Agenesis of a Pedicle in the Cervical Spine

LESLIE M. ZATZ, M.D., PETER W. BURGESS, M.D. AND JOHN W. HANBERY, M.D.
Departments of Radiology and of Surgery, Neurosurgical Division, Stanford University School of Medicine, Palo Alto, California

Widen ing of an intervertebral foram en in the cervical spine is a striking radiological finding and generally denotes a patient with destruction caused by a malignant lesion or with neurofibromatosis. It is, therefore, important to recognize the rare case in which widening of an intervertebral foramen is the result of agenesis of a pedicle so as to avoid needless operative interference.

Case Reports

Case 1. A 46-year-old school teacher had suffered from episodes of numbness and tingling in both arms and legs, particularly on the left, for about 10 years. These attacks were worse at night, and were influenced by positioning her head and arms. They involved the entire extremity rather than a dermatome pattern. She also complained of occasional pain in the posterior cervical region and in the interscapular area.

There were no other neurological symptoms, and the only positive findings on physical examination were a hyperactive tendon reflex of the left knee and a left plantar extensor response. There was a complete range of painless motion of her cervical spine. A previous roentgenogram was interpreted as showing pathological enlargement of the right intervertebral foramen between C6 and C7. Following repeated roentgenograms (Figs. 1–8) and a cervical myelogram (Fig. 4) the diagnosis of congenital absence of the pedicle was made. The cerebrospinal fluid was normal.

It was felt that the patient's symptoms were not related to the anomaly. The possibility that mechanical instability at the level of the defect might in some way have contributed to the patient's symptoms was considered but was not thought to be likely at that time. No specific treatment was recommended.

Case 2. A 35-year-old truck driver injured his left shoulder and neck in a fall on May 23, 1958. Thereafter, he had occipital headaches, some pain around the right scapula, and numbness extending into the right fourth and fifth fingers.

Initial roentgenograms were interpreted as showing a fracture of the right lamina and pedicle of the 5th cervical vertebra and the patient was placed in halter traction.

The patient subsequently was referred to Dr. Howard A. Brown for evaluation approximately 4 months after the injury. At that time the only findings were slight subjective decrease in sensation over the right fourth and fifth fingers. Dr. William Obata, in consultation with Dr. Brown, made additional films (Figs. 5–7), and subsequently a myelogram (Fig. 8) at which point the diagnosis of congenital absence of the left pedicle and lateral mass of C5 was made. Consultants in neurology and orthopedics felt that there was no disability relative to the congenital anomaly. The patient was last seen 7 months following his

Received for publication November 30, 1962.
Agenesis of Pedicle in Cervical Spine

565

Fig. 2. Case 1. (Left) RAO. The pedicle of C5 is small. There is no inferior articular facet. The pedicle of C6 is absent presenting the appearance of a widened intervertebral foramen extending from the pedicle of C3 to C7. The cervical canal is widened in the anterior-posterior direction at the C6 level. On the original film the anterior portion of the right transverse process of C6 could be seen. (Right) LAO. The pedicles on the left side are all intact. Projecting through the left C5–C6 intervertebral foramen is the hypertrophied abnormal right lamina of C6, which is part of the developmental change accompanying the absent pedicle.

Discussion

Seven cases of congenital absence of a pedicle in the cervical spine have been reported previously. Buetti referred to an anatomical description of the entity by Gruber in 1869. The first radiologic description in the literature was in a report by Hadley in 1946 of 3 cases. Subsequently, single cases were reported by Abel, Buetti, and Steinbach et al. Abel’s case was also included in an article by Hadley.

Excluding the case reported by Gruber for which there were no radiographs and temporarily excluding the second and third cases of Hadley, the remaining 6 cases presented striking similarities and will be considered as a group. In these 6 cases the pedicle and the dorsal portion of the transverse process were absent and the free end of the lamina was displaced dorsally behind the articular mass of the vertebra above. There was an anomalous articulation between the ventral surface of the abnormal lamina and the dorsal surface of the articular mass of the vertebra above. Flexion and extension views in an oblique projection of Abel’s case were made...
available to us and showed that these structures separated widely in flexion suggesting that there was not a true joint between them. The anatomical arrangement of the inferior apophyseal joint of the abnormal vertebra was normal though the joint was displaced dorsally which produced a widening of the anterior-posterior diameter of the intervertebral foramen in the oblique projection.

The abnormal position of the lamina and the abnormal articulation seen in these cases were certainly developmental in origin and indicated the congenital nature of the lesion. These changes would not be expected to follow destruction of a pedicle by infection or by an expanding mass. Hypertrophic changes which occurred around the articular processes and the vertebral bodies presumably were secondary to the mechanical instability at the level of the congenital defects and were not of value in differential diagnosis. In all cases, the ventral portion of the transverse process was present. Since this portion of the transverse process is derived from the costal homologue, this indicates that the defect was in the development of the neural arch.

