TINNITUS AS A MANIFESTATION OF A SURVIVAL STYLE REFLEX

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ABSTRACT

In cases of severe tinnitus distress the sufferer frequently possesses strong negative beliefs about the meaning of tinnitus, as a result of which the individual sees tinnitus as a possible threat to life, or alternatively to life quality. Tinnitus may also be viewed as a territorial intrusion, e.g. against the right to remain silent. Tinnitus can have similarities to an environmental predator. There may be only a very small signal to detect, there is a learning process involved in establishing the importance of threat, there is immediate and strong stimulation of the limbic system to produce fear and/or anger, and there is automatic and enhanced perception of the signal.

We have measured the negative beliefs of patients suffering from tinnitus, and related this to their distress, the passage of time, and response to retraining, particularly about the meaning of tinnitus. While this does not prove that changes in belief promote tinnitus habituation and reduction in its perception, it is consistent with this hypothesis.

MECHANISM OF SURVIVAL REFLEX

Animals living in a hostile environment rely on highly developed sensory systems to detect the presence of predators in their environment. Processing in the central auditory pathways facilitates signal detection in the presence of noise and thereby the ability to detect the sound of an hostile predator from other sounds in the environment. Sound localization occurs at the level of the superior olivary complex and inferior colliculus as soon as decussation of auditory fibres is achieved. Interaction with occulomotor nuclei can produce appropriate head and eye movements towards the threat. Subcortical pathways below the point of auditory perception, consisting of complex neuronal networks, are concerned with signal detection and with the filtering of auditory information. Signals are classified first on a general basis into particular categories, e.g. is this a communication? is this environmental sound? is this new? Important signals, which may be of significant temporal complexity, can undergo strong enhancement. This phenomenon is well demonstrated in the way humans respond to the sound of their name being called, even when the attention is strongly focused elsewhere. Setting of neuronal networks for signal detection requires repetition and learning, although when the lesson has an extremely strong emotional label it may be learnt very rapidly.

LIMBIC SYSTEM AND PRE-FRONTAL PATHWAYS

In the generation of a survival reflex there is strong stimulation of the limbic system. 12 million nerve fibres connect the limbic system, and also the frontal cortex with subcortical auditory pathways, in an integrated rather than an hierarchical fashion[1]. A small animal watching his friends and relations being eaten by snakes emerging from the grass is rapidly conditioned to respond with strong feelings of anxiety and fear. These feelings, together with the secondary responses of the autonomic nervous system, evoke an inevitable and rapid response to the threat, either in terms of freezing so the animal cannot be seen, or running away as fast as possible. An animal (such as a mongoose) whose behaviour patterns indicate the desirability of fighting the snake would exhibit strong anger. The important features of a sur-

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vival reflex is that it may be evoked by a very small stimulus, it is associated with strong negative emotional feelings, and it does not habituate, that is to say that repeated exposure to the stimulus does not result in any reduction of the response or attenuation of the perception, but rather may be enhanced by further exposure to the stimulus. A survival reflex dictates a rapid response. In this analogy cortical perception and subsequent evaluation of the signal may take in excess of half a second. Connections with the limbic system allow for a strong emotional and autonomic response at the earliest possible moment.

THREAT DETECTION AS A FUNCTION OF NATURAL SELECTION

The ability to detect small signals indicating the presence of a predator strongly enhances an animal's chance for survival. Animals with damaged sensory function, or poor central processing capabilities will rapidly be compromised and end up inside the proverbial snake. With better threat detection capabilities they survive and their neuronal mechanisms will be passed to subsequent generations. Thus the process of natural selection and evolution can be seen to rapidly select those animals with the best threat detection mechanisms. With mankind at the end of an evolutionary chain, threat detection mechanisms are also highly developed.

THE SIGNIFICANCE OF THE SURVIVAL STYLE REFLEX TO MAN

In a so-called civilised society life threats become less common, and the persona of the predator takes on another guise. Nevertheless we are all familiar with the feeling of unease walking down a dark street in a strange city late at night. Sensory systems are set to detect and analyze any new information in the environment that could mean danger. The more anxious a person we are, the more we tune the system to look for threats. In many situations the survival style reflex pathways may be activated by threats to life quality rather than to the threat of impending death. The same feelings of distress and anxiety may be elicited by the sound of a television through the wall, although our response is much influenced by cognitive variables. Does the television belong to an unpleasant neighbour or a much loved family member?

