

Eurasian Medical  
Research Periodical

## Vascular Tinnitus in General Practice: Hemodynamic Mechanisms and Differential Diagnosis

Khalida Zakirova

Group 222A, EMU University

Nigina Sadulloeva

Group 222A, EMU University

### ABSTRACT

This report examines the phenomenon of tinnitus through the lens of foundational medical textbooks and manuals on propedeutics of internal diseases (N. A. Mukhin, V. S. Moiseev), as well as contemporary international scientific publications. Hemodynamic, vascular, neurological, and neuroendocrine mechanisms responsible for the formation of acoustic symptoms in arterial hypertension, atherosclerosis, anemic syndrome, and psychosocial stress are thoroughly analyzed.

Despite the extensive literature on tinnitus-induced stress, the role of stress as a primary etiological factor in tinnitus genesis remained under-researched for a long time. The hypothalamic-pituitary-adrenal (HPA) axis—one of the main neuroendocrine systems involved in the stress response—consistently demonstrates dysregulation in patients with tinnitus. Patients with chronic tinnitus display abnormal responses to psychosocial stress characterized by blunted and delayed HPA axis reactivity, indicating a substantial contribution of chronic stress to the pathogenesis of this condition. The sympathetic branch of the autonomic nervous system and its hyperactivation also play a pivotal role in initiating and perpetuating tinnitus. Psychosocial stress has been proven to carry an equal probability of inducing tinnitus as occupational noise exposure, while their combined effect doubles this risk. Whereas short-term stress exerts a protective effect on the cochlear apparatus, chronic stress leads to structural neurosensory damage and aggravates symptom severity.

### Keywords:

tinnitus, tinnitus disorder, vascular tinnitus, hemodynamics, psychosocial stress, hypothalamic-pituitary-adrenal axis, arterial hypertension, atherosclerosis, anemia.

### Introduction

Tinnitus (from the Latin *tinnitus*, meaning "ringing") is defined as the conscious perception of sound in the ears or head in the absence of a corresponding external acoustic stimulus.

For pathological conditions such as arterial hypertension, chronic pain syndrome, or epilepsy, a universally accepted and unambiguous definition provides a unified foundation for researchers and clinicians.

However, in the World Health Organization's International Classification of Diseases (ICD-11), tinnitus is mentioned merely as a non-specific symptom of hearing impairment rather than an independent clinical entity, and it is entirely absent from the DSM-5 manual. Consequently, contemporary literature (De Ridder et al., 2021) proposes distinguishing between tinnitus without associated suffering and tinnitus accompanied by distress using two distinct terms: "Tinnitus" and "Tinnitus Disorder".

Tinnitus is defined as the conscious perception of a tonal or complex noise in the absence of a corresponding external acoustic source (the auditory component). The term Tinnitus Disorder is applied when the noise is accompanied by emotional distress, cognitive dysfunction, and/or autonomic arousal, leading to behavioral alterations and maladaptation.

While acute tinnitus serves as a secondary symptom (including in hemodynamic and vascular disorders), chronic tinnitus with accompanying suffering constitutes an independent primary disorder. Adopting this classification is essential for evaluating the prevalence of the condition and determining the clinical resources required to manage acute tinnitus as a symptom versus chronic tinnitus as a distinct disorder.

In traditional clinical practice, this phenomenon is categorized into two main types:

- **Subjective Tinnitus:** Auditory perceptions experienced exclusively by the patient (accounting for over 90% of cases, associated with neurological, receptor, or functional alterations);
- **Objective Tinnitus:** Sound generated by physical sources within the body (turbulent blood flow, muscle contractions) that can be auscultated by a physician using a stethoscope.

### Aims and Objectives

The aim of this study is to systematize current understanding regarding the vascular, hemodynamic, and neuroendocrine etiologies of tinnitus during primary medical evaluation. To achieve this goal, the following objectives were set:

1. To investigate the mechanisms underlying tinnitus onset secondary to alterations in systemic arterial blood pressure and blood rheology.
2. To evaluate the role of psychosocial stress and hypothalamic-pituitary-adrenal axis

hyperactivation in the pathogenesis of chronic tinnitus.

