-old man with secondary syphilis. The upper recordings were taken before treatment and the lower recordings two years later. R = right ear, L = left ear. Wave I and wave V are marked. Initially, only the left ear had abnormal ABR, with prolonged wave V latency and I-V interval. The interaural time difference, i.e. the difference between the latency of wave V in the left ear and the right ear (IT_5), is abnormal. In the second ABR, recorded after recovery from the disease, both ears have prolonged wave V latencies and I–V intervals.

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decreased in one ear but this abnormality had disappeared on retesting.

Pure tone audiometry

Thirteen of the 26 patients in the study had sensori-neural hearing-loss when first seen at the hospital before treatment for the disease. In all cases except one, the hearing-loss was predominantly found in the high frequencies. Seven of the patients had slight high tone loss, two in one ear only. Two other patients had moderate high tone loss; one in both ears, the other in one ear with slight high tone loss in the other ear. Three patients had extensive bilateral hearing-loss which was severe in the high frequencies (Klockhoff *et al.*, 1973). One patient (Case 10) had a trough-shaped slight hearing-loss in the middle frequencies, normal hearing at 4 kHz and 6 kHz in the right ear and at 2 kHz in the left ear, and high tone loss above these frequencies, especially in the left ear.

Eleven of the patients were retested between three and 19 months after treatment. In nine of the patients the hearing was unchanged. Two patients with secondary syphilis showed hearing improvement. Neither of these two patients had noticed impaired hearing before treatment.

One of these patients (Case 9), a 58-year-old man, had a sensori-neural hearing-loss affecting not only the high frequencies but also the low and middle frequency range before treatment of the disease. The pure tone average (p.t.a.) of the frequencies 0.5 kHz, 1 kHz and 2 kHz was 35 dB. for the right ear and 32 dB. for the left ear (Fig. 2A). After treatment of the disease, the hearing improved significantly. The final audiogram showed a p.t.a. of 13 dB. in the right ear and 22 dB in the left ear (Fig. 2B). Thus, the hearing in the low and middle frequencies improved between 10 and 35 dB., but the high frequency hearing-loss remained constant. Cerebrospinal fluid (CSF) examination before treatment revealed 28 mononuclear cells $10^6/1$, total protein 740 mg/l and reactive TPI. After treatment all tests normalized.

The other patient (Case 19), a 52-year-old man, had a slight bilateral high tone loss before treatment. After treatment, the right ear had improved 25 dB., 10 dB. and 20 dB. and the left ear 10 dB., 15 dB. and 10 dB. at the frequencies 3 kHz, 6 kHz and 8 kHz respectively. CSF examination before treatment revealed 19 mononuclear cells $10^6/1$, total protein 875 mg/l, CNS IgG synthesis

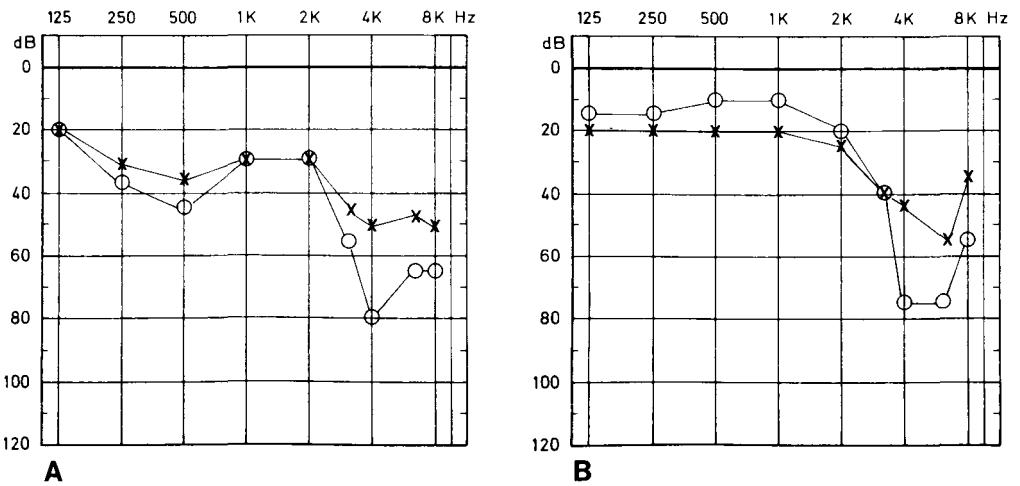


FIG. 2 A and B

A 58-year-old man with secondary syphilis. A: a pure tone audiogram, registered before treatment, showing a hearing-loss affecting all frequencies but above all the high tone range. B: an audiogram registered 15 months after treatment. The hearing has improved between 10 dB. and 35 dB. at the frequencies 0.25 kHz and 1 kHz, but the high tone loss remains unchanged.

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10,45 mg/day and reactive WR. After treatment all tests normalized.

