

## EPIDEMIOLOGICAL AND RADIOLOGICAL PATTERNS OF OTOSCLEROSIS: A RETROSPECTIVE STUDY

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**Abstract:** Otosclerosis is one of the main causes of deafness in adults, characterized by primary osteodystrophy of the otic capsule and sensorineural hearing loss. Even though Computed Tomography (CT) is the exam of choice, the findings can be subtle, since knowledge of radiological patterns can avoid underdiagnosis. Starting from patients with compatible clinics, a survey of the epidemiological and radiological behavior was carried out in a Brazilian public health institution, comparing it with available literature data, aiming to increase diagnostic accuracy.

A total of 31 patients with compatible clinical and tomographic findings were selected, and all images and corresponding reports were reviewed. As otosclerosis was clinically suspected in both mastoids of the 31 individuals studied, even if the CT evidence was only unilateral, both petrosal bones (62 in total) were included. Parameters such as age, sex and laterality were evaluated.

The disease was graded using the Symons and Fanning Classification: grade 1, exclusively fenestral; grade 2, patchy localized cochlear disease, with or without fenestral involvement, and extension to the basal cochlear gyrus or middle/apical gyrus or both basal and middle/apical gyri; grade 3, diffuse confluent cochlear involvement with or without fenestral involvement.

There was a higher prevalence in females (65%), in addition to bilateral involvement (54%) and in patients in the 4th decade of life (36%), followed by patients in the 5th decade (23%) and 3rd decade (19%).

Of the 62 CT scans evaluated, 48 had findings of primary osteodystrophy of the otic capsule, with grade 1 otosclerosis being the most common (62%), followed by grade 2 (24%) and, less common, grade 3 (12%). Such data are consistent with current literature.

Considering that the findings of otosclerosis

may be tenuous, despite clinically compatible, the study of the epidemiological and radiological profile proves to be a useful tool to improve diagnostic accuracy.

**Keywords:** otosclerosis; optical capsule; Hearing Loss; fenestral; cochlea

## INTRODUCTION

Otosclerosis is one of the main etiologies of sensorineural hearing loss in adults, characterized by primary osteodystrophy of the otic capsule. Computed Tomography (CT) is often used as the preferred imaging modality for evaluation. However, it is worth highlighting that tomographic findings can be subtle, which can result in underdiagnosis, highlighting the relevance of knowing radiological epidemiological patterns for a more accurate diagnosis.

## OBJECTIVES AND METHODS

In this study, a comprehensive investigation of the epidemiological and radiological behavior of otosclerosis was carried out in a Brazilian public health institution. The patient cohort included 31 individuals with symptoms compatible with otosclerosis and concordant tomographic findings, with the analysis encompassing both clinical data and corresponding CT images and reports.

It is important to note that although evidence of otosclerosis on CT was seen unilaterally in some cases, both mastoids were evaluated for all 31 participants, totaling 62 petrosal bones analyzed. Demographic parameters such as age, sex and handedness were meticulously documented for accurate sample characterization.

## CLASSIFICATION OF SYMONS AND FANNING

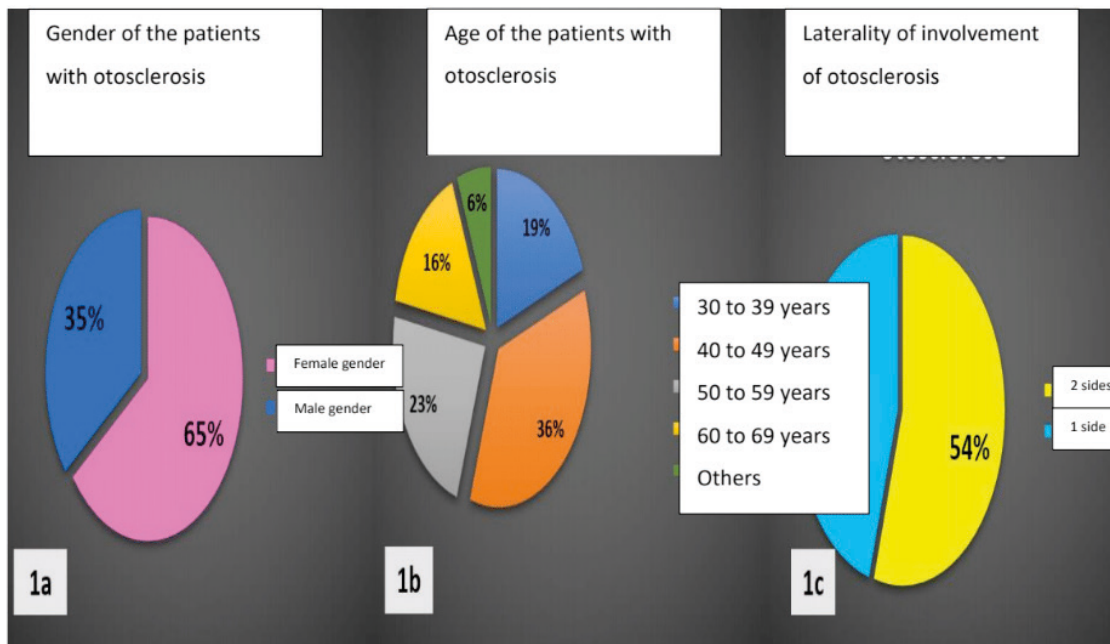
To classify the extent of otosclerosis, the Symons and Fanning Classification was used, which stratifies the disease into three distinct degrees, characterized as follows:

