Transoral Decompression of Atlanto-Axial Dislocation Due to Odontoid Hypoplasia*

Report of Two Cases

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The transoral approach to the upper cervical spine is not a new procedure. In 1930, German6 demonstrated its feasibility in dogs; Crowe12 drained several cases of tuberculous spondylitis and retropharyngeal abscesses through the mouth; Scoville reported its use for removal of the odontoid process in basilar impression; Southwick and Robinson18 and Mosberg and Lippman described the transoral treatment of lesions of the second cervical vertebra; Fang and Ong reported six cases of transoral reduction and fusion of atlanto-axial dislocations.

The two cases we are reporting stimulated us to review the pathophysiology of atlanto-axial dislocations due to hypoplasia or "dysgenesis" of the odontoid process and to attempt what we feel is a rational, relatively safe, surgical procedure for the treatment of this disorder.

Surgical Procedure

Preoperative preparation. A tracheostomy should be performed 1 to 3 days prior to surgery. Nose and throat cultures should be obtained and the patient placed on appropriate antibiotic therapy; teeth should be examined for signs of occult infection.

Operative Technique. The patient is placed in the Trendelenburg position with the head in extension in the pin headrest. The nasopharynx is packed off to prevent blood from draining into the nasal sinuses during the operation. A McIvor mouth gag with tongue depressor attachment is placed and opened for maximum exposure (Fig. 1 A). A midline incision is then made through the soft palate and uvula. A Gelpi self-retaining retractor is used to retract the palatal soft tissue laterally (Fig. 1 B). A midline incision is then made in the posterior pharynx. The anterior ring of C-1 is easily palpable and acts as a good landmark for the level of the incision. The posterior pharyngeal tissue is sutured back on itself for exposure (Fig. 1 C). With an electric or air drill, the anterior ring of the atlas is removed exposing the odontoid process. The ligamentous attachments of the odontoid are then severed as well as the attachment of the odontoid to the body of C-2 and the odontoid removed. With a slightly lower incision, the entire body of C-2 may be easily exposed. Following completion of surgery, the posterior pharynx and palate are closed in layers.

Postoperative Care. The patient is allowed nothing by mouth and is kept on intravenous therapy for 7 days. Normal feeding is gradually introduced during the second week. Antibiotic therapy is maintained until oral feeding has been reestablished.

Case Reports

Case 1. This 32-year-old dyschondroplastic dwarf entered Yale-New Haven Hospital February 17, 1966, because of 5 years of progressive respiratory distress. She had been unable to walk for the last 6 months.

The woman weighed 53 lbs and was 4 feet tall; the size of the head was normal. There was no diaphragmatic or intercostal movement; she was breathing solely with the neck muscles. There was analgesia below C-3 on the right and C-2 on the left. Function related to the posterior columns was intact. There was a complete paralysis of both legs and the right arm, with only slight movement of the left biceps, triceps, and finger flexors. There was clonus in all four extremities with bilateral Babinski responses. Cranial nerves were intact.

X-rays of the cervical spine revealed a hypoplastic odontoid process. The body of the odontoid was not ossified. The unfused apical segment was lying against the anterior ring of
the atlas. There was a dislocation of C-1 forward on C-2. The body of C-2 and the base of the odontoid were angulated posteriorly, narrowing the cervical canal to 6 mm in sagittal diameter and impinging against the ventral aspect of the cervical cord.

First operation. The patient was placed in Crutchfield tongs in an attempt to reduce the subluxation. This failed, and the patient's respirations became more embarrassed. Arterial blood sample at the time revealed a pH of 7.3, pCO₂ of 75 mm, pO₂ of 45 mm, and an O₂ saturation of 73%. Immediate tracheostomy was performed and the patient placed on the Byrd Respirator. On February 28, a posterior decompression and fusion were carried out.

One week following surgery she could wiggle the toes of the left foot and had developed bicep function in the right arm. The left biceps and finger flexor had improved slightly. There was no change in the sensory examination. Over the following 4 weeks, the neurological picture failed to improve further. Because of this we felt justified in attempting further decompression of the cord through an anterior approach.

Second operation. On March 31, through a transoral approach, the anterior arch of C-1, the odontoid remnant, and the posterior superior aspect of the body of C-2 were excised. The patient remained in tongs postoperatively.

Postoperative course. There was a benign postoperative course, and by the 14th postoperative day the patient had pinprick sensation over the entire left side of the body. She could wiggle the toes of the right foot as well as the left. There were flexor and extensor movements in the left knee and hip. The strength of both arms was continually improving. By the third postoperative month she could raise both arms off the bed and give a weak hand grasp with the left hand. She required respiration assistance only ½ hour three times daily to maintain normal blood gas concentration. Now in her 11th postoperative month, she can be mobilized in a wheelchair but shows no further neurological improvement and still requires intermittent respiration assistance.

