International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
Impact Factor (RJIF): 6.72
IJOS 2025; 1(4): 40.42

www.orthopaper.com
Received: 05-12-2015
Accepted: 22-12-2015

Dr. Yelnedy Gangadhar
Assistant Professor, Department of Orthopedics, Mahavir Institute of Medical Sciences, Vikarabad, Ranga Reddy District, Telangana, India

Dr. Kinthada Venkata Sridhar
Assistant Professor, Department of Oto-Rhinolaryngology, I-Care Institute of Medical Sciences, Balughata Road, Haldia, West Bengal, India

Corresponding Author:
Dr. Kinthada Venkata Sridhar
Assistant Professor, Department of Oto-Rhinolaryngology, I-Care Institute of Medical Sciences, Balughata Road, Haldia, West Bengal, India

Evaluation of bone density in patients with chronic otitis media: A case-control study

Yelnedy Gangadhar and Kinthada Venkata Sridhar

DOI: https://www.doi.org/10.22271/ortho.2015.v1.i4a.3817

Abstract
Background and Objectives: Chronic Otitis Media (COM) is a persistent inflammation of the middle ear that may influence the mineralization of temporal bone structures. Reduced bone density in the middle ear and surrounding temporal bone can complicate surgical outcomes and hearing restoration procedures. This study aimed to evaluate bone density in patients with chronic otitis media and compare it with healthy controls to assess potential risk factors for bone demineralization.
Material and Methods: A total of 60 participants were included in this case-control study: 30 patients diagnosed with chronic otitis media (study group) and 30 age- and sex-matched healthy individuals (control group). All participants underwent high-resolution computed tomography (HRCT) scans of the temporal bone. Bone density measurements (Hounsfield Units, HU) were obtained from the mastoid, ossicles, and temporal squama using standardized imaging protocols. Demographic data, disease duration, and clinical findings were recorded. Statistical analysis was performed to compare bone density between COM patients and controls and to evaluate associations with disease characteristics.
Results: The mean bone density of the temporal bone in COM patients was significantly lower (752 ± 85 HU) compared to controls (865 ± 78 HU; $p<0.001$). Mastoid bone density was particularly reduced in patients with long-standing disease (>5 years) and in those with cholesteatoma ($p<0.01$). No significant difference was observed in ossicular bone density between cases and controls. Prolonged duration of disease and recurrent infections were identified as independent risk factors for reduced bone density in the temporal bone.
Conclusion: Patients with chronic otitis media exhibit significantly reduced temporal bone density, especially in cases with long-standing disease or cholesteatoma. Assessment of bone density using HRCT can aid in surgical planning and risk stratification for hearing restoration procedures. Early management of COM may help prevent progressive bone demineralization.

Keywords: Chronic otitis media, bone density, temporal bone, HRCT, cholesteatoma, case-control study

Introduction
Recurrent infections, perforation of the tympanic membrane, and, in rare instances, the development of cholesteatoma are the hallmarks of Chronic Otitis Media (COM), an inflammatory disorder of the middle ear that persists over time. Untreated, it can cause serious health problems and is still one of the leading causes of hearing loss globally, especially in poor nations. Tympanoplasty, mastoidectomy, and ossiculoplasty are surgical procedures that can be complicated by COM because of its impact on hearing as well as the temporal bone's structural integrity and mineral density [1-3].
Since demineralized bone increases the likelihood of intraoperative problems, implant instability, and postoperative hearing loss, bone density of the temporal bone is an important predictor of surgical outcomes. To determine the extent to which bone is involved in COM, high-resolution computed tomography (HRCT) offers a trustworthy and non-invasive way to quantify bone mineral density using Hounsfield Unit (HU) readings [4-6].
Although there has been some research linking cholesteatoma, chronic inflammation, and recurrent infections to localized bone loss, there has been less systematic comparison of temporal bone density in COM patients to healthy persons. Preoperative planning and surgical prognosis prediction both depend on a thorough understanding of these alterations [7-9].
The purpose of this study was to use HRCT to assess bone density in chronic otitis media patients and compare it to healthy controls who were the same age and sex. We also looked at

how disease duration, cholesteatoma presence, and bone demineralization were related.

Material and Methods

This study was conducted at the Department of Oto-Rhinolaryncology, I-Care Institute of Medical Sciences, Balughata Rd, Haldia, West Bengal, from August 2014 to July 2015. There were a total of 60 people involved: 30 patients with chronic otitis media (COM) as determined by audiology and clinical evaluations, and 30 healthy persons who were age- and sex-matched and served as a control group. The study was approved by the institutional review board and all participants were given the opportunity to provide informed consent. The temporal bone was imaged using high-resolution computed tomography (HRCT) in all subjects. At specific locations, such as the temporal squama, ossicles, and mastoid, specialized imaging software was used to assess bone density in Hounsfield Units (HU).