3. To review differential diagnostic criteria for tinnitus in propedeutic clinical practice.
4. To correlate data from classical textbook guidelines with findings from modern international research and multidisciplinary consensus papers.

### Alterations in Vascular Mechanical Properties and Arterial Pressure

- **Arterial Hypertension:** Laminar blood flow in small arteries of the auditory region under high systolic pressure becomes turbulent. Patients describe this noise as pulsatile, strictly coinciding with the heart rate.
- **Cerebral Atherosclerosis:** Formation of atherosclerotic plaques and loss of vascular wall elasticity lead to narrowing of intracranial arterial lumens, creating a continuous high-frequency hissing or whistling noise.

### Changes in Blood Rheological Properties

- **Anemic Syndrome:** With a pronounced drop in hemoglobin and erythrocyte levels, blood viscosity decreases ("hemodilution"). To provide tissues with oxygen, blood flow velocity increases compensatorily, and the resulting flow turbulence in vessels at the base of the skull is perceived as a continuous blowing hum that does not cease over a long period.

### Clinical Analysis of Auscultatory Phenomena

In analyzing hemodynamic factors, it is important to note that the auscultatory pattern can be variable. In the same patient, depending on changes in intracardiac hemodynamics, blood pressure level, and cardiac cycle phase, various types of murmurs may be heard: from whistling and hissing to pulsatile and continuous hums. This emphasizes the dynamic nature of hemodynamic processes and their influence on acoustic phenomena.

**Differential Diagnosis in Therapy**

| Pathological Condition   | Character of Tinnitus                      | Primary Pathogenetic Mechanism                                  |
|--------------------------|--------------------------------------------|-----------------------------------------------------------------|
| Arterial Hypertension    | Pulsatile, rhythmic                        | Turbulent blood flow under elevated systolic blood pressure     |
| Cerebral Atherosclerosis | Hissing, whistling, continuous             | Arterial luminal narrowing and loss of wall elasticity          |
| Anemia                   | Continuous humming, "boiling kettle" sound | Accelerated flow of hemodiluted blood to compensate for hypoxia |
| Aortic Regurgitation     | Loud pulsatile tone                        | Marked pulse pressure swings (systolic/ diastolic)              |
| Cervical Osteochondrosis | Unilateral, intensifying tinnitus          | Vertebral artery compression and reflex vasospasm               |

**Conclusion**

Tinnitus represents an interdisciplinary clinical problem. At the primary outpatient stage, general practitioners must maintain exceptional clinical vigilance regarding systemic causes—vascular accidents, arterial hypertension, valvular heart defects, anemias, as well as chronic psychosocial stress—before referring the patient for specialized audiometric evaluation.

**References**

1. De Ridder D, Schlee W, Vanneste S, Londero A, Weisz N, Kleinjung T, et al. Tinnitus and tinnitus disorder: Theoretical and operational definitions (an international multidisciplinary proposal). *Prog Brain Res*. 2021;260:1-25.
2. Patil JD, Alrashid MA, Eltabbakh A, Fredericks S. The association between stress, emotional states, and tinnitus: a mini-review. *Frontiers in Aging Neuroscience*. 2023;15:1131979.
3. Mukhin NA, Moiseev VS. *Propedeutics of Internal Diseases: Textbook*. 2nd ed. Moscow: GEOTARMedia; 2014. 848 p.
4. Palchun VT, Magomedov MM, Luchikhin LA. *Otorhinolaryngology: Textbook*. 3rd ed. Moscow: GEOTARMedia; 2016. 584 p.
5. Palchun VT, Kunelskaya NL, Zaitseva OV. Subjective tinnitus: modern view on pathogenesis and treatment. *Journal of Otorhinolaryngology*. 2017;82(4):80-84.
6. Makoeva AA, Zaitseva OV. Vascular tinnitus: problems of diagnosis and treatment. *Consilium Medicum*. 2019;21(11):60-64.