- Grade 1, characterized by exclusively fenestral involvement;
- Grade 2, which encompasses the presence of irregularly located cochlear disease, with or without involvement of the oval window. According to the site of cochlear involvement, it can be subclassified into: grade 2A (involvement of only the basal cochlear turn), grade 2B (involvement of the middle/apical turns), grade 2C (involvement of both the basal and middle/apical turns).
- Grade 3, which corresponds to confluent and diffuse cochlear involvement, with or without involvement of the oval window.

## RESULTS AND DISCUSSION

The results of this research, detailed in graphs 1a, 1b and 1c, characterized below, revealed a higher prevalence of otosclerosis in females, with a percentage of 65% of the cases analyzed. Furthermore, bilateral involvement of the disease was observed in 54% of patients. Regarding the distribution by age group, the fourth decade of life stood out with the highest proportion of cases, representing 36% of patients, followed by the fifth decade (23%) and third decade (19%).

Of the 62 CT scans of the temporal bones analyzed, 48 of them showed evidence of primary osteodystrophy of the otic capsule, with a characteristic distribution of otosclerosis. The classification of otosclerosis according to the Symons and Fanning Classification revealed that the grade 1 form was the most predominant, observed in 62% of cases, followed by grade 2, which corresponded to 24% of cases. Grade 3,



GRAPH 1a: Shows the prevalence of the disease according to the patient's gender. There was a higher prevalence in females (65% of cases).

GRAPH 1b: Shows prevalence of the disease according to the patient's age. There was a higher prevalence in patients in the 4th decade of life (36%).

GRAPH 1c: Shows laterality of disease involvement. There was a higher prevalence of bilateral involvement (54%).

which indicates more extensive cochlear involvement, was less common, representing 12% of cases. Regarding the subclassifications of grade 2 otosclerosis, the majority were categorized as grade 2B (15%), followed by grade 2A (7%) and grade 2C (4%).

These findings agree with the trends described in the current literature on otosclerosis. In particular, the predominance of grade 1 otosclerosis is consistent with the observation that the disease often manifests exclusively fenestraly. Furthermore, the results of this study corroborate the known demographic distribution of otosclerosis, which is more prevalent in women, generally affecting both ears and commonly diagnosed in individuals between 40 and 60 years of age.

## SELECTION OF ILLUSTRATIVE CASES

Below, some cases of the patients evaluated were selected, exemplifying each type of classification used. In Figure 1, a normal case can be seen, without findings of otosclerosis, for the purpose of comparison with pathological cases. Figure 2 shows a case of otosclerosis classified in group 1; in Figure 3 in group 2A; Figure 4 in group 2B; Figure 5 in group 2C; Figure 6 in group 3.

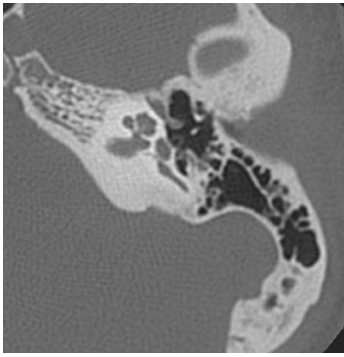


Figure 1: Axial CT images of the petrous bone without findings of otosclerosis in the left ear, of a 49-year-old patient with disease only on the contralateral side. Normal ante fenestram fissula (yellow arrow).