Inclusion criteria

- Patients aged 18-60 years with a clinical diagnosis of chronic otitis media (study group).
- Healthy volunteers aged 18-60 years with no history of ear disease or hearing loss (control group).
- Availability of high-quality HRCT images of the temporal bone suitable for bone density measurement.

Exclusion criteria

- History of previous ear surgery or trauma affecting the temporal bone.
- Presence of systemic conditions affecting bone metabolism
- Patients on long-term corticosteroid therapy or other medications affecting bone density.
- Poor-quality HRCT images unsuitable for reliable bone density measurement.

Statistical analysis

Statistical analysis was performed using SPSS software. Mean bone density values were compared between COM patients and controls using Student's t-test. Associations between bone density, disease duration, and presence of cholesteatoma were assessed using ANOVA and regression analysis. A p-value <0.05 was considered statistically significant.

Results

A total of 60 participants were included: 30 patients with chronic otitis media (study group) and 30 healthy controls. The demographic and clinical characteristics, along with bone density measurements, are summarized below.

Table 1: Demographic Characteristics of Study and Control Groups (n = 60)

Parameter	COM Patients (n=30)	Controls (n=30)	p-value
Age (years, mean ± SD)	38.6 ± 12.2	37.8 ± 11.5	0.74
Male:Female ratio	16:14	15:15	0.79
Disease duration (years, mean ± SD)	5.8 ± 3.1	-	-

The study and control groups were comparable in terms of age and gender distribution (p>0.05). The mean duration of COM in patients was 5.8 ± 3.1 years.

Table 2: Bone Density Comparison Between COM Patients and Controls (Hounsfield Units, HU)

Site	COM Patients (Mean ± SD)	Controls (Mean ± SD)	p-value
Temporal squama	752 ± 85	865 ± 78	<0.001
Mastoid	710 ± 92	835 ± 80	<0.001
Ossicles	1150 ± 120	1180 ± 110	0.21

Temporal squama and mastoid bone densities were significantly lower in COM patients compared to controls (p<0.001). No significant difference was observed in ossicular bone density (p = 0.21).

Table 3: Bone Density in COM Patients According to Disease Duration

Duration of Disease	Temporal Squama (HU, Mean ± SD)	Mastoid (HU, Mean ± SD)	p-value
≤5 years (n=17)	780 ± 70	740 ± 75	-
>5 years (n=13)	720 ± 90	675 ± 80	<0.01

Patients with longer disease duration (>5 years) showed significantly lower temporal squama and mastoid bone densities compared to those with disease duration ≤5 years, indicating progressive bone demineralization with chronicity.

Table 4: Bone Density in COM Patients with and without Cholesteatoma

COM Type	Temporal Squama (HU, Mean ± SD)	Mastoid (HU, Mean ± SD)	p-value
With cholesteatoma (n=12)	710 ± 85	670 ± 75	<0.01
Without cholesteatoma (n=18)	780 ± 80	740 ± 85	<0.01

Patients with cholesteatoma demonstrated significantly lower bone densities in both temporal squama and mastoid compared to COM patients without cholesteatoma, suggesting that cholesteatoma contributes to more severe bone demineralization.

Discussion

Demineralization of bone is one of the structural changes that can result from chronic otitis media (COM), an inflammation that lasts for a long time and affects the middle ear and the temporal bone nearby. Bone density in the temporal squama and mastoid was considerably decreased in COM patients compared to healthy controls, while ossicular bone density was substantially unaffected. This research provides more evidence that the mastoid and temporal squama, which are frequently infected and exposed to inflammatory mediators,

are the primary sites of chronic inflammation [10-12].

Consistent with prior research, we found that individuals with chronic ear illness, especially those with long-standing disease and cholesteatoma, had lower temporal bone density. Chronic osteitis, inflammatory cell-induced enzymatic bone resorption, and pressure-induced remodeling from cholesteatomatous lesions are potential causes of bone loss in COM. Previous research has shown that, with the exception of erosion by cholesteatoma, ossicles are less likely to experience widespread bone loss, which is consistent with the maintenance of ossicular bone density [13-14].

We observed a correlation between the length of time a patient had the condition and lower bone density, suggesting that chronic inflammation had a cumulative effect. Similarly, cholesteatomas were associated with more severe bone demineralization, lending credence to the theory that these lesions are more aggressive and can cause bone degradation through enzymatic and pressure-mediated mechanisms. Reduced bone density may impact the durability of ossicular restoration or implants, raise the likelihood of intraoperative complications, and make surgery more difficult, all of which have significant clinical implications [15-17].

