

# Congenital Absence of the Posterior Arch of the Atlas, Associated with a Non-displaced Fracture of C2

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## Abstract

Isolated absence of the posterior arch of the atlas with or without an intact posterior tubercle is generally considered a benign anomaly. Recognition of this defect as a benign variant is important in evaluating patients with cervical spine trauma. Neurologic symptoms may result from impingement of an intact tubercle during neck motion; however, this patient had an intact tubercle and no neurological symptoms. This anomaly may also be associated with atlanto-axial instability.

## Introduction

Developmental anomalies of the upper cervical spine and foramen magnum are not rare occurrences; partial or total congenital absence of the posterior arch of the atlas has been well documented in the literature (1,3-9,11-13).

Since such anomalies may be mistaken for fractures in patients who have sustained cervical spine injuries, recognition of this benign variant is clinically important in order to avoid further therapeutic and diagnostic maneuvers to treat this finding.

## Case Report

A 22-year-old woman was brought into the emergency department after sustaining a decelerating type neck injury to the cervical spine in a motor vehicle accident. On initial examination in the emergency department, the patient complained of neck and back pain. Physical examination, including a neurological evaluation was normal. Cervical spine radiographs revealed a non-displaced fracture of the body of the second cervical vertebra and absence of the posterior arch of the atlas with ossification in the region of the posterior tubercle (**Figure 1**). The latter was confirmed by computerized tomography which also confirmed the lateral portions of the atlas not being visualized revealing that the posterior tubercle was intact. As a result of the C2 fracture patient was admitted to the hospital and placed in a halo jacket.

## Discussion

Normal developmental anatomy of the cervical spine has been well defined by Epstein (2), and Rothman and Simone (10).

Each vertebral segment develops from three paired chondrification centers, two for the vertebral body, two for the costal elements, and one for each side of the neural arch. As normal development proceeds, the outgrowth from each neural arch center becomes the

pedicle, superior and inferior articular processes, transverse process, lamina, and spine. Because of this complex sequence of development it is not uncommon for a variety of anomalies to occur (**Figure 2**).

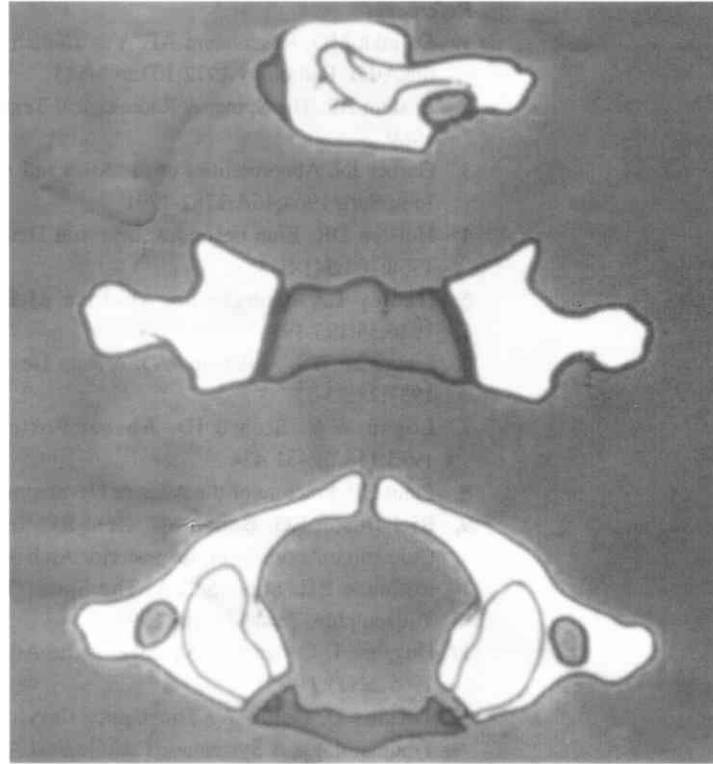
### ***Review of the Literature***

Numerous examples of total or partial absence of the posterior arches of the atlas are well documented. (1, 3-9,11-12). Most of these anomalies were discovered as incidental findings when radiographs were obtained on trauma patients, or for non-specific neck pain. In all cases, including this patient, the defect was best seen in the lateral projection.

Of the reported cases, only two patients had a neurologic deficit and one had atlanto-Axial instability. In the case reported by Richardson (9), a fifteen year old male who presented with intermittent quadroparesis from impingement of the posterior tubercle on the spinal cord, the authors postulated that impingement was caused by the



**Figure 1:** Cross table lateral projection of C-Spine. Ossicle in the posterior aspect of C-1, and non displace fracture of C-2.



**Figure 2:** The outgrowth from each neural arch center becomes the pedicle, superior and inferior articular processes, transverse process, lamina, and spine.

mobility of the posterior tubercle remnant in the spinal cord when the patient extended his neck. Excision of the tubercle led to full recovery.

The second case of neurologic abnormality associated with this anomaly was described by Holsten (4). A twenty-five year old athlete injured his neck while swimming. Radiographic examination demonstrated absence of the posterior arch of the atlas with an intact posterior tubercle. The patient was treated with long term cervical traction and went on to an uneventful recovery. Torklus and Gehle (12) reported on a case with atlanto-axial instability, and no neurological deficit or symptoms.

Plaut (8) quoted the work of Geipel who examined this anomaly by autopsy findings. He found bands of fibrous tissue bridging the gap. Logan and Stuard (7) confirmed this finding on their post mortum investigations. They were able to show that a fibrous band connecting the intact posterior tubercle replaced the posterior arch.

### Conclusion

Isolated absence of the posterior arch of the atlas with or without an intact posterior tubercle is generally considered a benign anomaly. Recognition of this defect as a benign variant is important in the evaluation of patients with cervical spine trauma. Neurologic symptoms may occur due to impingement of an intact tubercle during normal neck motion. Of interest is that our patient had an intact tubercle and no neurological symptoms. This anomaly may also be associated with atlanto-axial instability.

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