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NEUROAUDIOLOGICAL FINDINGS IN CHRONIC PRIMARY FIBROMYALGIA WITH DYSESTHESIA

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ABSTRACT. Thirty-six patients (31 females and 5 males) with "chronic primary fibromyalgia" combined with dysesthesia were studied using neuroaudiological tests. Auditory brainstem response (ABR) was pathological in 11 patients (31 %). In six instances the I–V interpeak latency (IPL) was prolonged, in two instances the interaural difference of wave V (IT5) was pathological, and in three instances there was a reduction of the amplitude of wave V. A comparison of the I–V IPLs between the female patient group and a matching control group showed that there was a significant prolongation of this parameter in the patient group. The ABR-findings indicate that a brainstem dysfunction might be present in some patients with fibromyalgia. The results of the impedance audiometric tests were generally normal in the patient group.

Key words: chronic primary fibromyalgia (CPF), dysesthesia, auditory brainstem response (ABR), impedance audiometry, tensor tympani syndrome.

Patients with chronic muscular pain constitute an increasing problem for the health services (12). Chronic pain of muscles and muscle insertions of the locomotor system is in western literature often termed chronic primary fibromyalgia (CPF). The pain is usually located to the neck-shoulder girdle and the lumbar hip region with simultaneous involvement of the extremities. The patients also show psychosomatic symptoms indicating a dysfunction of the autonomic nervous system. In earlier studies mental symptoms have also been observed which could indicate a psychoorganic syndrome (Johansson & Nyström, to be published). In many patients discrete neurological signs such as dysesthesia have also been observed (12).

In an earlier study of patients with CPF combined with dysesthesia and symptoms of a psychoorganic syndrome, eye motor abnormalities which can be consistent with CNS-dysfunction were observed (20). Similar findings in patients with CPF have recently been described by Ödquist et al. (15).

The same patients who were studied using oculomotor tests were also investigated using neuroaudiological methods. In addition to ordinary pure tone audiometry the methods used were auditory brainstem response (ABR) audiometry and impedance audiometry.

In ABR-audiometry the auditory system is stimulated with a series of short high intensity clicks which initiates a number of auditory evoked potentials generated in the brainstem. The response consists of five waves (I to V) generated in the cochlear nerve (waves I and II) and in the brainstem (waves III, IV and V) (3, 14). It has been shown that ABR-audiometry is of great value in detecting lesions in the eighth nerve and in the brainstem (16, 21, 22, 23).

In impedance audiometry the admittance of sound to the ear is estimated by measuring how much of an incident sound (the probe tone) is reflected back from the tympanic membrane to the external ear canal. The method is extremely important in audiological practice for various purposes, e.g. tympanometry and measurements of the stapedius reflex (5, 6, 7, 11). The stapedius reflex is elicited when a loud sound is brought into the ear. The cochlea is stimulated and via the cochlear nerve, interneurons in the brainstem and the facial nerve the stapedius muscles in both the ipsi- and the contralateral middle ear are activated. The ossicular chain stiffens and less sound enters the ear and more of the sound is reflected back into the external ear canal. The method can be used to diagnose lesions in the middle ear, the cochlea, the cochlear nerve, the brainstem and the facial nerve (6, 7, 11).

METHODS

All patients were tested with pure tone and speech audiometry prior to the neuroaudiological testing. For this pur-

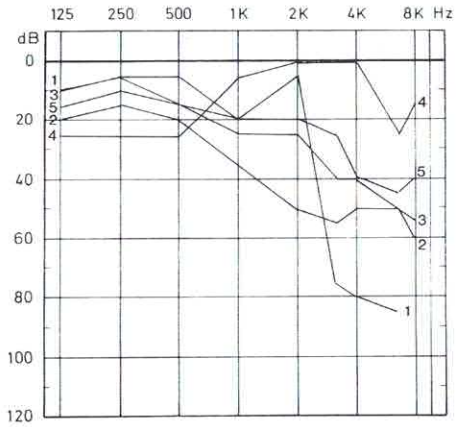

Fig. 1. Pure tone audiograms (left ear) from five of the patients (all of them females) with chronic primary fibromyalgia and hearing loss. Cases 1 and 4 had unilateral sensorineural hearing losses and the others bilateral, symmetrical sensorineural hearing losses. Cases 1, 2, 3 and 5 had high frequency losses and case 4, 9 slight low frequency hearing losses. The intensity is given in dB HL.

pose Madsen 0B 70 audiometers calibrated according to ISO-standards (ISO 389) were used. All testing was performed in sound proof test rooms by audiological assistants.

