

AGENESIS OF THE POSTERIOR ARCH OF THE ATLAS: AN INCIDENTAL FINDING IN A POLYTRAUMATIZED PATIENT

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AGENESIA DEL ARCO POSTERIOR DEL ATLAS: UN HALLAZGO INCIDENTAL EN UN PACIENTE POLITRAUMATIZADO

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ABSTRACT

The first cervical vertebra is subject to numerous anatomical variations. One of these is posterior arch agenesis, which is classified into five distinct morphological types. Together, all types of posterior arch agenesis comprise only 4% of atlas variations. Furthermore, complete agenesis of the posterior arch associated with the presence of the posterior tubercle is rare. This work reports a case of posterior arch agenesis with the presence of the posterior tubercle in a 33 year-old male victim of a motor vehicle collision. Despite being asymptomatic, this anatomical variation can present with headaches and neck pain. It is mostly found as an incidental finding in imaging studies performed by the emergency team and, as a result, it is often misdiagnosed as a C1 fracture. Knowledge of the variations relating to the first cervical vertebra is therefore essential to avoid delays in diagnosis and treatment of polytraumatized patients. **Level of evidence V; Case report.**

Keywords: Cervical atlas; Congenital abnormalities; Multiple trauma; Anatomic variation.

RESUMO

A primeira vértebra cervical é alvo de inúmeras variações anatômicas. Uma destas inclui a agenesia do seu arco posterior, que é classificada em cinco tipos morfológicos distintos. Apesar de uma incidência de 4% na população em geral, a agenesia completa do arco posterior, associada à presença do tubérculo posterior do atlas, é rara. Objetivou-se no presente trabalho relatar a agenesia completa do arco posterior com a presença do tubérculo posterior da primeira vértebra cervical em um paciente de 33 anos de idade, que sofreu um acidente automobilístico. Em geral, essa condição é assintomática, porém, essa variação anatômica pode causar sintomas como dores de cabeça. Na maioria dos casos, é um achado acidental em exames de imagem realizados pela equipe de emergência. Como resultado, a agenesia de arco posterior de atlas pode ser interpretada erroneamente como uma fratura. Portanto, o conhecimento das variações anatômicas da primeira vértebra cervical é essencial para evitar erro no diagnóstico e tratamento de pacientes politraumatizados. **Nível de Evidência V; Relato de caso.**

Descritores: Atlas cervical; Anormalidades congênitas; Traumatismo múltiplo; Variação anatômica.

RESUMEN

La primera vértebra cervical puede presentar numerosas variaciones anatómicas. Una de ellas es la agenesia del arco posterior, que se clasifica en cinco tipos morfológicos distintos. En conjunto, todos los tipos de agenesia del arco posterior comprenden solo el 4% de las variaciones del atlas. Además, la agenesia completa del arco posterior asociada con la presencia del tubérculo posterior es rara. Este trabajo relata un caso de agenesia del arco posterior con presencia del tubérculo posterior en un paciente del sexo masculino de 33 años de edad que sufrió un accidente automovilístico. A pesar de ser asintomática, esta variación anatómica puede causar dolores de cabeza y cuello. Se encuentra principalmente como hallazgo incidental en pruebas de imagen realizadas por el equipo de emergencia y como resultado, a menudo se diagnostica erróneamente como una fractura de C1. El conocimiento de las variaciones anatómicas de la primera vértebra cervical es, por lo tanto, esencial para evitar retrasos en el diagnóstico y tratamiento de pacientes politraumatizados. **Nivel de Evidencia V; Relato de caso.**

Descriptor: Atlas cervical; Anomalías congénitas; Traumatismo múltiple; Variación anatómica.

INTRODUCTION

The first cervical vertebra (Atlas) is situated between the occipital bone and the second cervical vertebra (Axis). It is one of the main components of head movement, due to its joints, and it serves as an attachment for several muscles.¹

Anatomical variations of this vertebra are known in the literature.^{1,2}

Despite this, radiological assessment of living patients is uncommon, and some variations can be misinterpreted as fractures, causing confusion among physicians.³⁻⁵

This work reports a case of agenesis of the posterior arch of C1, which was presented as an incidental finding in a polytraumatized patient.

Study conducted at the Universidade Federal Fluminense, Morphology Department, Biomedical Institute, Niterói, RJ, Brazil.

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CASE REPORT

This study was conducted in accordance with the Declaration of Helsinki, and the patient signed an informed consent form.

A 33 year-old male patient was admitted to an emergency service following a motor vehicle collision. Although asymptomatic, he was submitted to the standard protocol for polytraumatized patients.

Radiological investigation showed a change in the cervical region: there was no continuity between the posterior tubercle of the atlas and its lateral masses. (Figure 1) Further examination showed that this condition was not caused by the trauma, as the patient had developed no symptoms whatsoever.

The patient signed an informed consent form, and is not identified in this manuscript.

