

## Impedance Fluctuation and a "Tensor Tympani Syndrome"

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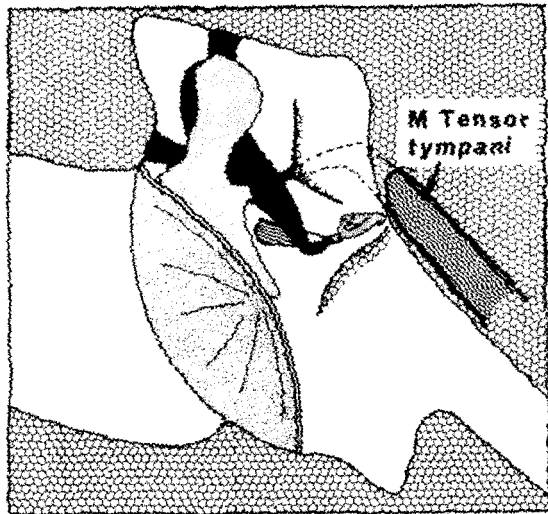
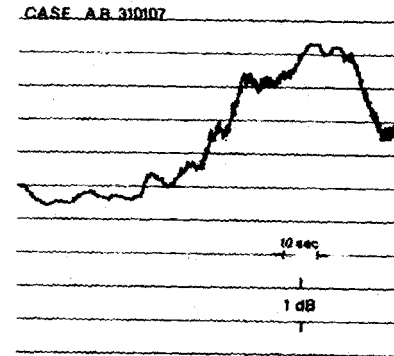


FIGURE 1

The physiology of the human tensor tympani muscle (Fig. 1) remains obscure. As reported in the monograph "Middle Ear Muscle Reflexes in Man", it does not respond to sound. This is in contrast to the findings in most animals which exhibit acoustic tensor tympani reflexes in common with the stapedius reflex responses. There is no acoustic tensor reflex in man unless the sound stimulation is strong, sudden and threatening enough to produce a s.c. "startle reaction". It was found namely that tensor reflex responses could be obtained as a component of a startle response elicited by a short, sudden stream of air towards any of the eyes, an "orbital air jet".

Here follows a report on spontaneous activity tensor tympani muscle and associated symptoms which constitute what might be called a "tensor-tympani Syndrome".

There are individuals in whom the acoustic impedance of the middle ear is not constant in a prolonged recording, which is ordinarily the case, but fluctuates appreciably, quite irregularly and rather slowly. It was concluded that such a very typical impedance fluctuation is caused by spontaneous tonic tensor tympani muscle activity and it was therefore called "THE TONIC TENSOR PHENOMENON".



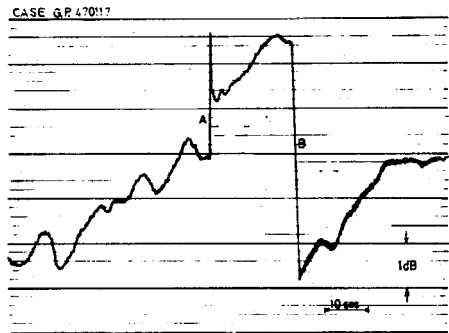
REPRESENTATIVE IMPEDANCE PATTERN OF A "TONIC TENSOR PHENOMENON" I. E. SLOW SPONTANEOUS IRREGULAR TONIC CONTRACTIONS OF THE TENSOR TYMPANI MUSCLE.

THE SMALL "SAW TOOTH DEFLECTIONS" SUPERIMPOSED ARE SYNCHRONOUS WITH THE PATIENT'S PULSE.

FIGURE 2

Figure 2 shows a representative recording of a tonic tensor phenomenon. It is a slow irregular impedance fluctuation, always superimposed by a saw tooth curve of small deflections, synchronous with the patient's pulse.

As an expression of the raised tension of the tympanic membrane, the acoustic impedance in these ears is extremely labile: Small changes in the mechanical load on the tympanic membrane result in abnormally great impedance changes. At tympanometry for instance, a slight air pressure change of less than 3 mm H<sub>2</sub>O in the auditory canal can produce the same impedance change as would usually require at least 25 mm H<sub>2</sub>O air pressure change in a normal ear.



SPONTANEOUS M. TENSOR TYMPANI ACTIVITY IN A PATIENT OFTEN SUFFERING FROM TENSION HEADACHE. THE IMPEDANCE CHANGE AT A IS ASSOCIATED WITH SWALLOWING AND THAT AT B IS PRODUCED BY MINIMIZING THE IMPEDANCE WITH A PRESSURE CHANGE VIA THE PROBE IN THE AUDITORY CANAL.

FIGURE 3

Figure 3 shows two manifestations of the abnormal impedance liability in an ear, exhibiting a tonic tensor phenomenon. Note the sudden great impedance changes by slight changes of the air pressure load on the tympanic membrane at A from the inside by swallowing and at B from the outside by a few mm H<sub>2</sub>O air pressure change in the auditory canal.

In several of the roughly 250 tonic tensor cases behind this presentation, this extreme impedance liability was the only abnormality immediately observed and the spontaneous tensor activity was not recorded until the position of the tympanic membrane had been smoothly adjusted by a slight air pressure change in the auditory canal, until a suitable position of the ear drum was found - usually close to the impedance minimum of the ear.

