Case Reports

Atlanto-axial Dislocation Simulating a Head Injury; Hypoplasia of the Odontoid

Case Report

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The patient in this case presented clinical findings suggestive of a severe head injury but was found instead to have an atlanto-axial dislocation, secondary to hypoplasia of the odontoid.

Case Report

D.H., a 14-year-old girl, was entirely well until May 9, 1965. On entering an automobile she had grazed her forehead on the inner roof of the car. She then fell backward so that the back of her head struck the pavement. Observers stated she was semi-responsive and appeared to be struggling to say she could not breathe. Her friends urged her to get up and go home, but she rapidly became unresponsive. She was rushed to a local hospital where she was found to be cyanotic, completely areflexic, and was believed to be moribund. Since a surgeon was not available, immediate transfer to the University of Michigan Hospital was arranged. In the ambulance, the patient was given intravenous 50 per cent glucose to reduce presumed cerebral swelling and her head was kept in extension to provide an airway.

Examination in the emergency room revealed a cyanotic, comatose, slender female who responded only to severe stimuli and then only by moving the right arm and leg. The blood pressure was 90/60 and the pulse was 110 and weak. Respirations were 24 per minute, irregular and labored. In addition to the apparent left hemiplegia, a left Babinski was present and both arms and legs were hypotonic and hyporeflexic. Pupils were dilated to mid-range and reacted only sluggishly to light. Corneal reflexes were depressed but there was no evidence of facial paresis and a gag reflex was present. There was no external evidence of trauma to the head.

Respiration was marked by flaring of the nostrils and the use of accessory muscles. Intercostal function was decreased bilaterally. Breath sounds were reduced over the left side of the chest. The abdominal musculature appeared flaccid and diaphragmatic motion was paradoxical. These findings could not be explained by a head injury alone.

Skull and chest films were normal. Cervical spine films in a neutral position appeared normal, but with the head held in extension, there was obvious dislocation of the atlas posteriorly on the axis (Fig. 1). Skeletal traction by means of Vinke tongs was immediately instituted. The patient was placed on a Stryker frame and given oxygen. Several hours later, she had improved to the point where she was awake, and able to converse, although her condition remained critical due to extremely poor respiration. There was now mild paresis of the distal musculature of the right arm, as well as the left hemiplegia noted earlier. Vibration and position sense were decreased on the left, but response to touch and pin-prick were intact bilaterally. There was marked tenderness to palpation in the occipito-vertebral region. In addition, the patient had complete amnesia for the events of her accident. Following tracheotomy and continued traction, her neurological and respiratory condition began to improve. Open mouth views taken several days after admission showed apparent absence of the odontoid. Laminagrams of the atlanto-axial region demonstrated a small corticated osseous well separated from the axis. This was felt to represent the apical segment of a hypoplastic odontoid (Fig. 2).

Operation. Atlanto-axial fusion was carried out via

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the posterior approach on May 25, 1965. The atlas and axis were wired together by passing a loop of heavy wire under their laminae. The loop was then brought back over the spinous process of the axis. The laminae were drawn together tightly and the ends of the wire were then tied around the spinous process of the axis. Iliac crest bone was laid along the laminae of C1, C2, and C3 to complete the fusion (Figs. 3 and 4).

Postoperative course. The patient tolerated the procedure well and was taken out of Vinke tongs and placed in a Forester collar. She was soon able to walk and when discharged (June 22, 1965) her only neurological deficit was weakness of dorsiflexion of the left foot and of the intrinsic muscles of the left hand. Bilateral Hoff- man's sign and slight hyperreflexia of the legs were also present. Since that date, the patient has remained asymptomatic.

Discussion

Coma, left hemiplegia, and mid-range dilated pupils in a patient with a history of trauma suggested a severe head injury. However, the patient was observed to have poor intercostal function, paradoxical diaphragmatic motion, and the use of accessory respiratory muscles. These findings were not consistent with a diagnosis of head injury. Cervical spine films with the head in extension

Fig. 2. Retouched laminograms of the atlanto-axial region demonstrate hypoplasia of the odontoid. The cut on the left shows the body of the axis and the anterior arch of the atlas. The base of the odontoid is absent and the body of the axis is slightly notched where the odontoid is expected to arise. The apical segment of the odontoid is shown well separated from the body of the axis by the cut on the right.

