

Radiological Case Report / Caso Clínico

Posterior Semicircular Canal Dehiscence Imaging Findings: Case Report

Achados Radiológicos da Deiscência de Canal Semicircular Posterior: Relato de Caso

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Abstract

Introduction: The temporal bone has a complex anatomy, including the semicircular canals in the vestibular system, which are essential for human balance. Posterior semicircular canal dehiscence (PSCD) is a rare condition characterized by bone erosion in this structure, leading to vestibulocochlear symptoms such as vertigo, tinnitus, and hearing loss.

Objective: To describe the radiological findings of a patient diagnosed with PSCD through high-resolution computed tomography using multiplanar reconstructions in the Stenvers and Pöschl views. **Results:** The findings included a high jugular bulb associated with dehiscence, while other inner ear structures remained intact. The radiological findings were correlated with the patient's symptoms, emphasizing the importance of imaging for accurate diagnosis.

Final Considerations: This case report contributes to the clinical and radiological understanding of PSCD, highlighting the importance of a multidisciplinary approach for management and its impact on patients' quality of life. Further studies are needed to deepen knowledge and improve therapeutic strategies.

Keywords

Posterior semicircular canal dehiscence; Vertigo; Vestibulocochlear; Otoneurology; Radiology.

Resumo

Introdução: O osso temporal apresenta uma anatomia complexa apresentando no aparelho vestibular os canais semicirculares, essenciais para o equilíbrio humano. A deiscência do canal semicircular posterior (DCSP) é uma condição rara caracterizada pela erosão óssea nessa estrutura, resultando em sintomas vestibulococleares como vertigem, zumbido e perda auditiva.

Objetivo: Descrever os achados radiológicos de um paciente diagnosticado com DCSP por tomografia computadorizada de alta resolução utilizando cortes multiplanares nas incidências de Stenvers e Pöschl.

Resultados: Os achados incluíram bulbo jugular alto associado à deiscência, com preservação das demais estruturas do ouvido interno, correlacionando os achados radiológicos aos sintomas apresentados e ressaltando a importância da radiologia para o diagnóstico preciso.

Considerações Finais: Este relato contribui para a compreensão clínica e radiológica da DCSP, ressaltando a importância de uma abordagem multidisciplinar para o manejo e o impacto na qualidade de vida dos pacientes. Estudos adicionais são necessários para aprofundar o conhecimento e aprimorar as estratégias terapêuticas.

Palavras-chave

Deiscência de canal semicircular posterior; Vertigem; Vestibulococlear; Otoneurologia; Radiologia.

1. Introduction

The temporal bone has a complex anatomical structure, fundamental to vestibular and auditory function. Among its main formations are the semicircular canals, which play an essential role in human balance.¹ Alterations in these canals, such as semicircular canal dehiscence (SCD), result in vestibulocochlear symptoms, including vertigo, tinnitus, and hearing loss.^{2,3} Posterior SCD is a rare condition characterized by erosion or absence of the bony layer covering the posterior semicircular canal, forming an anomalous "third window" in the bony labyrinth.^{4,5}

Despite its clinical impact, the diagnosis of posterior SCD is challenging due to its similarity to other otoneurological conditions and its low prevalence. For an accurate diagnosis of this anomaly, high-resolution computed tomography (CT) should be performed, which identifies specific anatomical alterations.⁴

There are few case reports based on radiographic findings, as they require a high degree of medical skill to verify them, which results in late diagnosis due to their difficult identification.^{5,6}

The medical literature addresses the most common anomalous vestibular disorders, one of which is superior SCD.^{7,8,9,10} The identification and description of a rare case of posterior SCD based on radiographic findings provides a better understanding of this pathological phenomenon. It also provides a basis for future research in neuroimaging and otoneurology.

Therefore, the following guiding question was defined: what are the radiological findings associated with posterior SCD and their correlation with clinical symptoms to improve the diagnostic capability of this condition?

2. Case Report

The manuscript was structured according to the CARE (Case Report Guidelines) guidelines, using the CARE-writer® tool to ensure observance of international standards whilst preparing clinical case reports. The full report is available at: <https://app.care-writer.com/share/38f92f6b-6b1e-45e5-ad08-a439f812011c>.

All procedures followed the ethical principles of Resolution 466/2012 of the National Health Council,¹² which regulates research involving human beings in Brazil. Written informed consent was obtained from the legal guardians of the clinic where the imaging exams were performed, ensuring anonymity and confidentiality. The study was approved by the Research Ethics Committee of the University of Alto Vale do Rio do Peixe (UNIARP), in report number 6.841.346 and CAAE 79134824.4.0000.0259.