ABR

ABR audiometry was performed in a sound proof test room. 1 024 clicks with alternating phase were presented monaurally through TDH-39 earphones. The repetition rate was 25 stimuli/s. The intensity level was kept constant at 80 dB nHL (115 dB peak equivalent SPL). Surface self-adhesive silverchloride electrodes were attached to the forehead, the earlobes and on the nose (ground electrode). The signals were bandpassed using a filter with a low cut-off frequency of 150 Hz and a high cut-off frequency of 2500 Hz. The signals were conveyed to a Nicolet 527 signal averager and one averaged response consisted of 1 024 individual sweeps. Identical test procedures were carried out two to five times to ensure reproducibility. The averaged responses of two identical stimulus rounds were superimposed on a graph using an X-Y-plotter. Forehead positive deflections were delineated upwards. The latencies of waves I and V were measured and the I–V interpeak latency (IPL) was calculated. The test results for each patient were compared with those of age and sex-matched control groups consisting of a total of 1 109 subjects of different age, some of them with normal hearing, others with cochlear hearing losses of various extents (18, 19). Control mean ±2 SD was considered as normal.

The I–V IPL is considered a reliable measure of the function of the auditory pathway from the cochlear nerve to the mesencephalon (21). This parameter was used in the present study because it is insensitive to irrelevant factors such as peripheral hearing. Normal values for the I–V IPL from the control groups were 3.95 ms for the females and 4.15 ms for the males. The interaural difference of wave V (IT 5) was also calculated. An IT 5 of 0.4 ms or more was considered to be pathological, indicating dysfunction of the auditory pathway (22).

The amplitudes of waves I and V were also calculated. A ratio between waves V and I of 0.5 or less was considered to be a borderline finding indicative of brainstem dysfunction (13, 17, 23).

Thirty-one of the patients in the present study were females (mean age: 45.3 years, range 29–58 years). This part of the patient group was compared with a matching control group selected from the large sample of controls. This subgroup consisted of 55 healthy females (mean age: 44.3 years, range 35–54 years) with normal hearing. A comparison of the I–V IPLs between the female patient group and the matching control group was performed. Only ABR-recordings from one ear for each subject were used for this comparison which included a statistical analysis with Student's *t*-test.

Impedance audiometry

Impedance audiometry was performed with a Madsen model Zo 70 electro-acoustic impedance bridge with a probe tone frequency of 220 Hz. The middle ear pressure was measured with tympanometry. In those ears which had normal middle ear pressure and also normal otoscopic findings the test was continued with measurements of the stapedius reflex thresholds with ipsi- and contralateral stimulation, with the stapedius reflex decay test and with measurements of the "tensor tympani syndrome". These tests were performed in a total of 30 patients. The stapedius reflex thresholds for the frequencies 0.5, 1.0 and 2.0 kHz were measured directly from the graphs. For reflexes elicited with contralateral stimulation the normative values described by Lidén (9) were used. This means that reflex thresholds exceeding 95 dB HL are regarded as pathological. For the stapedius reflex decay test the normative criteria established by Anderson et al. (1) were used. Regarding the "tensor tympani syndrome" the criteria described by Klockhoff (7, 8) were adopted. According to these criteria the tensor tympani syndrome is present if a slow, irregular impedance fluctuation superimposed by a rapid fluctuating activity, synchronous with the patient's pulse, is present.

Patient group

Thirty-six patients (31 females and 5 males) with CPF were studied. The patients have been described in detail elsewhere (20).

RESULTS

Pure tone audiometry

Fourteen of the patients were found to have normal hearing capacity (<20 dB HL for all frequencies measured) in both ears. Sixteen patients were found to have slight to moderate sensorineural symmetrical high frequency hearing losses consistent with presbycusis and/or noise-induced hearing loss.

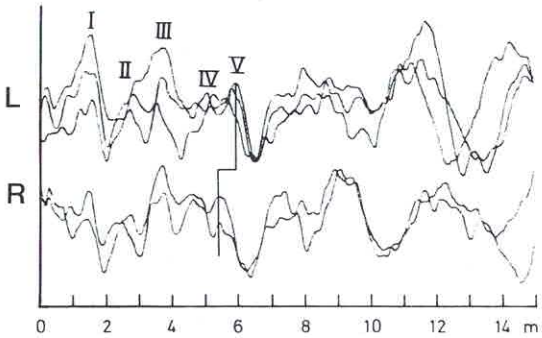

Fig. 2. ABR-recordings from a male patient (49 years old) with fibromyalgia. Stimulus intensity: 80 dB nHL. Waves I to V are reproducible. There is a latency difference of wave V (IT5) of 0.4 ms between the left ear (L) and the right ear (R), a value which is pathological. When the patient was retested more than two years after the first test session the ABR-recordings showed the same abnormality.

