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Agenesis of the Neural Arch of the Axis

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Anomalies of the upper cervical spine and skull base are not infrequent, and have been well documented in several recent monographs and articles [1–4]. However, there has been no previous report of agenesis of the neural arch of the axis. Such a case is described here.

Case Report

An 18-year-old woman had low neck pain 2 days after a motor vehicle accident. Examination revealed tenderness of the paraspinal musculature and marked limitation of movement, but no further abnormality.

Radiography of the cervical spine revealed almost total absence of the neural arch of the axis including the inferior articular facets. Only very short bony spurs were seen projecting posteriorly from the body (fig. 1A). Flexion views showed slight forward subluxation of C2 on C3, and views in extension showed abnormal widening of the C2–C3 disk space anteriorly. The spinous process and laminae of C3 were larger than normal. The superior articular facets of C3 did appear to have formed but were somewhat dysplastic. The patient had not had any surgery. She was placed in a soft collar for 3 weeks, and after 5 weeks had regained a full range of movement, although she was still suffering some pain.

Discussion

The neural arch of the axis forms at an early stage of embryonic development by dorsolateral migration of mesenchymal cells from the primitive centrum. Paired ossification centers form at the arch during the second fetal month, fusing posteriorly at 2–3 years and with the body by 7 years [3].

Abnormalities of development of the neural arch of the axis are rare, and agenesis of the arch has not been previously described. The abnormality is particularly interesting, since one of the key factors in maintaining spinal stability, the apophyseal joints, is not present. Clearly, this does not affect C1–C2 stability, for which the dens and supporting ligaments are mainly responsible. Louyot et al. [5] described one case in which the neural arch and inferior articular facets of the axis were hypoplastic, and forward subluxation of C2 on C3 in the flexed position did occur. Similar instability was present in the two documented cases of spondylolysis of the axis [6, 7]. Others have also described retrosomatic or lateral clefts of the axis, in which defects extend from the vertebral body to the partes interarticulares, but stability was not documented [3, 8]. All of these anomalies may occur in association with occipitalization of the atlas [4, 8]. The case under review represents an isolated anomaly.

In this case, instability also appears to be related to a presumed laxity of the interspinous ligaments between C1 and C3. This is shown in the flexed position (fig. 1B). The excessive mobility thus permitted is chiefly being transmitted through the C2–C3 disk. In addition, the altered mechanical factors relating to the absent apophyseal joints have moved the axis of rotation of the C2 vertebral body more anteriorly than is normal. Both of these factors place abnormal stresses on the disk and anterior and posterior longitudinal ligaments, and abnormal opening out of this disk occurs in the extended position (fig. 1A). Since the disk and associated ligaments are the only remaining important influence in preserving stability, the minor degree of forward subluxation of C2 on C3 that is seen in figure 1B is to be expected.

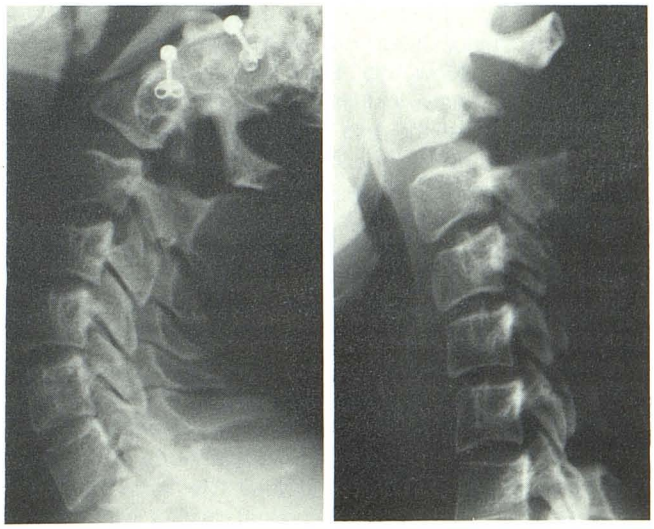

Fig. 1.—Lateral views of the cervical spine in extension (**A**) and flexion (**B**).

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Although the patient shows no relevant signs or symptoms, one can speculate on the development of early degenerative changes at the C2–C3 level. Fortunately, the degree of instability does not appear to be great and it is hoped that fusion will be unnecessary.

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