J.G.G.C., a 13-year-old male, born and resident in Joinville, Santa Catarina, and an elementary school student, sought an otolaryngologist due to progressive hearing loss. He reported bilateral hearing loss and tinnitus for at least two years, and denied a history of traumatic brain injury. He denied allergies, continued medication use, or congenital diseases. He had a family history of hearing loss. On physical examination, he appeared in good general condition, with no scarring or otological alterations.

For clinical investigation, a non-contrast CT scan of the skull and ear was performed at Bethesda Hospital in Joinville, Santa Catarina. A mastoid CT scan was performed in July 2023 on a Canon Medical Systems Aquilion Prime SP Computed Tomography scanner using 80 channels simulating 160. The reconstructed volume was FC08, D-FOV 220.0 (M), X=256, Y=256, Interp TCOT+. Slice thickness of 0.5 mm, interval of 0.3 mm. A total of 167 images were obtained (Figure 1).

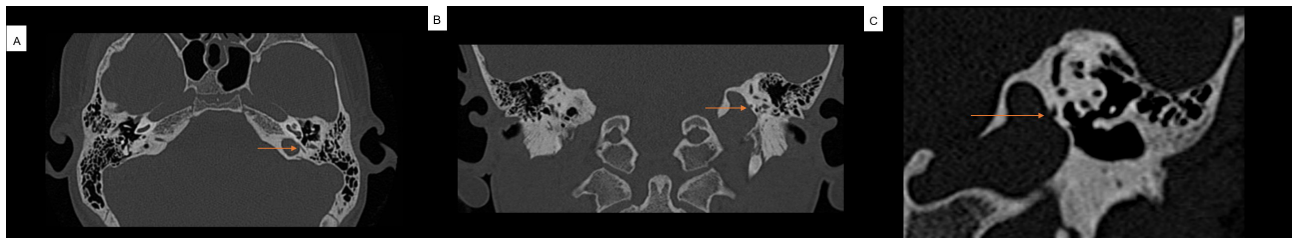


Figure 1 – Head CT of patient J.G.G.C., performed in Joinville, Santa Catarina, 2023. A- Axial plane section of the mastoid region. B- Coronal plane section of the mastoid region. C- Oblique coronal plane section of the mastoid region. Red arrows point to the high left jugular bulb, which is associated with semicircular canal dehiscence in A, B, and C. This anatomical alteration, associated with the patient's tinnitus and hearing loss, suggests a diagnosis of posterior SCD.

Radiological analysis allowed a correlation between these symptoms and the patient's tinnitus and hearing loss. CT revealed a high left jugular bulb, which is associated with posterior SCD on that side. Mastoid air cells and tympanic cavities showed normal aeration. Ossicular chains showed normal morphology and dimensions. Cochleae, vestibules, and other semicircular canals showed preserved morphology and attenuation coefficients. Internal auditory canals, vestibular aqueducts, and facial nerve canals were intact. Therefore, the diagnostic impression was a high left jugular bulb associated with dehiscence of the posterior semicircular canal on that side, supporting the diagnosis of SCD. The remainder of the CT scan of the mastoids showed no significant alteration.

3. Discussion

PSCD presents a diagnostic challenge due to its rarity and clinical similarity to other otoneurological conditions. The semicircular canals are formed by the superior, lateral, and posterior canals. Together with the vestibule, these structures give rise to the vestibular system.^{2,20} The semicircular canals respond to gravity and centrifugal force.² Therefore, morphological changes in these structures will affect spatial and movement perception causing hearing changes.^{4,21} In the presence of dehiscence, there is a loss of communication with the cerebrospinal fluid surrounding the brain. This triggers a dysfunction in the vestibulocochlear nerve, generating the signs and symptoms of vestibular disorders, where vertigo is the main symptom of vestibular syndrome.^{21,22}

The etiopathogenesis of SCD is not well defined. It is known that it may be related to abnormalities in embryonic bone development, anatomical abnormalities, or cranial trauma.^{4,23,24} Regarding the affected canal, Stimmer et al.,²⁵ conducted studies in 2011–2012 in Germany, where they analyzed 700 CT scans and identified the presence of 1.2% of dehiscence in the posterior canal.²⁵ No information was found regarding the percentage of this pathology in Brazil. SCD is usually unilateral.¹ However, many patients are asymptomatic.⁴ When symptomatic, signs and symptoms include autophony, sound- or pressure-induced vertigo, pulsatile tinnitus, chronic imbalance, aural fullness, hearing loss, and nystagmus evoked by sound or pressure and eye movements in the same direction may be observed depending on the affected canal.^{3,21} Due to the lack of evidence, the posterior canal is said to be rare and is usually associated with superior canal symptoms.^{23,24,26}

For the diagnosis of SCD, the classic symptoms, physiological evidence of the third mobile window and altered imaging examination should be considered. Other complementary exams include the tuning fork test, electrocochleography and Vestibular Evoked Myogenic Potential (VEMP).²¹ The patient in this case report presented complaints of bilateral hearing loss and tinnitus, in addition to the altered imaging examination with the presence of a high jugular bulb in the mastoid region on the left, unilateral, therefore suggesting the diagnosis of posterior SCD.

