Traumatic atlantooccipital dislocation

Case report

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Traumatic atlantooccipital dislocation is unusual, and survival is even more so.1,2 We are reporting the management of a patient who survived this rare lesion.

Case Report

This 23-year-old man was admitted to the emergency room after his automobile left an elevated expressway near, but not on, the exit.

Examination. The patient was alert and quadriplegic, with spontaneous diaphragmatic respiration and a sensory level at C-5. Right 10th and 12th cranial nerve palsies were noted. During examination the sensory level rose to C-2, and ensuing respiratory distress prompted immediate tracheostomy. There was a very deep laceration beneath the chin extending toward the floor of the mouth. The remainder of the physical examination was normal. Roentgenograms of the cervical spine demonstrated an atlantooccipital dislocation and a fracture of the C-6 spinous process (Fig. 1). Tomograms of the atlas and axis demonstrated no fractures.

The patient was placed in skeletal traction. Tracheostomy for respiratory assistance was performed, and catheter drainage of the urinary bladder was provided.

Approximately 1 hour after admission the patient exhibited voluntary movements of the right extremities followed over the next several days by weak movements of the left leg and, to a small degree, the proximal musculature of the left arm. There was early return of pain perception bilaterally, but it remained diminished on the right as compared to the left.

Because of distraction of the occiput from the atlas when sufficient traction was applied to maintain alignment (Fig. 2), skeletal traction was discontinued and a four-poster
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A vigorous physical therapy program was instituted in the brace; the patient's appetite, nutrition, and general sense of well-being improved. Approximately 5 months after initial injury, the patient was able to walk with a cane and a left short-leg brace with a dorsal assist. The patient sat unassisted in bed and made independent transfers. The left extremities remained weaker than the right and he remained hoarse.

Although apparently stable in his brace, the patient continued to complain of cranial instability and “popping” of his neck. Cervical spine films in the brace demonstrated good alignment. Careful flexion of the patient's neck without the brace under fluoroscopic control demonstrated continuing anterior dislocation of the occiput on the atlas in flexion with realignment in slight extension. This objective evidence of persistent instability for more than 5 months following injury prompted an occipito-cervical fusion.

**Operation.** Naso-tracheal intubation was performed with the patient awake in the supine position and still in a brace. The skeletal fixation headholder was then applied under local anesthesia. The patient, still awake, was then turned to the prone position on the operating table with positive control of his head at all times. Proper atlantooccipital alignment was verified radiographically. Only then was the patient anesthetized. The occiput of the skull and the laminae of the first two cervical vertebrae were exposed. Four small horizontal burr holes, two on either side of the midline, were made in the occipital bone with a high-speed air drill, and No. 18 wire sutures were passed extradurally through the holes and around the arch of C-1 bilaterally. A third No. 18 wire suture was passed across the midline through the two medial holes and around the arch of C-1. A fourth wire was passed through the spinous process of C-2 and around the arch of C-1. Semi-solid methyl methacrylate was molded over the wire “struts” from the lamina of C-2 to the occiput and allowed to harden in place to complete the mechanical stabilization in a manner similar to that described by Kelly, et al.3 (Fig. 3).

**Postoperative Course.** Recovery was complicated by a superficial staphylococcal
wound infection that responded rapidly to appropriate antibiotic therapy and local care. Because of the presence of a foreign body, antibiotic coverage was continued in the hospital for 1 month after operation. A stable “fusion” with good alignment was obtained (Fig. 4), and the patient was discharged from the hospital approximately 7 months after injury and 6 weeks after operative stabilization. At the time of discharge, he was walking with the aid of a cane and a left short-leg brace. He was experiencing progressive return of function of the right arm and leg. The left leg remained moderately spastic. Although hoarseness persisted at the time of discharge, he could swallow normally. He was advised to continue the use of the four-poster brace for approximately 4 months.

Discussion

Anatomy and Mechanism of Injury

Werne and Martel have described in detail the functional anatomy of the occipito-atlanto-axial joints. The combined unit acts as a ball-in-socket type of joint limited in flexion by skeletal contact between the basion of the occiput and the tip of the dens, limited in extension by the tectorial membrane (a cephalad continuation of the posterior longitudinal ligament), and in rotation and lateral flexion by the alar “check” ligaments. According to Werne, severance of both the tectorial membrane and alar ligaments is necessary to produce atlantooccipital dislocation. In our case, as in that of Gabrielson and Maxwell, the mechanism of injury is conjectural, but the deep laceration of the chin and the fracture of the C-6 spinous process both imply extreme hyperextension.

The neurological deficit in this patient is probably best explained on the basis of injury to the vascular supply to the upper cervical cord and lower medulla. The more
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persistent deficit, namely, the right 10th and 12th cranial nerve palsies and the left hemiparesis, are reminiscent of the “alternate hemiplegia” seen with occlusion of the vertebral artery or its branches contributing to the anterior spinal artery.

Management

The general principles of management of this lesion are similar to those for other cervical spine fractures and include the best possible anatomical reduction of the dislocation with skeletal traction. Airway protection, ventilatory support, maintenance of adequate nutrition, careful skin care, and vigorous physical therapy are essential. Perfect anatomical realignment may not be possible. One must constantly be aware that an atlantooccipital dislocation is an extremely unstable lesion, and excessive traction should be avoided lest distraction of the head from the cervical spine occur (Fig. 2). The authors recommend transition to a four-poster brace as early as possible (12 weeks in our case) to facilitate nursing care and allow early physical therapy and ambulation.

Although a large series is not available for evaluation, surgical intervention and stabilization is probably necessary in traumatic atlantooccipital dislocations. Certainly our patient at 5 months post-injury and the patient reported by Gabrielsen at 1 year post-injury showed no evidence of spontaneous fibrous fusion. Both continued to complain of an unstable head.

Operative intervention should be deferred until the patient is free of infection and is in positive nitrogen balance, with all other wounds healed. Ideally, he should show sufficient neurological improvement to facilitate pulmonary toilet. The choice of the type of stabilization fusion performed depends on the surgeon. The use of methyl methacrylate over wire struts as described by Kelly, et al., was chosen in this case because it provides the immediate stability of an “internal brace” and allows immediate mobilization of the patient in the postoperative period.

References


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