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

AGENESIA DE ARCO POSTERIOR DE ATLAS: UM ACHADO ACIDENTAL EM UM PACIENTE POLITRAUMATIZADO

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.

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, thus giving origin to the first cervical vertebrae. 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.

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. A secondary ossification center usually appears for the posterior tubercle.

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

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".

Posterior arch agenesis is a fairly uncommon condition that affects 4% of the general population. 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.

An analysis of CT scans performed by Junewick et al. (2011) 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. 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. 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.

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.

<table>
<thead>
<tr>
<th>Author</th>
<th>Sex</th>
<th>Age</th>
<th>Type</th>
<th>Symptoms</th>
<th>Other congenital anomalies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Castâno-Duque et al. (1997)</td>
<td>Female</td>
<td>63</td>
<td>D</td>
<td>Cervicalgia and “seasickness”</td>
<td>None reported</td>
</tr>
<tr>
<td>Sharma et al. (2000)</td>
<td>Female</td>
<td>32</td>
<td>D</td>
<td>Pain and spinal stenosis</td>
<td>None reported</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>30</td>
<td>D</td>
<td>Neck pain and spinal stenosis</td>
<td>None reported</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>35</td>
<td>D</td>
<td>Neck pain and weakness in the upper limbs</td>
<td>None reported</td>
</tr>
<tr>
<td>Klimo Jr et al. (2003)</td>
<td>Male</td>
<td>17</td>
<td>D</td>
<td>Upper limb numbness</td>
<td>A dense fibrotic tissue joining the posterior tubercle to the lateral masses</td>
</tr>
<tr>
<td>Panagopoulos et al. (2005)</td>
<td>Male</td>
<td>24</td>
<td>D</td>
<td>Neck pain</td>
<td>None reported</td>
</tr>
<tr>
<td>Sagiuchi et al. (2006)</td>
<td>Male</td>
<td>26</td>
<td>D</td>
<td>Lhermitte’s sign after yawning due to compression of the spinal cord by the posterior tubercle</td>
<td>None reported</td>
</tr>
<tr>
<td>Jensen et al. (2010)</td>
<td>Female</td>
<td>24</td>
<td>D</td>
<td>None</td>
<td>None reported</td>
</tr>
<tr>
<td>Png et al. (2015)</td>
<td>Male</td>
<td>52</td>
<td>D</td>
<td>Right hand neuropathy</td>
<td>Fusion of the posterior tubercle to the spinous process of the axis secondary to cervical spondylosis</td>
</tr>
<tr>
<td>Sahoo et al. (2018)</td>
<td>Female</td>
<td>17</td>
<td>D</td>
<td>Progressive spastic quadriplegia</td>
<td>None reported</td>
</tr>
</tbody>
</table>

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).
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REFERENCES


CONTRIBUTION OF THE AUTHORS: Each author made significant individual contributions to this manuscript. RMPF (0000-0003-0481-6528)* attended the patient initially, and performed the exams. JHMM (0000-0002-0403-5417), LASP (0000-0002-2756-1794)* and MAB (0000-0001-7988-1071)* gathered clinical data and conducted the survey RMPF, JHMM, LASP, RCP (0000-0002-4624-3935) and MAB reviewed the manuscript and contributed to the intellectual concept of the study. All the authors approved the final version of the manuscript. *ORCID (Open Researcher and Contributor ID).