Differential diagnoses to be considered include vestibulocochlear disorders such as Ménière's disease, lesions of the vestibular nerve, vestibular nuclei, and cerebellum. Other causes associated with vertigo include multiple sclerosis, tumors, and vascular lesions of the brainstem.³

Regarding treatment, milder clinical symptoms are controlled by avoiding provocative stimuli, and in patients whose vestibular symptoms are disabling, surgery to close the dehiscence via the middle fossa can improve clinical manifestations.⁴

High-resolution CT is considered the gold standard, as it allows multiplanar views for detailed visualization of the posterior semicircular canal. Obtaining detailed images of tiny structures represents a significant technical challenge in radiological practice. The correct selection of parameters, such as slice thickness (usually between 0.5 mm and 0.625 mm), appropriate bone window (2800/600 or 4000/700), and specific angles for multiplanar reconstructions, is essential to avoid partial volume artifacts or artifacts caused by overlapping adjacent structures and to ensure diagnostic accuracy.²¹

Another important challenge is differentiating true dehiscences from pseudoanatomical alterations caused by partial volume artifacts or the overlapping of adjacent structures. Experienced radiologists are essential to properly interpret these images and correlate them with the patient's clinical presentation, minimizing false-positive diagnoses.

Furthermore, the use of post-processing tools, such as 3D reconstructions and bone density maps, increases diagnostic confidence.¹⁵ Therefore, CT of the temporal bones in reconstruction and the Pöschl and Stenvers view—axial and coronal planes parallel to the semicircular canal—confirm erosion at the apex of the semicircular canal.^{4,21}

4. Final Considerations

PSCD is a rare and challenging condition, whose identification requires the use of advanced imaging technologies and a detailed diagnostic approach. This case report highlighted the importance of high-resolution CT with specific radiological protocols, such as Stenvers and Pöschl views, for accurate diagnosis.¹¹ Correlation between radiological findings and clinical symptoms was essential for the diagnosis of PSCD.

Reports like this enrich the medical literature and reinforce the importance of a multidisciplinary approach for comprehensive, evidence-based care. Additional studies, with larger sample sizes and longitudinal data, are essential to expand our understanding of PSCD. (Table 1)

Table 1 - Bibliometric characterization of current publications on the subject. Caçador, Santa Catarina, 2024. (N=8)^{10,13,14,15,16,17,18,19}

N	Authors / Language	Title	Year	Type
1	Castellucci et al. ¹³ / Inglês	Posterior semicircular canal dehiscence with vestibulo-ocular reflex reduction for the affected canal at the video-head impulse test: considerations to pathomechanisms.	2024	Case series
2	Khandalavala et al. ¹⁴ / Inglês	Third window lesions of the inner ear: a pictorial review.	2024	Systematic review
3	Zarandy et al. ¹⁵ / Inglês	Prevalence of otic capsule dehiscence in temporal bone computed tomography scan.	2023	Case report
4	Fischer, Shih e Tolisano ¹⁰ / Inglês	Disambiguating concurrent superior and posterior canal dehiscence syndrome.	2022	Case report
5	Lee et al. ¹⁶ / Inglês	Posterior semicircular canal dehiscence: case series and systematic review.	2020	Systematic review
6	Dasgupta et al. ¹⁷ / Inglês	Audiovestibular quantification in rare third window disorders in children.	2020	Case report
7	Philip et al. ¹⁸ / Inglês	Posterior semicircular canal dehiscence: a diagnostic and surgical conundrum.	2019	Case report
8	Van Bulck, Leupe e Forton ¹⁹ / Inglês	Children with posterior semicircular canal dehiscence: a case series.	2019	Case report

Ethical Disclosures / Divulgações Éticas

Conflicts of interest: The authors have no conflicts of interest to declare.

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Confidentiality of data: The authors declare that they have followed the protocols of their work center on the publication of data from patients.

Confidencialidade dos dados: Os autores declaram ter seguido os protocolos do seu centro de trabalho acerca da publicação dos dados de doentes.

Protection of human and animal subjects: The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Proteção de pessoas e animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pelos responsáveis da Comissão de Investigação Clínica e Ética e de acordo com a Declaração de Helsínquia da Associação Médica Mundial.

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