

Agnieszka J. Szczepek and Birgit Mazurek

Dear Reader,

You have in your hand a book containing years of experience and summarizing the work of many clinical and basic scientists: ENT/ORL specialists, audiologists, epidemiologists, psychologists, pharmacologists, psychosomatic medicine specialists, biologists, and neuroscientists. Despite various backgrounds, all of these specialists have dedicated their professional life—at least to some extent—to *better understand the interactions between tinnitus and stress*. But is tinnitus not an auditory problem? Why are so many scientific disciplines taking interest in tinnitus and why stress?

Tinnitus is a phantom sound perceived only by the affected person and can be a symptom of a variety of diseases. A majority of these diseases have a common denominator: they cause hearing loss, their treatment causes hearing damage, or they are associated with overstimulation of the somatosensory system (Shore et al. 2016). The fact that tinnitus is associated with hearing loss has been known for a long time, and it is also known that not all patients with hearing loss necessarily develop tinnitus (Mazurek et al. 2010). The mechanisms of how hearing loss may induce tinnitus are not the topic of this book and are discussed elsewhere, for instance, by Jos Eggermont and Larry Roberts (2004). First looking at Table 1.1 makes one realize that although tinnitus is an auditory symptom, the illnesses associated with tinnitus are distributed over the entire medical field. This, of course, has consequences in *if* and *how* will the patients be treated for their tinnitus symptoms.

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Table 1.1 Known risk factors for developing tinnitus and conditions associated with tinnitus *partially based on Baguley et al. (2013)*

Medical conditions	
Otological, infectious	Otitis media, labyrinthitis, mastoiditis
Otological, neoplastic	Vestibular schwannoma, meningioma
Otological, labyrinthine	Sensorineural hearing loss, Ménière's disease, vestibular vertigo
Otological, other	Impacted cerumen, otosclerosis, presbycusis, noise exposure
Neurological	Meningitis, migraine, multiple sclerosis, epilepsy
Traumatic	Head or neck injury, loss of consciousness
Orofacial	Temporomandibular joint disorder
Cardiovascular	Hypertension
Rheumatological	Rheumatoid arthritis
Immune mediated	Systemic lupus erythematosus, systemic sclerosis
Genetically mediated	Paget's disease, Alport's syndrome
Infectious diseases mediated	Mumps, Rickettsia, Leishmania
Mitochondrial dysfunction	Nonsyndromic mitochondrial hearing loss, MELAS syndrome
Endocrine and metabolic	Diabetes mellitus, hyperinsulinemia, hypothyroidism, hormonal changes during pregnancy
Psychological	Anxiety, depression, emotional trauma
Ototoxic medications	Analgesics, antibiotics, antineoplastic drugs, corticosteroids, diuretics, immunosuppressive drugs, nonsteroidal anti-inflammatory drugs, steroidal anti-inflammatory drugs, phosphodiesterase 5D inhibitors, methadone, pegylated interferons, inhibitors of viral reverse transcriptase

Tinnitus is a phantom sound perceived only by the affected person and can be a symptom of a variety of diseases and conditions.

Stress is a physiological reaction of the organism to the environmental changes that helps in adaptation to new, unknown circumstances. This reaction is possible because of stress hormones. How, when, and where these hormones are produced and what kind of consequences their presence may have are presented by Ron de Kloet and Agnieszka Szczepek in Chap. 2.

Clinical experience continuously teaches us that **the interface between tinnitus and stress** can change the course of treatment and of convalescence. Patients themselves refer to the emotional or social stress as a major factor influencing the onset and progression of their tinnitus. Further, the already existing tinnitus may act as stressor, thus leading to therapeutic impasse (see Chap. 3 written by Sylvie Hébert, Birgit Mazurek, and Agnieszka Szczepek). Therefore, it is important to recognize

stress and to deal with it and stress-induced conditions that may worsen tinnitus. Similarly, tinnitus-related stress may worsen both—tinnitus itself and comorbid psychological conditions.

