Transoral Fusion of Odontoid Fracture

Case Report

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The odontoid process is a pivot for rotation of the atlas on the axis, but more significantly, it limits posterior motion of the atlas through its articulation with the anterior ring. Anterior dislocation is avoided by the confinement of the thick transverse ligament. The dens represents the body of C-1 which later becomes fused with the axis. Interposed at the base is a cartilaginous disc which ultimately ossifies. Ossification begins at the periphery but may not reach the center until advanced age. In a certain number of persons (23% of patients age 30 to 50 years) fusion does not occur or is incomplete, allowing dislocation, either spontaneously or as the result of minor trauma. Occasionally the entire process is absent.

The incidence of odontoid fractures is not known, since many are not recognized due to immediate death. Amyes and Anderson found 63 among 398 patients having x-ray evidence of fracture or dislocation of the cervical spine. It may not be recognized early because of head injury, or the symptoms of soreness and stiffness of the neck are attributed to cervical sprain or subarachnoid hemorrhage. The signs are seldom outstanding. Only five of the cases of Amyes and Anderson had sufficient cervical cord compression to cause weakness of the arms or legs. The most feared consequence is upper cervical myelopathy due to chronic or repeated dislocation.

The selection of treatment still remains an enigma. Alexander, et al., felt that all cases should be operatively fused. Only one fracture united in their four cases not treated surgically. Conversely, Amyes and Anderson found nonunion in only three of their 63 cases. They felt nonunion was more likely if the fracture was in the substance of the dens, whereas those across the base were likely to heal. Reduction and immobilization seem essential in achieving union. The total period of fixation by traction or external devices should continue until there is x-ray evidence of healing, usually 4 to 8 months.

Surgical treatment by the posterior route has been well-described. Fusion of C-1, C-2, and C-3 by an onlay graft is likely to succeed (11 out of 12 cases). However, the simplicity of transoral fusion was not recognized until 1962 when Fang and Ong reported the results of operation in six cases. They approached and successfully fused the lateral joints, but had one death due to vertebral artery injury and infection.

As far as we know, the following case is the only one where the attack has been directed at the fracture opening itself.

Case Report

A 49-year-old woman was referred by Dr. Robert Reid of Perris, California. She had no symptoms prior to July 19, 1962, when she was involved in an automobile accident, striking the right side of her face against the steering wheel, and sustaining a fracture of the clavicle and right patella. Since that time she had complained of sharp, aching pain in the suboccipital region, and noticed a tendency of her head to draw to the right. There was no sensory loss over the occipital region. Head and neck movements were limited to 25% of the normal range in any direction, and were accompanied by great occipital pain. The neurological examination was otherwise normal. Tomograms of the cervical spine (Fig. 1) showed an ununited fracture of the odontoid through the base with marked hypertrophic changes. Motion was present on flexion and extension views.

Operation. On May 10, 1966, a fusion of the odontoid process was carried out transorally. A wire-reinforced endotracheal tube was inserted through the mouth. The palate was elevated with a catheter through each nasal passage, and the mouth was held open with a McIvor gag. Localizing x-rays were made after a needle had been inserted into the
operative site. A 4 cm vertical incision brought us immediately onto dense, fibrous tissue, which was dissected free until the fracture line could be identified. It was a wide, gaping space, with smooth margins, and filled with granulation tissue. This tissue was sucked and curetted away. A motor-driven burr was used to roughen and undercut the sclerotic bone margins to fashion a bed for the graft. A dowel of bone was removed from the iliac crest, shaped to bridge the fracture line vertically, and fit the bed. It was inserted as manual traction was applied to the head; when the traction was released, the graft was locked into position (Fig. 2). The ligamentous structures were closed with one layer of fine chromic catgut, and the mucous membranes were sutured with silk.

Postoperative Course. Because of a previously diagnosed gastric ulcer, feeding was maintained through a Levine tube. Tetacycline HCl (500 mg) was administered four times a day, and the head and neck were immobilized with sand bags. Immediate edema of the tongue developed, and later of the pharynx. On May 14, 1966, she became delirious and required a brace to maintain neck position. She rapidly improved and by May 16, 1966, was able to walk. The sutures were allowed to fall out, and she was discharged in a Minerva jacket on May 22, 1966. On September 6, 1966, the cast was removed.

When last examined on July 4, 1967, her headaches were minor. Narcotics, taken heavily before operation, were no longer required. Rotation of the head and neck was carried out to a normal range; extension was 75% normal and flexion was full. There were no symptoms related to the fusion site. Lateral tomograms in flexion and extension showed union to have occurred, and no detectable motion was seen.

The patient died on July 14, 1967, from an overdose of barbiturates taken during a period of despondency. At the time of autopsy the upper cervical spine was removed by Doctor Rene Modglin. After cleaning of the soft tissues, sagittal section was made and demonstrated a solid bony union (Fig. 3).

Discussion

No particular problem occurred during the procedure. The oral endotracheal tube never hindered manipulation. The attachment of the ligaments about the bone was more dense than expected, and the handle of the Stryker flexible-shaft machine was not long enough to work comfortably. A standard dental drill, with burrs used in endaural surgery, was excellent. The later stages of the procedure were facilitated by an operative microscope. The odontoid can be stabilized during operation by a clamp on the anterior ring of the atlas.

The pharyngeal edema was never sufficient to obviously obstruct the airway, but hypoxia could have accounted for the postoperative delirium. It subsided promptly and tracheotomy was never thought necessary.

The full head and neck rotation is a distinct improvement over the 70–85% limitation reported with posterior fusion. The technique of the operation is quite simple,

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**Fig. 1.** Lateral tomogram of upper cervical spine demonstrating hypertrophic changes about an open fracture line (arrow) of the odontoid.