Discussion

Reversible dysfunction of the auditory system both of a central type (causing ABR abnormalities) and of a peripheral type (causing hearing loss) was demonstrated in the present study of 26 patients with secondary or early latent syphilis. Results of CSF analysis and ABR test before treatment in these patients have been described earlier (Löwhagen *et al.*, 1983a, b). Fourteen of the patients demonstrated abnormal CSF findings and seven disclosed pathological ABR patterns. A significant correlation was found between CSF pathology and abnormal ABR.

In this follow-up study, four of seven patients with ABR abnormality showed recovery, with normal test results after treatment. However, in three of the patients the ABR abnormality remained constant or even showed progression, although blood tests and CSF findings indicated healing of the infection.

According to Tamari and Itkin (1951), the incidence of sensori-neural hearing-loss in early latent syphilis is as high as 17 per cent. In this study, half of the patients with early syphilis had sensori-neural hearing-loss at the initial test before treatment. In most cases, the hearing-loss was slight, affecting only the high frequencies. Of those patients with hearing-loss, all but one were males and nine out of 13 were above 40 years old. The etiology of the hearing-loss was probably

TABLE I

FOLLOW-UP OF 7 PATIENTS WITH ABNORMAL ABR BEFORE TREATMENT.

		Before treatment					After treatment			
		Hearing		*ABR*			*ABR*			
Case	Age years		P.t.a. dB	wave V latency ms	I–V interval ms	Amplitude of wave V	interval months	Wave V latency ms	I–V interval ms	Amplitude of wave V
3	34	R normal	15	5.8	4.3	normal	24	6.0*	4.5*	normal
		L normal	17	6.2*	4.7*	decreased*		6.2*	4.7*	normal
				abnormal IT_s				normal IT_s		
5	42	R h.f.l.	13	6.1*	4.5*	decreased*	4	5.8	4.2	normal
		L h.f.l.	15	6.1*	4.5*	normal		6.0	4.3	normal
10	63	R h.f.l.	25	6.1*	4.7*	normal		5.9	4.5	normal
		L h.f.l.	22	6.1*	4.7*	normal		6.0	4.5	normal
12	20	R normal	7	5.5	4.0	decreased*	7	5.5	4.0	normal
		L normal	5	5.5	4.1	decreased*		5.6	4.2	normal
17	39	R normal	5	6.0*	4.5*	normal	9	6.3*	4.8*	normal
		L h.f.l.	5	5.9	4.5*	normal		6.1*	4.7*	normal
18	43	R normal	7	6.0*	4.4	normal	14	6.0*	4.4	normal
		L normal	5	6.1*	4.6*	normal		6.0*	4.5*	normal
19	52	R h.f.l.	15	5.9	4.5*	normal	12	5.7	4.2	normal
		L h.f.l.	12	5.5	4.0	normal		5.6	4.1	normal
				abnormal IT_s				normal IT_s		

Cases nos. 10, 12, 18 and 19 had before treatment intrathecal immunoglobulin production and are identical with patients nos. 4, 5, 7 and 10 respectively in Table II in Löwhagen *et al.* 1983a.

P.t.a.: pure tone average; R: right ear; L: left ear; h.f.l.: high frequency loss. IT_s = interaural time difference of wave V.

*Indicates abnormal test result (Löwhagen *et al.*, 1983b).

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presbyacusis and/or noise damage in many of these cases. In two of the patients studied, the hearing improved after treatment and a syphilitic etiology of their hearing-loss seems plausible. Recovery of hearing-loss has been reported both after treatment with penicillin only (Nelson and Duncan, 1945; Balkany and Dans, 1978) and after treatment with a combination of penicillin and corticosteroids (Willcox and Goodwin, 1971; Balkany and Dans, 1978). Our observation supports the importance of screening for syphilis in all patients with unexplained sensori-neural hearing-loss (Zoller *et al.*, 1978).

There are several possible mechanisms by which syphilis might affect the auditory system. One explanation might be that the hearing-loss and the brainstem lesions are correlated to a concomitant meningitis. Both of the patients with improvement of auditory function in this study had CSF findings suggesting meningeal involvement. In one of these patients, the hearing-loss was cochlear, according to the normal ABR result. In the other patient (Case 19), the ABR was abnormal, indicating either a retrocochlear lesion or a cochlear lesion with a concomitant brainstem dysfunction. The course of the hearing function in these two cases somewhat resembles the reversible hearing loss reported to occur after meningitis (Dodge and Schwartz, 1965; Nadol, 1978; Rosenhall and Kankkunen, 1980). Brainstem dysfunction revealed by ABR has recently been reported to occur in patients with meningitis (Özdamar *et al.*, 1983).

Besides a meningeal reaction, localized vascular lesions within the CNS might occur in early syphilis (Stokes *et al.*, 1944). A case of secondary syphilis with quadriparesis compatible with a vasculitis in the pons has recently been described (Lichten *et al.*, 1980). The observed pathological ABR pattern in early syphilis might thus reflect vascular involvement in the brainstem, resulting in permanent loss of the affected neurons, explaining the irreversibility of the ABR pattern in three of the patients studied.

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