Although her neurological picture appears to have stabilized, the fact that she showed further improvement following the second operation substantiates the view that a posterior decompression does not adequately decompress a spinal cord deformed by encroachment on its ventral surface.

Case 2. This 50-year-old man had had recurrent episodes of quadriplegia for 20 years. Two months before admission he was hit with a steel window in the back of the right shoulder and immediately became quadriplegic with numbness of all four extremities. He had remained weak with constant paresthesia in both arms. Even slight flexion of the neck caused severe pain in all extremities.

Examination. Neurological examination revealed moderate quadriplegia with a spastic gait. There was generalized hyperreflexia with bilateral Hoffmann responses. Plantar responses were normal. Posterior column functions were intact. There was analgesia over the C-2 dermatome and hypalgesia over the C-3 dermatome bilaterally. Slight flexion of the neck caused pains shooting into the arms and legs; extension of the neck relieved these pains.

X-rays of the cervical spine showed failure of fusion of a hypoplastic odontoid to the
body of C-2. There was instability of the atlanto-axial articulation with dislocation of C-1 forward on C-2 during even slight flexion of the head. The hypoplastic odontoid remnant was dislocated posteriorly, impinging upon the ventral cervical cord (Fig. 2 left). Cervical myelography revealed marked posterior displacement of the cervical cord at C-1 and upper C-2 (Fig. 2 right). Vertebral angiography was negative.

Operation. On April 11, 1966, tracheostomy was performed. On the following day, through a transoral approach, the anterior arch of C-1 and the entire odontoid remnant were removed. The patient was placed in Crutchfield tongs postoperatively.

Over the next 48 hours, strength in the arms improved markedly. The paresthesias and pains in all extremities disappeared.

Second operation. Two weeks later the patient underwent a posterior fusion of C-1 to C-2. Follow-up examination at 10 months showed that the patient was asymptomatic and neurologically intact, with a normal gait. Laminograms taken at this time confirmed removal of the anterior arch of C-1 as well as the malformed odontoid.

Discussion

For several years otolaryngologists and orthopedic surgeons have been biopsying lesions and draining infections of the upper cervical spine through the mouth. The hesitancy of neurosurgeons to adapt this approach not only to the upper cervical spine but to the brain stem arises from the fear of infection and the seemingly technical feat involved. Our experience reinforces that of others that postoperative wound infections do not appear to be a problem, probably because of the local resistance of the tissue within the mouth to its own bacterial flora. Aided by modern high-speed drills, the operation can be accomplished with relative ease and safety.

The surgical treatment of a chronic atlanto-axial dislocation should be aimed first at decompressing the cervical cord and reducing its deformity and, second, at stabilizing the atlanto-axial articulation. The posterior approach has until recently been the usual approach to lesions of the cervical spine and cervical cord. The anterior cervical operation is now becoming a popular approach for cervical spondylisis with cord compression. The logic behind the anterior approach involves the fact that the disease can thus be attacked directly and the deformity of the cord corrected. The posterior approach at best affords a partial decompression and often leaves the deformity of the cord unaffected.

The same arguments apply to treatment of cases with nonreducible atlanto-axial dislocation or basilar impression. The posterior approach does not make possible a direct attack.
on the pathological process, serves only to partially decompress the cord from the impinging odontoid, and results in only occasional improvement of the neurological disability. Use of the transoral approach in these cases not only provides adequate decompression but allows removal of the offending element and correction of the deformity of the cord.

Posterior decompressive procedures have carried a high morbidity and mortality when performed for nonreducible atlanto-axial dislocations. A major contributing factor appears to be the necessity for some degree of flexion of the head for adequate operative exposure. Flexion in these cases further narrows the sagittal diameter of the spinal canal and thus causes increased embarrassment to the already compromised cord. An anterior operation, either through a transoral or a transcervical approach, has the advantage of being performed with the head in extension rather than flexion.

Both of our cases required fusion at a second procedure. Transoral fusion of the atlanto-occipital articulation has been reported. We are currently trying to work out a technique that will make this feasible as part of the primary operation.

Summary

We have reported two cases of atlanto-axial dislocation due to odontoid hypoplasia which were successfully treated by transoral decompression. We have briefly reviewed the technique involved as well as the reasons why we believe this approach superior in the treatment of this problem.

References

5. German, W. J. Personal communication.
11. Southwick, W. O. Personal communication.