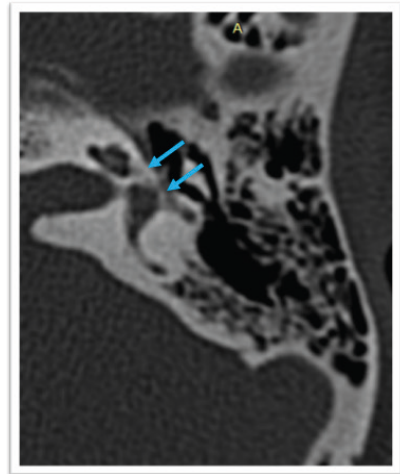


Figure 4: Axial CT images of the temporal bones with grade 2B otosclerosis in a 55-year-old female patient, showing a reduction in the usual bone density, which extends from the fissula ante fenestram to the middle turn of the cochlea (blue arrows).

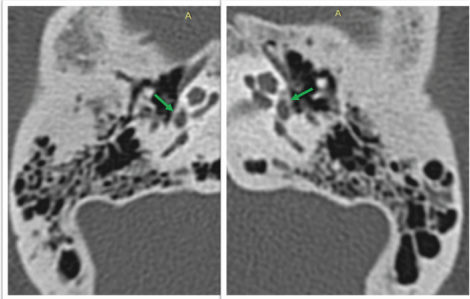


Figure 2: This axial image of a computed tomography (CT) of the temporal bones shows an example of a case of otosclerosis classified as Grade 1. This is a 40-year-old patient with the presence of a reduction in bone density in the ante-fenestram fissula of both the ears (green arrows).

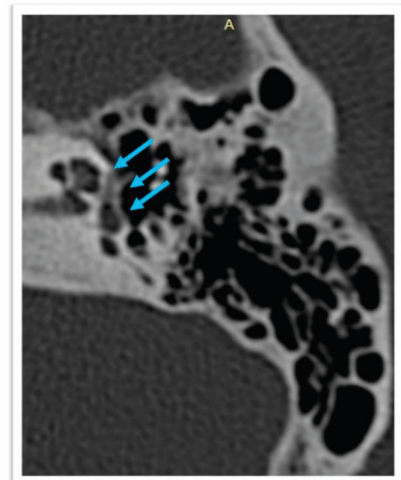


Figure 5: Axial CT images of the temporal bones with grade 2C otosclerosis in a 59-year-old male patient, noticing an irregular reduction in the usual bone density around the lateral aspect of the basal, middle and apical turns of the cochlea (blue arrows).

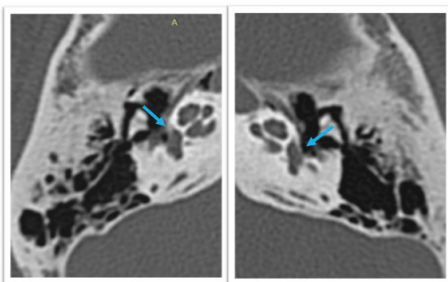


Figure 3: Axial CT images of the temporal bones showing otosclerosis classified as grade 2A in a 51-year-old male patient. Note a reduction in usual bone density and narrowing of the basal turn in both ears (blue arrows).

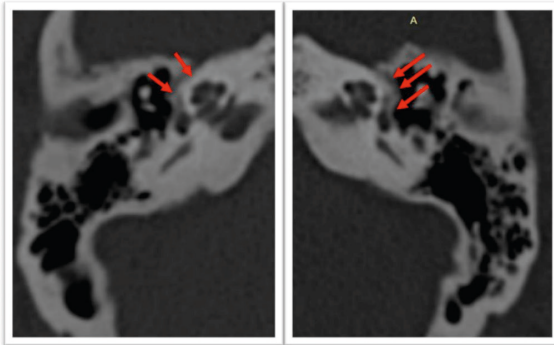


Figure 6: Axial CT images of the temporal bones with grade 3 otosclerosis in a 35-year-old patient demonstrated severe otosclerosis, with significant reduction in bone density around the cochlea (red arrows).

## CONCLUSIONS

In summary, this study provides a comprehensive analysis of the epidemiological and radiological aspects of otosclerosis in a cohort of patients in a Brazilian public health institution, contributing to a deeper understanding of this condition and, potentially, improving diagnostic accuracy in future clinical contexts. Considering the potential subtlety of tomographic findings in otosclerosis, even in cases with compatible symptoms, the comprehensive investigation of the epidemiological and radiological profile of this condition, whether in a context of large territorial coverage or restricted to a specific institution, emerges as a valuable tool to improve diagnostic accuracy.

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