TINNITUS AS A LIFE QUALITY THREAT; EFFECTS OF NEGATIVE COUNSELLING

In cases where tinnitus evokes very severe distress, usually a mixture of fear or anxiety, and anger or irritation, there is almost always a strong belief that tinnitus possesses negative properties which are believed to have an inevitable impact on life quality in the future. We have identified a list of common negative beliefs from our tinnitus patients (Table 1). In clinical practice these negative beliefs may be easily acquired if they do not develop spontaneously. Enquiries about the meaning of tinnitus will result in the discovery of other people who have had bad experiences and who continue to be troubled by tinnitus over long periods of time. Prophets of doom are much more prevalent than angels of mercy. Much of the available literature (even from tinnitus 'support' groups), and to which people turn, contains the information that there is no treatment for tinnitus, that little is known about it and that you have to put up with it. A high proportion of health care professionals use this information to compose a short homily which is delivered to the tinnitus patient; that little can be done. Examination of the clinical milestones of patients with tinnitus reveals that these episodes of negative counselling are very strongly associated with exacerbation in tinnitus distress, the emotional reaction to tinnitus and also its perception, e.g. increasing loudness, more continuous duration of perception etc.

Table 1: Commonest beliefs in distressing tinnitus

Tinnitus will get worse
Tinnitus will go on forever
Tinnitus is a physical disease
There is no treatment for tinnitus
I will be deprived of sleep because of tinnitus
Tinnitus will make me go deaf
Tinnitus will make me go mad/I won't be able to stand it
Tinnitus is caused by a tumour
Tinnitus means I will have a stroke
My ability to cope will be severely reduced
My family life / social life will suffer greatly

CHANGES IN NEGATIVE BELIEFS DURING RETRAINING THERAPY

Our main therapeutic approach is termed retraining therapy [2-4]. A major component is a technique of directive counselling aimed at changing patients' beliefs about the meaning of tinnitus, and instilling a benign hypothesis based on the neurophysiological model of tinnitus[5-7]. In a randomized trial we have placed patients into therapy groups receiving sound therapy by low levels of broad band noise, by amplification of environmental sounds, or by directive counselling alone. Fig. 1 shows the change in negative beliefs of all of 128 patients progressing through a one year retraining programme. Each measurement episode is also a directive counselling session. After the first and second session there is a significant change in the belief status of all patients.

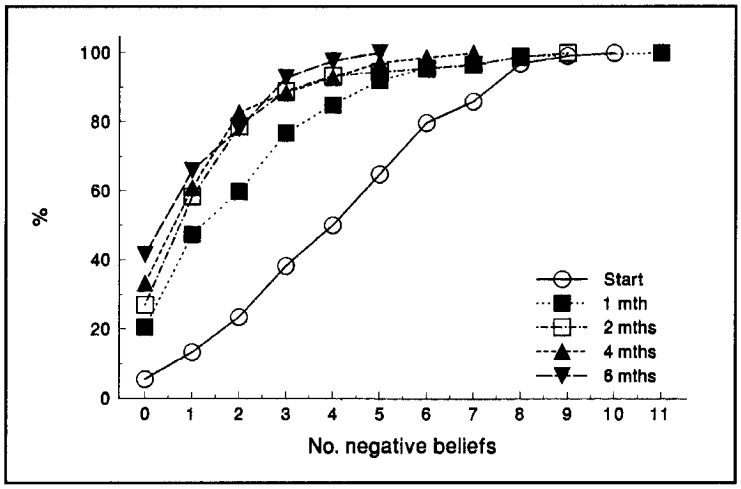

Figure 1: Cumulative distributions of the percentage of patients who had negative beliefs less/equal to a given value on the horizontal axis. Open circles/solid line indicate measurements at the start of treatment. Solid squares/dotted line: 1 month later; Open squares/dash-dotted line: 2 months later; Solid, up triangles/dashed line: 4 months later; Solid, down triangles/long dashed line: 6 months later. Note the shift in the distribution from the start of treatment and 1 - 6 months later.

CONCLUSION

The development of tinnitus distress is related to the development of negative beliefs about the nature of tinnitus, its future course and the effect that it might have on the individual's life quality. The negative emotional experiences of those suffering from tinnitus are similar to those of other threats, particularly threats to life or life quality. The neurophysiological mechanisms are often similar to a survival style reflex in which a very small signal triggers sub- cortical pathways in a process of selective signal detection and enhancement, with strong limbic and autonomic stimulation. The stimulus in tinnitus may be constantly present, in contradistinction to a survival reflex, thus evoking a state of continuing distress.

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