

Vertebral Artery Stenosis Caused by Cervical Osteophyte: A Rare and Reversible Cause of Vertebrobasilar Insufficiency. Case Report

Estenose da artéria vertebral causada por Osteófito Cervical: Uma causa rara e reversível de insuficiência vertebrobasilar. Relato de caso

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Abstract

Bow Hunter syndrome manifests when the vertebral artery is compressed following head rotation. Symptomatic compression with vertebral artery stenosis due to cervical osteophytes is a rare cause and occurs due to a progressive degenerative process. In most cases, compression originates anteromedially from the uncinat process and is asymptomatic due to the competence of the contralateral vertebral artery. In the described patient, compression presented superomedially due to osteophytes in the superior articular facet of the C5 vertebra, and the contralateral vertebral artery was obstructed. Careful evaluation with imaging, mainly preoperative 3D angiotomography, is necessary to determine the most beneficial approach for decompression. The treatment of choice for symptomatic compression induced by cervical spondylosis is decompression surgery.

Keywords

- ▶ vertebral artery
- ▶ vertebrobasilar insufficiency
- ▶ osteophyte
- ▶ Bow Hunter's Syndrome

Resumo

A síndrome de Bow Hunter se manifesta quando a artéria vertebral é comprimida após a rotação da cabeça. A compressão sintomática com estenose da artéria vertebral devido a osteófitos cervicais é uma causa rara e ocorre devido a um processo degenerativo progressivo. Geralmente, a compressão se origina anteromedialmente do processo uncinado e é assintomática devido à competência da artéria vertebral

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Palavras-chave

- artéria vertebral
- insuficiência vertebrobasilar
- osteófito
- Síndrome de Bow Hunter

contralateral. No paciente descrito, a compressão se apresentou superomedialmente devido a osteófitos na faceta articular superior da vértebra C5, e a artéria vertebral contralateral estava obstruída. Uma avaliação cuidadosa com imagens, principalmente angiotomografia 3D pré-operatória, é necessária para determinar a abordagem mais benéfica para a descompressão. O tratamento de escolha para compressão sintomática induzida por espondilose cervical é a cirurgia de descompressão.

Introduction

Vertebral artery stenosis (VAS) can be caused by intrinsic lesions (such as atherosclerosis, vascular dissection, and vasculitis) and extrinsic lesions (including neoplasia, infections, fractures, fibrosis, and osteophytosis).^{1,2} Approximately a quarter of ischemic strokes occur in the territory of the posterior cerebral circulation, and 20-25% of these are caused by VAS.^{1,3}

Symptomatic compression with stenosis of this vertebral artery due to cervical osteophytes is a rare cause and occurs due to a progressive degenerative process affecting cervical vertebral bodies and intervertebral discs. This condition can lead the patient to present with ischemic strokes and/or Transient Ischemic Attacks (TIAs), also described as Vertebrobasilar Insufficiency (VBI).⁴⁻⁷

In most cases, compression originates anteromedially from the uncinat process and is asymptomatic due to the contralateral vertebral artery's competence.^{7,8} In the described patient, compression presented superomedially due to osteophytes from the superior articular facet of the C5 vertebra, and the contralateral vertebral artery was obstructed.

Case Report

A 76-year-old male patient, hypertensive, diabetic, and with chronic atrial fibrillation, sought medical attention due to multiple falls associated with vertigo for 2 months, worsening with rotation and extension of the head. Cardiovascular etiologies were ruled out, and he underwent cranial and cervical vessel angiotomography (ATC), showing complete occlusion of the right VA and stenosis of the left VA at the level of C4-C5 due to an osteophyte originating from the superior facet of the C5 vertebra with a superolateral direction, invading the vertebral foramen, with 80% occlusion (►Fig. 1).

Surgical treatment was proposed for AV decompression with posterior cervical arthrodesis using lateral mass screws at the level of C3-C4, C4-C5, and C5-C6, sparing the fourth and fifth left cervical vertebrae. Decompression of the left vertebral foramen at the level of C4-C5 was performed, with confirmation of arterial patency with intraoperative ultrasound.

The patient was discharged on the second postoperative day, with complete improvement of vertigo and falls. Follow-up angiotomography showed complete decompression of

the vertebral foramen and removal of the osteophyte, with patent VA (►Fig. 2).