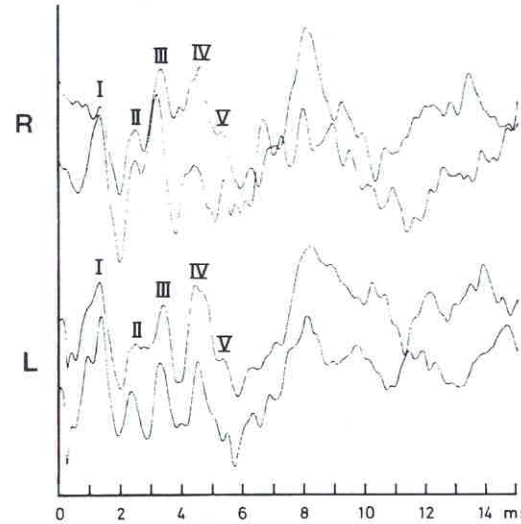

Fig. 3. ABR-recordings from a female patient (53 years old) with fibromyalgia. R: right ear, L: left ear, stimulus intensity: 80 dB nHL. Waves I to IV are reproducible but wave V is highly variable and the amplitude of this wave is diminished. ABR was performed on this patient on another occasion and the abnormal pattern of wave V was found to be the same.

One patient had a slight unilateral conductive hearing loss.

Five patients had sensorineural hearing losses in excess of what can be expected to be caused by age and noise exposure (Fig. 1). Three of them had symmetrical hearing loss in the high frequencies. Another patient had a steep unilateral high frequency loss and normal hearing in the opposite ear. Still another patient had a slight low frequency loss in one ear and normal hearing in the other ear.

ABR

Ten of the 36 CPF-patients had abnormal ABR-recordings. Seven of the patients whose pain symptoms had become more acute were retested from 7 months to 2 years 10 months after the initial testing. Five of these patients had abnormal recordings at the initial testing and their retest results were identical with the initial ones. One of the patients with normal recordings at the initial test had abnormal test results at the retest session. Thus, altogether 11 patients (31%) of the 36 subjects tested had abnormal ABR-recordings. Six of these patients with pathological ABR-results had significantly prolonged I–V IPLs (control mean ±2 SD), five unilaterally and one bilaterally (Fig. 2). Two of these cases had abnormal IT 5 as well. Two other patients had abnormal IT 5 as the only pathological finding. Three other patients had a pathologically reduced amplitude of wave V (the V/I quotient ≤0.5), two of them unilaterally and one bilaterally (Fig. 3).

For the 31 female patients the mean I–V IPL for one ear only (the right or the left ear was tested at random) was 4.13 ms (SD: ±0.20 ms). The corresponding value for the control group is 3.95 ms (SD: ±0.22 ms). The distribution of the I–V IPLs for the patients and the controls are shown in Fig. 4. The difference between the two groups concerning the I–V IPL is significant ($p<0.01$).

Impedance audiometry

Twenty-eight of the 30 patients who were tested using impedance audiometry, had normal stapedius reflex thresholds. In one patient no reflex could be registered in one ear and in another the reflex thresholds were slightly elevated in one ear. This patient also had pathological ABR-recordings for the same ear.

The stapedius reflex decay test was normal in all instances examined.

Three of the 30 patients who were tested with impedance audiometry showed signs of the tensor tympani syndrome, one indisputable (Fig. 5) while the other two had only discrete signs of this syn-

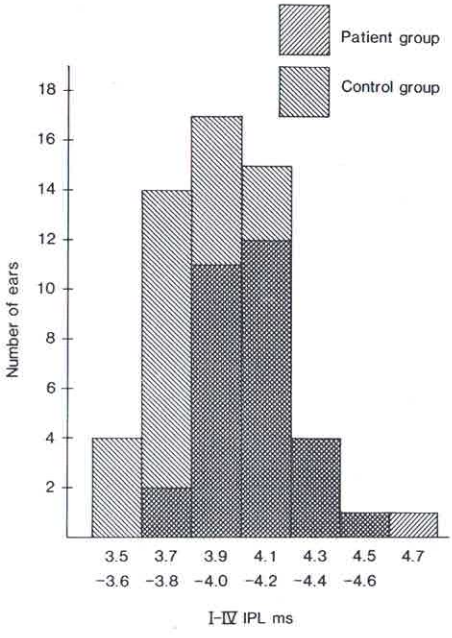

Fig. 4. Histogram showing the I–V IPLs (*x*-axis) of the female patient group and of a matching control group. Only results from one ear from each subject is included in this graph. The mean I–V IPL is slightly longer in the patient group (*x*: 4.13 ms, SD ±0.20 ms) than in the control group (*x*: 3.95 ms, SD ±0.22 ms), a difference which is significant ($p<0.01$).

drome. All other patients had stable, undisturbed impedance baseline registrations for both ears.