Difficulties in recording a stapedius reflex response in the expected way, is another, rather natural consequence of the tensor tympani muscle activity in the peripheral end of the ossicular chain.

However, a stapedius reflex response can still be recorded in these ears either by acoustic overstimulation with supra threshold intensities or - a safer way - by gently pulling the tympanic membrane a little bit outwards with a slight lowering of the air pressure in the auditory canal - a way of mechanical facilitation of the stapedius response.

To sum up: The finding of a conspicuous impedance liability in an ear, in which there is no reason to suspect interruption of the ossicular chain, is a sign of an elevated tensor tonus and signals that spontaneous tensor tympani activity often can be brought to appear, if not immediately seen.

## Associated Symptoms - the "TENSOR TYMPANI SYNDROME"

The tonic tensor phenomenon is associated with symptoms of such a high representation that it seems justified to talk of a TENSOR TYMPANI SYNDROME.

The ear symptoms are: "Fullness", "tinnitus" and "dysacusis"

There is a high relation to tension headache and vertigo.

It is a psychosomatic syndrome caused by increased psychic tension due to mental stress.

The fullness in the ear is more or less episodic and can be otalgic.

The tinnitus is mostly of a low sensation level and is sometimes pulsating.

The dysacusis consists of various abnormal acoustic sensations such as murmurs, clicks, tickling sensations, etc. and may involve distortion.

The tensor muscle activity does not cause hearing loss, at least not a significant hearing loss in the conventional sense. Still the patient may complain of "difficulties in catching what people say". This phenomenon is likely to be caused by mental distraction, a decreased ability to concentrate caused by the raised psychic tension always present.

## THE TENSOR TYMPANI SYNDROME

(Prevalence of symptoms In 76 cases)

TONIC TENSOR ACTIVITY - causing spontaneous ear impedance

Fluctuation, the typical "Tonic Tensor Phenomenon"

Fullness in the ear - sometimes otalgic	83%
Tinnitus - sometimes pulsating	62%
Dysacusis - various abnormal acoustic sensations	42%

### TENSION HEADACHE

Frontal and/or occipital 88%

### VERTIGO

Dizziness and Dysequilibrium 80%

The syndrome is caused by INCREASED PSYCHIC TENSION due to mental stress.

(It should be noted that the survey of symptoms given above does not include patients exhibiting tonic tensor phenomena in ears struck by genuine ear disease, such as Ménière, Otosclerosis etc. In such cases it is difficult to judge whether symptoms of the actual character originate from the disease or are true components of the Tensor Tympani Syndrome)

As seen from the figures there is a high incidence of tension headache. Electromyographic recording from the temporal muscles simultaneous with the impedance recording of a tonic tensor phenomenon in patients with tension headache revealed that these two psychosomatic muscle dysfunctions in the scalp and in the ear are of essentially the same fluctuant character.

In the tensor tympani syndrome there is also a lot of vertigo intermixed. It is mostly a matter of unspecific dizziness with a neurotizing dysequilibrium, causing fear to fall in the traffic and, above all, to enter overcrowded store houses. The patient may feel like he is walking on soft pillows. The floor feels unreliable and there may be sudden needs to grasp for support. Distinct rotatory attacks can occur but are rare and mostly of a short duration. The vertigo can be incapacitating. Patients may have been reported sick during long periods of time under diagnoses such as "pseudo- Ménière disease", "psychasthenic neurosis" or simply "vertigo". In several cases the unexplained symptoms, not at

least headache and vertigo, had initiated extensive clinical examinations regarding threatening diagnostic alternatives such as brain tumor, cardiovascular disease, multiple sclerosis, etc.

As regards the origin of the vertigo experiments reveal that the dizziness is not caused by the tensor muscle activity via the ossicular chain. According to electronystagmography the caloric excitability is not affected. Instead, there are a lot of signs pointing to vertigo of central origin: Directional preponderance - even spontaneous nystagmus, dysrhythmic periods and square waves were frequent phenomena. The hypothesis is that the vertigo emerges from an asymmetric, eventually fluctuant tonus in the reticular formation, which is known to be of great importance for vestibular reflexes and is also under influence from psychic reactions. If so, "central tension dizziness" may be a suitable term for the vertigo involved in the tensor tympani syndrome.

It is clinically very fruitful to know the tensor tympani syndrome:

There are patients with vertigo handles as cases of "too low blood pressure", who have in fact the tensor tympani syndrome.

Moreover, tonic tensor phenomena are not infrequently found in Ménière's disease. In such cases it is difficult to judge whether symptoms such as tinnitus, fullness and dysequilibrium are due to the inner ear disease or are components of the tensor tympanic syndrome, and the vertigo, apart from the intense rotatory attacks, may to a large extent be a "central tension dizziness".

As regards headache problems the recording of a tonic tensor phenomenon implies presence of tension headache- Several patients have been found to be misdiagnosed as cases of migraine, nasal sinus trouble, cervical rhizopathia, etc. - diagnoses that might have been correct in the past and sometimes found to be still relevant but no longer the main causes.

As regards therapy reassurance comes first: Information that the neurotizing symptoms need not signal a dangerous disease which the patients often have suspected with a circulus vitiosus as a result. The knowledge that there is a psychosomatic dysfunction due to stress is of great help. If prevalence and intensity of symptoms remain intolerable, physical relaxation therapy is often found

to be effective, sometimes supported by medication in which case Diazepam is the drug of choice.

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