The interface between tinnitus and stress can change the course of treatment and of convalescence.

A recent study recognized the **diversity of medical specialists treating tinnitus** (see Fig. 1.1) (Baguley et al. 2013). In practice, this means that in various countries, patients with tinnitus may be seen by practitioners with different medical backgrounds. It is common knowledge that not all health practitioners are by default trained in recognizing and treating the consequences of stress, present in form of depressiveness, generalized anxiety, tinnitus-related distress, and other symptoms. We are fully aware of the fact that the uniform and universal medical treatment of tinnitus all over the world is not possible, at least not yet. However, what is possible would be the additional knowledge sharing—and with this in mind, we wrote this book for you.

Many physicians refer tinnitus patients to specialized centers, but at the same time, the majority of patients report first being told that their condition is “incurable,” that “they have to learn how to live with it,” or that “nothing can be done” for them. The way in which such declarations are delivered to the patient may have enormous negative psychological consequences and can worsen tinnitus-related distress.

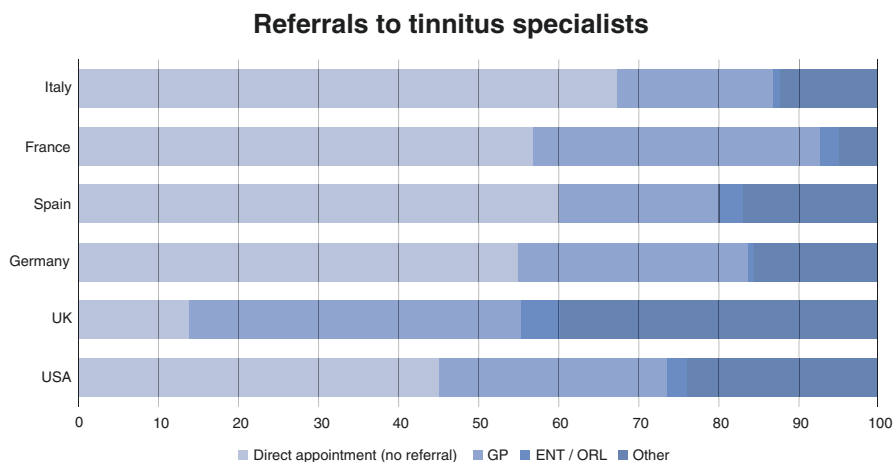


Fig. 1.1 Percentage of medical practitioners referring the patients with tinnitus to specialized individuals or centers depending on a country. *Based on data published in Baguley et al. (2013)*

Telling the patients with tinnitus that their condition is “incurable,” that “they have to learn how to live with it,” or that “nothing can be done” may have an enormous negative psychological consequences and can worsen tinnitus-related distress.

1.1 Tinnitus and Tinnitus-Related Distress

To apply proper therapy, it is important to differentiate between tinnitus and the tinnitus-related distress. Treatment of tinnitus percept is connected with a treatment of the disease that caused tinnitus, such as for instance treatment of hearing loss with cochlear implants will often result in tinnitus regression (Olze et al. 2011).

Perceiving tinnitus does not necessarily mean being distressed by it (Fig. 1.2). Further, the subjective loudness or pitch of tinnitus must not automatically correlate with the degree of tinnitus-related distress (Bauer et al. 2016). In fact, in several cases of idiopathic tinnitus or tinnitus with known but incurable causes, the main therapeutic objective is to *reduce the distress caused by tinnitus*. By the way, when referring to measures of therapeutic success, one should distinguish what precisely was determined, for instance, tinnitus percept—by evaluating audiometric properties of tinnitus (e.g., tinnitus loudness or tinnitus pitch) or tinnitus-induced distress (e.g., visual analogue scales or one of multiple psychometric questionnaires) (Hall et al. 2016).