Discussion

VA compression due to cervical spondylosis is an uncommon cause of VBI. When the symptomatology is generated by specific head movements, it is called Bow Hunter syndrome, described by Sorensen in 1978.⁸⁻¹²

Arterial blood flow can be impaired by intrinsic lesions (60%), with atherosclerosis being the most common cause, and extrinsic lesions (40%). Extrinsic compression due to osteophytes originating from the superior facet joint is rare and accounts for 6% of cases. The primary level of cervical involvement is C5-C6, with only 18% of cases at the C4-C5 level. More than 60% of patients with VBI experience at least

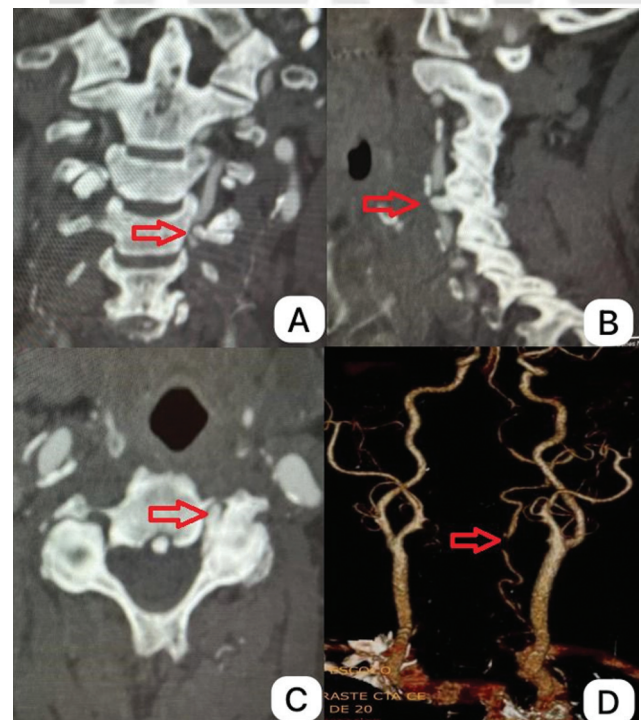


Fig. 1 CT of cervical vessels - coronal (A), sagittal (B), and axial (C) views showing osteophyte invading the vertebral foramen, with 80% occlusion of its diameter and compression of the left vertebral artery. Originating from the superior articular facet of the fifth cervical vertebra. Image D, 3D reconstruction showing interruption of flow through the left vertebral artery (red arrow).

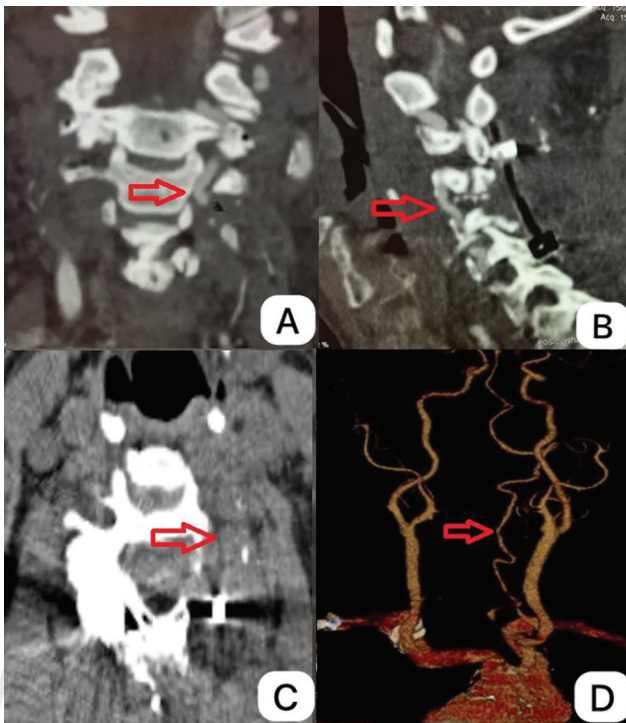


Fig. 2 Postoperative CT - coronal (A), sagittal (B), and axial (C) views showing decompressed left VA with preserved diameter. Image D, 3D reconstruction showing resumption of flow through the left vertebral artery with preservation of its diameter (red arrow).

one episode of vertigo during the disease. The most frequent symptoms are visual disturbances (diplopia, visual hallucinations, and blindness); sudden falls secondary to loss of tone in the lower limbs, without loss of consciousness, incoordination, and muscle weakness.¹³⁻¹⁹

Symptomatology is evident when the contralateral VA is congenitally atretic or hypoplastic, terminates as the posterior inferior cerebellar artery, or is occluded or stenosed by acquired processes. Neck movement to the ipsilateral side of the compression and neck extension typically intensify symptoms. ATC is widely used due to its availability and speed in obtaining a diagnosis, and when performed with 3D reconstruction, it can clearly show the extent of osteophyte formation and its relationship with the VA, facilitating appropriate surgical planning.^{15,20,21}