DISCUSSION

Hearing loss affecting the low frequencies has been reported to occur in 1/3 of patients with a fibrositis syndrome (CPF) (4). In the present study hearing losses which could not be ascribed to old age or noise exposure were found in five patients (14%). Four of these patients had high frequency losses and one slight unilateral low frequency hearing loss. Hearing loss is, however, a common symptom in the general population and the present material is too small to permit any definite conclusions as to whether or not hearing losses occur in cases of CPF.

Recently oculomotor abnormalities indicating that fibromyalgia has its origin in the CNS or that the disease secondarily influences the CNS have been reported (15, 20). The idea that the CNS often is affected in CPF is strongly supported by our

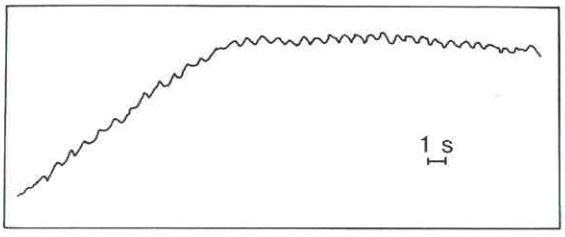

Fig. 5. Impedance audiometry registration from a male patient (53 years old) with fibromyalgia. Increased impedance is depicted upwards. There is a slow deviation of the baseline after a change of the pressure in the external ear canal. A regular rapid activity with a frequency of 1–2 Hz is superimposed on the baseline. This type of impedance activity in patients with tension headache has been described by Klockhoff (8) and has been called the tensor tympani syndrome.

observation that the ABR-recordings were pathological in 31% of the patients examined. Pathological ABR-audiometry indicates either a lesion affecting the first auditory neuron (resulting in a retrocochlear hearing loss) or a lesion of the auditory pathway at a location within the brainstem from the pontomedullary junction to the mesencephalon. A retrocochlear lesion usually causes both a hearing loss and abnormal stapedius reflex thresholds (1, 10). A brainstem lesion generally causes no measurable hearing loss and the stapedius reflex test is also often normal (5). Of the five patients with hearing losses of unknown etiologies in the present study, four had normal ABR-recordings, and only one had a pathological ABR.

All eleven patients with abnormal ABR also had pathological eye motor dysfunction. In five cases both the saccades and the smooth pursuits were pathological as well as the auditory brainstem recordings. In five other cases only the smooth pursuits and the ABR were abnormal and in one instance the saccades and the ABR were abnormal. A combination of pathological ABR and abnormal oculomotor tests is strongly suggestive of a brainstem lesion. One difficulty in interpreting oculomotor tests is that these tests are sensitive to pharmacological influences and to fatigue. ABR, on the other hand, is totally insensitive to such external factors (24, 25).

The abnormal oculomotor test results described earlier might possibly be caused by defective function of the eye muscles as part of a generalised muscular disorder. A neuromuscular disorder can

be detected using impedance audiometry (2). The results of the measurements of stapedius reflex thresholds were generally normal, and those of the stapedius reflex decay tests invariably normal, which makes a neuromuscular disorder a less probable explanation of the pathological findings regarding eye motility. Moreover, there were no other clinical symptoms or signs indicative of a neuromuscular disorder in the patient group.

Another possible explanation for the eye motor abnormalities observed is defective proprioception in the cervicocranial area. Patients with tension headache often exhibit mild to moderate oculomotor dysfunction according to findings in our laboratory (Carlsson & Rosenhall, to be published). Such patients very often have a tensor tympani syndrome (7, 8). This syndrome, which can be detected using impedance audiometry, was only observed in three cases in the present material. This fact indicates that although defective proprioception was probably not the cause of the oculomotor abnormalities observed earlier, it may have been a contributing factor. Moreover, the pronounced divergence of the impedance findings between CPF and tension headache indicates that the two conditions are not closely related.

The data from our earlier study and the present one strongly indicate that CPF is either accompanied by a CNS-disorder which explains some of the symptoms present or that the syndrome causes secondary brain damage. Another possibility is that the syndrome, which includes muscular pain, autonomic dysfunction and mental symptoms, is secondary to a brain dysfunction. Studies in progress will hopefully contribute to a better understanding of the mechanisms involved in the disease.

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