Recent discovery of genes and proteins responsible for the regulation of so-called daily or circadian rhythms in the auditory system has dramatically changed our view on how the hearing functions. This discovery explains for instance changing susceptibility of the ear to noise-induced damage depending on the time of the day. Interestingly, the circadian rhythms are highly sensitive to the emotional and

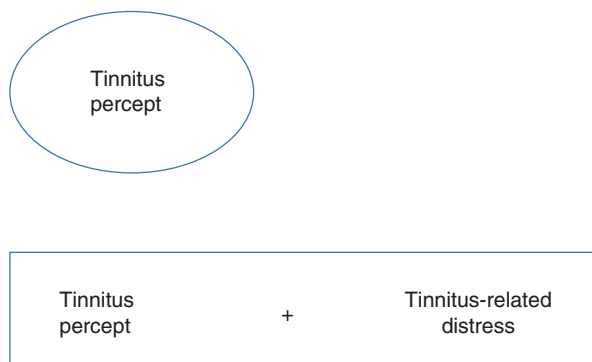


Fig. 1.2 Tinnitus may or may not be accompanied by a tinnitus-related distress

social stress. In Chap. 4, Christopher Cederroth, Vasiliki Basinou, Jung-Sub Park, and Barbara Canlon explain the insides of the internal clock in the ear and its connection with stress.

A bulk of tinnitus research has been done using animal models. Without these experiments we would be far from what we know about tinnitus today. Understanding the experimental set-ups, the ways tinnitus can be induced and measured, and finally the experimental backgrounds used in stress science is essential when translating the basic science results into the clinical situation. In Chap. 5, Jos Eggermont explains how animals help us understanding the paradigm of tinnitus and stress.

The diagnosis of tinnitus-related distress is commonly made based on psychometric instruments (questionnaires). Such instruments are considered as subjective methods. In search of the objective diagnostic means, we present state of the art regarding the use of biomarkers in diagnosis of stress-related conditions as well as in tinnitus (Chap. 6 written by Agnieszka Szczepek and Birgit Mazurek).

Furthermore, we deal with the stress-related psychometric diagnosis (Chap. 7 written by Matthias Rose and Petra Brüggemann), stress-related treatment options (Chap. 8 written by Rilana Cima), and stress-related outcome measurement when treating *tinnitus-related distress* as well as *stress-related comorbid conditions* (Chap. 9 written by Deborah Hall). Although at first these three last chapters may seem redundant—they are not. In Chap. 7, we present and discuss the instruments used to measure stress in general and in context of tinnitus. In Chap. 8, some of the instruments are presented as accompanying various psychological therapy settings. The last Chap. 9 presents and reviews the instruments predominantly used as outcome measurements in clinical trials, which are assessing the effectiveness of drugs and other means of intervention. In addition, as the book is also intended for the electronic version to be read in full or in chapters, we wanted the reader to have access to full information rather than forcing him or her to purchase additional chapters.

In the spring of 2015, Birgit Mazurek and I were contacted by Elisa Geranio from Springer International, who followed our work in the field of tinnitus and stress and suggested writing a book about it. We have met in summer 2015, during the Third Congress of European ORL-HNS in Prague, and while sipping espresso in the exhibition grounds, we talked about this project, discussing the best and the most up-to-date topics for chapters. Over a year has passed, all of our contributors did a great job, and now it is time to finish the last polishing steps and send the book to the publishing house. Our main intention was to help the health practitioners see two, often underestimated aspects of tinnitus, being *the exaggeration of tinnitus symptoms* and *the external stress contributing to the amplification of tinnitus*. Tinnitus is a symptom that clinically requires multiple level competences to be dealt with. Our hope is that the otologists, ENT/ORL specialists, audiologists, and the general practitioners who consult with tinnitus patients and refer them to specialized tinnitus units will benefit from the practical knowledge of stress-related aspects relevant for the treatment of patients with tinnitus.

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