The treatment of choice for symptomatic compression induced by cervical spondylosis is decompression surgery. There are reports of antiplatelet therapy and other conservative therapies, but they are less effective. Regarding surgical strategies, some authors advocate the resection of non-bony tissues, such as muscle tendon, bone membrane, and other perivascular fibrous bands, in addition to osteophyte removal, to allow the VA to regain its initial caliber.²¹⁻²⁴

In a recent systematic review of VAS caused by osteophytosis, which evaluated 214 articles on the subject, surgical management with osteophyte resection was achieved in 45% of cases through anterior discectomy with fusion, followed by anterior decompression without fusion (28%), posterior decompression without fusion (21%), and only 3% with posterior decompression with fusion as described in our case.²⁵

The posterior surgical approach is indicated for the resection of osteophytes originating from the superior articular facet due to direct visualization of compression and complete resection thereof. We chose to perform arthrodesis of the affected levels in our patient due to the aggressiveness of the decompression and excision of the inferior articular facet of C4 and superior articular facet of C5 to access the vertebral artery located anterior to the nerve root.^{17,26,27}

During surgery, we utilized pre- and post-decompression osteophyte ultrasound to assess vascular patency, which proved to be an easy, instantaneous, effective, reliable, and cost-effective procedure, particularly considering the high cost of neuroimaging exams. Additionally, we avoided using electrical bipolar during vertebral artery and venous plexus manipulation to preserve vascularization.²⁸

Other surgical approaches may be used depending on osteophyte origin for better visualization and decompression. The anterior approach is suitable for marginal osteophyte resection, typically compressing the VA medially, while the anterolateral approach provides a better operative field for safely removing both superior articular and anterior transverse process osteophytes.^{17,26,27}

Solo decompressive surgery preserves the cervical range of motion, which is an important factor in the patient's functional ability to return to daily activities and quality of life. However, some authors report that isolated decompression carries a higher risk of postoperative recompression, leading authors to conclude that fusion is the safer option for patients.^{21,29,30}

Conclusion

Compression and insufficiency of the vertebral artery (VA) resulting from cervical spondylosis are relatively uncommon occurrences. Typically, they remain asymptomatic owing to the compensatory function of the contralateral VA. Therefore, patients experiencing persistent vertigo and sudden drop attacks despite normal cardiological evaluations should undergo a thorough examination to investigate the possibility of vertebral artery occlusion and vertebral basilar insufficiency. Precise preoperative evaluation, notably with the aid of 3D angiotomography, becomes imperative to ascertain the optimal approach for decompression.

Conflict of Interests

The authors have no conflict of interest to declare.

References

- Khan S, Cloud GC, Kerry S, Markus HS. Imaging of vertebral artery stenosis: a systematic review. *J Neurol Neurosurg Psychiatry* 2007;78(11):1218-1225
- Citow JS, Macdonald RL. Posterior decompression of the vertebral artery narrowed by cervical osteophyte: case report. *Surg Neurol* 1999;51(05):495-498, discussion 498-499
- Cloud GC, Markus HS. Vertebral artery stenosis. *Curr Treat Options Cardiovasc Med* 2004;6(02):121-127
- Kadanka Z, Mares M, Bednarík J, et al. Predictive factors for mild forms of spondylotic cervical myelopathy treated conservatively or surgically. *Eur J Neurol* 2005;12(01):16-24