In the 6 cases, the lesion involved the 5th cervical vertebra three times, the 6th vertebra twice, and the 7th vertebra once. The lesion was on the left in 4 patients and on the right in 2. In 3 cases the lesion was discovered incidental to investigation following trauma, in 1 case incidental to evaluation for a foreign body in the pharynx, in 1 case during workup for a posterior-fossa tumor, and in 1 case for evaluation of symptoms which were thought not to be related to the lesion. Thus, it appears that the lesion was asymptomatic.

Cervical myelography in our 2 cases demonstrated that the nerve roots at the level of the lesion left the dural sac in close approximation and approximately opposite the midpoint between the comparable roots on the normal side. This finding is not specific but
FIG. 6. Case 2. (Left) RAO. The articular processes and pedicles on the right appear normal. The bulbous enlargement of the left side of the lamina of C5 can be seen projecting over the C4–C5 intervertebral foramen. (Right) LAO. The cervical canal is widened at the C5 level. A bulbous deformed lamina of C5 is dorsal to the articular process of C4. Inferiorly the lamina articulates with a hypertrophied superior facet of C6. There is no deformity of the posterior portion of the vertebral body at the site of the absent pedicle. Visible on the films but not on the reproduction was the anterior portion of the transverse process of C5.

FIG. 7. Case 2. AP projection with caudal angulation of beam. (Left) Head turned slightly to left. (Right) Head turned slightly to right. The left articular mass of C5 is absent. The approximation of C4 and C6 on the left is exaggerated by the projection. The abnormal lamina of C5 lies dorsal to the articular mass of C4 and C6 and is not seen clearly in this projection. An incidental spina bifida occulta of C5 is shown.
may occur in the presence of normal bony architecture. There was no evidence of encroachment upon the column of oil by a mass, but rather a suggestion of a broad dural outpouching into the widened foramen. This observation corroborated the impression of a congenital anomaly in our cases. Similar findings were described by Steinbach et al.\textsuperscript{6} Final confirmation of the diagnosis was obtained during operation in their case at which time no evidence of tumor or of fibrous or cartilaginous remnants at the site of the absent pedicle was found and a normal vertebral artery was seen.

The findings in the second and third patients reported by Hadley\textsuperscript{3} differed from those in the group of cases already described. The third patient had absence of the entire right side of the 3rd neural arch with massive articular processes from C2 and C4 bridging over the area of the defect. This was clearly a congenital lesion and would not be confused with a neoplastic lesion.

Hadley's second patient had an absent pedicle but none of the changes in the lamina and articulations that were seen in the 6 cases discussed above. Hadley\textsuperscript{4} recently has reported another patient with an almost identical radiographic picture in whom the absence of the pedicle presumably resulted from erosion by a tortuous dilated vertebral artery. The findings in that case were absence

**Fig. 8.** Case 2. AP cervical myelogram. (Left) Head turned slightly to the left. The contrast material pools along the right lateral gutter and the right cervical nerve roots appear as dark bands crossing the column of oil obliquely at about the level of each discal space. (Right) Head turned slightly to the right and the contrast material pools along the left lateral gutter demonstrating the left cervical roots. The 6th cervical root is seen at the midportion of the 5th vertebral body. It exits from the dura mater further cephalically than on the normal side and in much closer approximation to the 5th cervical nerve root. There is no evidence of encroachment on the column of oil by a mass. There is a rather wide outpouching which encompasses both the 5th and 6th cervical roots at the level of the congenital defect.
of the pedicle without any derangement of the lamina and a concave impression on the vertebral body bordering the intervertebral foramen. This suggests that the lesion in Hadley's second patient may not have been a congenital defect.

The striking changes in the position and configuration of the lamina and articulation at the site of a congenitally absent pedicle should prevent any confusion between this lesion and one caused by any type of mass including a tortuous vertebral artery. In the absence of these changes the diagnosis is in doubt and a myelogram and vertebral arteriogram would be necessary to exclude a mass lesion.

Summary

Two cases of agenesis of a pedicle of a cervical vertebra are presented. This lesion is uncommon and probably asymptomatic. Its importance lies in its resemblance to a destructive lesion of a pedicle or an expanding lesion in an intervertebral foramen from which it can be distinguished by the presence of accompanying developmental changes in the lamina. Myelography confirmed the diagnosis by revealing a slight outpouching of the dura mater at the enlarged intervertebral foramen with no evidence for a mass lesion in the area. Surgery can be avoided if these characteristic findings are present.

We are grateful to Howard A. Brown, M.D. and William Obata, M.D., Franklin Hospital, San Francisco, California, for permission to include their case in this report.

References