DISCUSSION

During embryogenesis, the caudal half of the first cervical sclerotome fuses with the cranial half of the second cervical sclerotome,

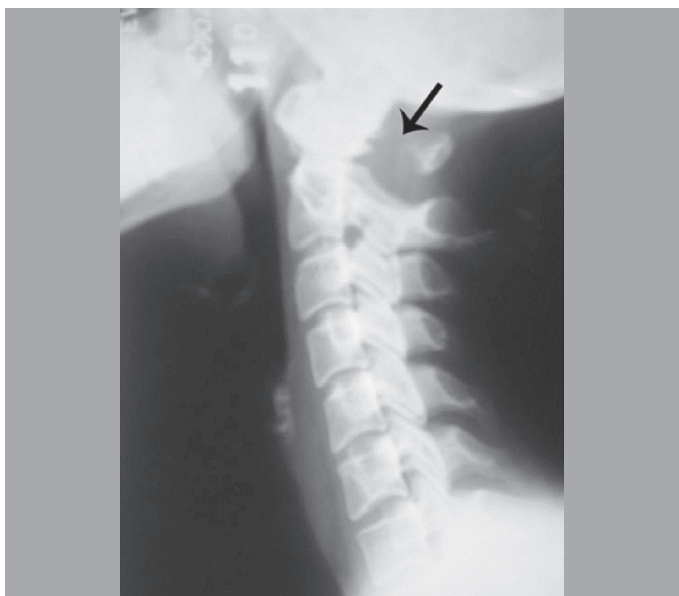


Figure 1. Lateral x-ray of the cervical column. The lack of posterior arch and presence of the posterior tubercle of the atlas can be seen (black arrow).

thus giving origin to the first cervical vertebrae.⁶ The atlas then undergoes endochondral ossification and possesses three ossification centers: two of these will form the lateral masses, while the remaining central one will give rise the dens of the axis.¹

The lamina originates from the lateral masses and expands dorsally to form the posterior arch of the atlas. In rare cases, the right and left laminae fail to fuse, leaving the posterior tubercle of the atlas isolated, a condition known as posterior arch agenesis.^{1,5,7} A secondary ossification center usually appears for the posterior tubercle.^{1,7}

The atlas also may be subject to numerous variations, such as its occipital assimilation, duplication, anterior arch agenesis, or even a bipartite atlas.^{2,5}

There are five distinct types of posterior arch agenesis, classified according to the form of fusion (A, B, C, D and E). The case presented herein is classified as Type D, described as "Absence of the posterior arch with persistent posterior tubercle".³

Posterior arch agenesis is a fairly uncommon condition that affects 4% of the general population.⁵ However, this prevalence refers to all posterior arch clefts, including minor defects, although some authors observe a prevalence of 0.69% for types C, D and E combined.⁸

An analysis of CT scans performed by Junewick et al. (2011)⁹ did not find a single case of type D. Furthermore, there are only a few reports of complete agenesis of the posterior arch with the presence of the posterior tubercle.^{3,8,10-16} A summary of these cases is given in Table 1.

Clinically, posterior arch agenesis is usually asymptomatic. There have been reports of symptoms such as intermittent tetraparesis, cervical pain, headache, and Lhermitte's sign, although these may be attributable to the trauma.^{5,17} The main concern for physicians is misdiagnosis of a fracture in cases of posterior arch agenesis, since it is mostly discovered as an incidental finding.^{7,9,17}

Despite the rare prevalence of the variation presented herein, anomalies of the first cervical vertebra are not uncommon. Hence, knowledge of the atlas variations are significant for healthcare professionals who deal with trauma or radiological studies, in order to avoid misdiagnosis.

All authors declare no potential conflict of interest related to this article.

Table 1. Summary of similar reported cases.

Author	Sex	Age	Type ³	Symptoms	Other congenital anomalies
Castãno-Duque et al. (1997) ¹⁰	Female	63	D	Cervicalgia and "seasickness"	None reported
Sharma et al. (2000) ¹⁶	Female	32	D	Pain and spinal stenosis	None reported
	Male	30	D	Neck pain and spinal stenosis	None reported
	Female	35	D	Neck pain and weakness in the upper limbs	None reported
Klimo Jr et al. (2003) ¹²	Male	17	D	Upper limb numbness	A dense fibrotic tissue joining the posterior tubercle to the lateral masses
Panagopoulos et al. (2005) ⁸	Male	24	D	Neck pain	None reported
Sagiuchi et al. (2006) ¹⁴	Male	26	D	Lhermitte's sign after yawning due to compression of the spinal cord by the posterior tubercle	None reported
Jensen et al. (2010) ¹¹	Female	24	D	None	None reported
Png et al. (2015) ¹³	Male	52	D	Right hand neuropathy	Fusion of the posterior tubercle to the spinous process of the axis secondary to cervical spondylosis
Sahoo et al. (2018) ¹⁵	Female	17	D	Progressive spastic quadriplegia	None reported

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