- 5 Chagas H, Domingues F, Aversa A, Vidal Fonseca AL, de Souza JM. Cervical spondylotic myelopathy: 10 years of prospective outcome analysis of anterior decompression and fusion. *Surg Neurol* 2005;64(Suppl 1):S1, 30–35, discussion S1, 35–36
- 6 Theodore N. Espondilose Cervical Degenerativa. *N Engl J Med* 2020;383:159
- 7 Sadasivan KK, Reddy RP, Albright JA. The natural history of cervical spondylotic myelopathy. *Yale J Biol Med* 1993;66(03):235–242
- 8 Kubik CS, Adams RD. Occlusion of the basilar artery: a clinical and pathological study. *Brain* 1946;69(02):73–121
- 9 Special report from the National Institute of Neurological Disorders and Stroke. Classification of cerebrovascular diseases III. *Stroke* 1990;21(04):637–676
- 10 Savitz SI, Caplan LR. Vertebrobasilar disease. *N Engl J Med* 2005;352(25):2618–2626
- 11 Simoceli L, Bittar RMS, Bottino MA, Bento RF. Perfil diagnóstico do idoso portador de desequilíbrio corporal: resultados preliminares. *Rev Bras Otorrinolaringol* 2003;69:772–777
- 12 Edlow JA, Newman-Toker DE, Savitz SI. Diagnosis and initial management of cerebellar infarction. *Lancet Neurol* 2008;7(10):951–964. Doi: 10.1016/S1474-4422(08)70216-3
- 13 Nagashima C. Surgical treatment of vertebral artery insufficiency caused by cervical spondylosis. *J Neurosurg* 1970;32(05):512–521
- 14 Berguer R, Flynn LM, Kline RA, Caplan L. Surgical reconstruction of the extracranial vertebral artery: management and outcome. *J Vasc Surg* 2000;31(1 Pt 1):9–18
- 15 George B, Bruneau M, Spetzler R. Pathology and surgery around the vertebral artery. 2011
- 16 Madonis SM, Jenkins JS. Vertebral artery stenosis. *Prog Cardiovasc Dis* 2021;65(March):55–59
- 17 Olin JW, Gornik HL, Bacharach JM, et al; American Heart Association Council on Peripheral Vascular Disease American Heart Association Council on Clinical Cardiology American Heart Association Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation American Heart Association Council on Cardiovascular Disease in the Young American Heart Association Council on Cardiovascular Radiology and Intervention American Heart Association Council on Epidemiology and Prevention American Heart Association Council on Functional Genomics and Translational Biology American Heart Association Council for High Blood Pressure Research American Heart Association Council on the Kidney in Cardiovascular Disease American Heart Association Stroke Council. Fibromuscular dysplasia: state of the science and critical unanswered questions: a scientific statement from the American Heart Association. *Circulation* 2014;129(09):1048–1078
- 18 Olin JW, Froehlich J, Gu X, et al. The United States Registry for Fibromuscular Dysplasia: results in the first 447 patients. *Circulation* 2012;125(25):3182–3190
- 19 Duan G, Xu J, Shi J, Cao Y. Advances in the pathogenesis, diagnosis and treatment of bow hunter's syndrome: a comprehensive review of the literature. *Intervent Neurol* 2016;5(1-2):29–38
- 20 Burle VS, Panjwani A, Mandalaneni K, Kollu S, Gorantla VR. Vertebral artery stenosis: a narrative review. *Cureus* 2022;14(08):e28068
- 21 Zaidi HA, Albuquerque FC, Chowdhry SA, Zabramski JM, Ducruet AF, Spetzler RF. Diagnosis and management of bow hunter's syndrome: 15-year experience at barrow neurological institute. *World Neurosurg* 2014;82(05):733–738
- 22 Kieffer E, Praquin B, Chiche L, Koskas F, Bahnini A. Distal vertebral artery reconstruction: long-term outcome. *J Vasc Surg* 2002;36(03):549–554
- 23 Sloan MA, Alexandrov AV, Tegeler CH, et al; Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. Assessment: transcranial Doppler ultrasonography: report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology* 2004;62(09):1468–1481
- 24 Thomas B, Barreau X, Pointillart V, Sibon I, Renou P. Endovascular embolization of a nondominant vertebral artery compressed by an osteophyte to prevent recurrence of vertebrobasilar infarctions. *J Stroke Cerebrovasc Dis* 2015;24(09):e257–e259
- 25 Ndongo Sonfack DJ, Bojanowski MW, Tarabay B, Gennari A, Shédid D, Yuh SJ. Vertebral artery stenosis from osteophyte: A systematic review and case series. *Neurochirurgie* 2024;70(03):101525
- 26 Denis DJ, Shédid D, Shehadeh M, Weil AG, Lanthier S. Cervical spondylosis: a rare and curable cause of vertebrobasilar insufficiency. *Eur Spine J* 2014;23(Suppl 2):206–213
- 27 Bulsara KR, Velez DA, Villavicencio A. Rotational vertebral artery insufficiency resulting from cervical spondylosis: case report and review of the literature. *Surg Neurol* 2006;65(06):625–627
- 28 Méndez GEF, Chacón CJR, Núñez NJB, Zerpá JR. Utility of Intraoperative Ultrasound in Neurosurgery. *Braz Neurosurg* 2021;40(02):e113-e
- 29 Miele VJ, France JC, Rosen CL. Subaxial positional vertebral artery occlusion corrected by decompression and fusion. *Spine* 2008;33(11):E366–E370
- 30 Matsuyama T, Morimoto T, Sakaki T. Comparison of C1-2 posterior fusion and decompression of the vertebral artery in the treatment of bow hunter's stroke. *J Neurosurg* 1997;86(04):619–623