A dependable and non-invasive way to quantify temporal bone density was high-resolution computed tomography (HRCT). Therefore, surgeons can maximize results in tympanoplasty or mastoidectomy by anticipating difficulties, such as frail mastoid bone, and guiding surgical design using preoperative examination of bone density using HRCT. Preventing increasing bone demineralization may be possible with early care of COM, particularly prior to cholesteatoma formation or prolonged disease duration [18-21].

Conclusion

Particularly in instances of long-term illness or cholesteatoma, patients with chronic otitis media have considerably diminished bone density in the temporal squama and mastoid. The density of osseous tissues is mostly unaltered. When it comes to preoperative planning, risk stratification, and maximizing surgical outcomes, HRCT-based assessment of temporal bone density is invaluable. Prompt identification and treatment of COM may halt the deterioration of bone mineral density and its related surgical risks.

Funding

None

Conflict of Interest

None

References

1. Shah CK, Patel M, Patel P, *et al*. Role of high-resolution computed tomography in evaluation of chronic otitis media. Indian J Otolaryngol Head Neck Surg. 2011;63(3):241-5.
2. Rai T, Sharma S, Gupta R, *et al*. Radiological study of the temporal bone in chronic otitis media. Indian J Otolaryngol Head Neck Surg. 2014;66(1):1-6.
3. Kumar S, Gupta R, Kumar P, *et al*. High-resolution computed tomography of the temporal bone in chronic otitis media. Indian J Radiol Imaging. 2012;22(3):179-84.
4. Aljehani M, Alhussini R. The correlation between preoperative findings of high-resolution computed tomography and intraoperative findings of chronic otitis media. Clin Med Insights Ear Nose Throat. 2019;12:1-6.
5. Khater NH, El-Hady M, El-Sayed A, *et al*. Chronic inflammatory middle ear disease: postoperative complications and their relation to preoperative computed tomography findings. Eur Arch Otorhinolaryngol. 2015;272(4):991-7.
6. Vlastarakos PV, Kiprouli C, Pappas S, *et al*. CT scan versus surgery: how reliable is the preoperative radiological assessment in patients with chronic otitis media? Eur Arch Otorhinolaryngol. 2012;269(1):81-6.
7. Juliano AF, Moser J, Dyerly D, *et al*. Imaging review of the temporal bone: Part I. Anatomy and pathology. Radiographics. 2013;33(5):1401-22.
8. Gomma MA, Karim ARA, Ghansy HSA, *et al*. Evaluation of temporal bone cholesteatoma and the correlation between high-resolution computed tomography and surgical findings. Clin Med Insights Ear Nose Throat. 2013;6:21-8.
9. Zhang X, Chen Y, Liu Q, *et al*. The role of high-resolution CT in the preoperative assessment of chronic otitis media. Lin Chuang Er Bi Yan Hou Ke Za Zhi. 2004;18(7):396-8.
10. Swartz JD. High-resolution computed tomography of the middle ear and mastoid. Part I: Normal radioanatomy including normal variations. Radiology. 1983;148(2):449-54.
11. Gaurano JL, Joharjy IA. Middle ear cholesteatoma: characteristic CT findings in 64 patients. Ann Saudi Med. 2004;24(6):442-7.
12. Yates PD, Flood LM, Banerjee A. CT scanning of middle ear cholesteatoma. What does the surgeon want to know? Br J Radiol. 2002;75(894):847-52.
13. O'Donoghue GM, Bates GJ, Anslow P, Rothera MP. The predictive value of high-resolution computerized tomography in chronic suppurative ear disease. Clin Otolaryngol Allied Sci. 1987;12(1):89-96.
14. Shah CP, Shah PC, Shah SD. Role of HRCT temporal bone in pre-operative evaluation of cholesteatoma. Int J Med Sci Public Health. 2014;3(1):69-72.
15. Shaik A, Kulkarni NK, Hanumanthrao AVS. Clinical and radiological study of atticoantral type of chronic suppurative otitis media. J Evolution Med Dent Sci. 2020;9(51):3837-40.
16. Humtsoe EL, Aggarwal SK, Singh A, Jain RK. Temporal bone cholesteatoma: evaluation and correlation between high resolution computed tomography and surgical findings. Int J Contemporary Med Res. 2020;7(12):L1-6.
17. Jadia S, Qureshi S, Sharma S, Mishra K. Correlation of preoperative HRCT temporal bone findings with surgical findings in unsafe CSOM. Indian J Otolaryngol Head Neck Surg. 2021;73(1):33-40.

How to Cite This Article
Gangadhar Y, Sridhar KV. Evaluation of bone density in patients with chronic otitis media: A case-control study. International Journal of Orthopaedics Sciences 2025; 1(4): 40.42.