Congenital anomalies of the posterior atlas arch

Deficiencies in the posterior arch of C1 have been well-studied with incidences ranging from 5.65% to 3% and five different classifications. Unfortunately, there is a paucity of information describing the detailed anatomy, muscle attachments, and histology of cases with a C1 posterior arch deficiency.

Pathology

Embryology

This rare anomaly is a developmental failure of chondrogenesis . In the embryological period C1 is usually formed from three primary ossification centers:

an anterior center developing into the anterior tubercle

two lateral centers giving rise to the lateral masses and posterior arch

In ~2% of the population, an additional ossification center develops in the posterior midline, subsequently forming into a posterior tubercle.

During ossification different anomalies can develop, comprising:

median cleft(s) of the posterior arch

varying degrees of posterior arch dysplasia

either with or without the presence of posterior tubercle

Fusion of ossicles usually occurs during age 3 to 5 years. Incomplete posterior fusion may even be normal in children up to 10 years old [1)]

Fang et al. found a case of an isolated unilateral posterior arch defect in an 83-years-old male cadaver. Histology revealed that the posterior arch defect was filled with collagen fibers and fibrocartilaginous tissue without muscle or bony tissues. This is the first report detailing the histological findings of a posterior arch defect of C1 [2)].

1)
Sabuncuoglu H, Ozdogan S, Karadag D, Kaynak ET. Congenital hypoplasia of the posterior arch of the atlas: case report and extensive review of the literature. Turk Neurosurg. 2011 Jan;21(1):97-103. PMID: 21294100.
2)
Fang Y, Saga T, Iwanaga J, Dumont AS, Tubbs RS. The first histological observation of a C1 posterior arch defect. Folia Morphol (Warsz). 2022 Apr 5. doi: 10.5603/FM.a2022.0035. Epub ahead of print. PMID: 35380011.