Fig. 3. Postoperative lateral cervical spine film. Wire, fusing the atlas to the axis, surrounds the laminae of these two vertebrae. Iliac crest bone was then placed along the laminae of C1, C2, and C3 to complete the fusion.

Fig. 4. Drawing depicts operative fusion of the axis to the atlas. A loop of wire was passed under the laminae of the atlas and axis, brought back over the spinous process of the axis, and then tied in place. Odontoid is absent in this illustration.
demonstrated posterior atlanto-axial dislocation and subsequent examination revealed bilateral neurological findings, confirming the presence of high cervical spinal cord injury.

The severe respiratory embarrassment suffered by this patient probably accounted for the dilated pupils and unresponsive state. However, Friede reported that abrupt stretch of the cervical spinal cord at the level of the atlas resulted in chromatolysis of reticular formation neurons similar to that seen in severe experimental concussion of the brain. Constriction of the vertebral arteries by posterior dislocation of the atlas should also be considered. The vertebral arteries cross the transverse processes of the cervical vertebrae, including the atlas and the axis, and then penetrate the atlanto-occipital membrane to enter the foramen magnum. Atlantal dislocation could therefore result in vertebral insufficiency. Ford emphasized this possibility in his report of atlanto-axial dislocation secondary to os odontoideum. His patient had transitory disturbances of vision, vertigo, and syncope associated with excessive mobility of the atlas and presumed vertebral insufficiency. The possible role of vertebral insufficiency with trauma to the other cervical vertebrae has been emphasized elsewhere.

Fracture of the odontoid, rupture or dissolution of the transverse ligament, and hypoplasia or agenesis of the odontoid can result in atlantoaxial dislocation. The odontoid is ossified from 3 centers. Two lateral centers merge at 5 months of age. An apical center which appears from the 2nd to the 5th year of life unites with the odontoid in the 12th year. The entire odontoid usually fuses with the body of the axis in the 3rd or 4th year of life. Complete failure of odontoid development is termed agenesis of the odontoid. Failure of apical fusion results in hypoplasia or os odontoideum and is illustrated by our case.

Although comparatively rare, 20 cases of agenesis of the odontoid have been reported since Roberts' original description in 1933. These cases have been well reviewed by Schiller and Nieda, Schultz et al., Rowland et al., and Giannestros et al. In an excellent review, Wallin has summarized the reported cases of os odontoideum and discussed the radiographic criteria for differentiating this entity from fracture of the odontoid. It is apparent from the cases reported that dislocation of the atlas with hypoplasia or absence of the odontoid presents less threat of loss of life or severe neurological deficit than might be presumed. Due to absence or hypoplasia of the odontoid there is less compromise of the vertebral canal with dislocation than with fracture of the odontoid where loss of life and severe neurological deficit becomes more likely. Thus, absence of the odontoid is not of itself an indication for operative fusion. Nonetheless, if sufficient instability is present and persistent pain or neurological symptoms occur, fusion must be carried out. Fusion may be simply accomplished by wiring the lamina of the atlas to the axis. However, if the neurological condition of the patient is critical due to spinal cord or medullary compression and reduction can not be brought about by traction, laminectomy with removal of the arch of the atlas may be necessary to effect decompression. Under these circumstances, the laminae of the axis and C3 may be fused to the occiput as described in 1935 by Kahn and Yglesias.

Summary

We have reported the case of a young girl who, immediately following a minor head injury, developed coma, hemiplegia, dilated pupils, and marked respiratory distress. Atlanto-axial dislocation secondary to hypoplasia of the odontoid was found and successfully treated. We have briefly discussed the neurological findings, utilizing related reports.

References

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