Reduction and Fusion of Fracture of the Odontoid Process

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Fractures of the odontoid process and instability of the C1-C2 articulation are not rare. The fractures and degree of instability vary, but when there is instability, the obvious danger to the spinal cord which may result from mild trauma, even several years after the instability occurs, is sufficient to demand a dependable method of stabilization. In the relatively rare congenital defects seen of the odontoid process, instability at this level is equally dangerous to the patient.

Some fractures of the odontoid process occur into the body of C-2, not across the base of the odontoid process; in such cases, firm healing and satisfactory stabilization may take place with proper immobilization. Fibrous union, however, or no union at all is the more common outcome.

Skeletal Traction and Anesthesia

At an early stage in treatment of odontoid fractures, Crutchfield tongs are inserted in the skull and traction applied. Usually, complete reduction is achieved under 5 to 7 lb of traction, but in some of the complex fractures involving dislocations into the body of C-2, more strenuous efforts may be necessary using direct pull of traction under the personal supervision of the surgeon and with frequent radiological confirmation (Fig. 1 A). Once satisfactory reduction is obtained, danger to the neural elements is past and fusion may be scheduled as an elective procedure if it seems necessary.

In the operating room, anesthesia is begun and an endotracheal tube inserted without flexing or extending the cervical spine. Movement of the cervical spine is prevented by the surgeon’s holding the Crutchfield tongs during the process of intubation.

When the endotracheal tube is in place and the patient under anesthesia, he is moved by four attendants and the anesthesiologist to the operating table. He is placed in the prone position with the face in a circular head-rest and traction of 10 to 12 lb maintained in a straight pull from the head. Special care is exercised to avoid any pressure of the head-rest against the eyes. The head of the table is usually elevated 15° to 20° to achieve optimum position and to minimize bleeding (Fig. 1 B).

Incision

A midline incision is made from the inion to the level of the spinous process of C-6. The occipital bone and the laminae of C-1, C-2, C-3, and C-4 are exposed by sharp dissection. Blunt dissection is avoided lest it increase the dislocation. The laminae and spinous processes are denuded of all fibrous attachments (Fig. 1 C). Some cortical bone may be removed, but this tends to weaken the thin laminae, especially at the C-3 level. Although at one time this was thought to be essential, omission of the removal of cortical bone has not made the fusion less secure.

A periosteal elevator is introduced beneath the laminae of C-1, C-2, and C-3 vertebrae on each side, and a small portion of the heavy lamina of C-2 is nibbled away with a small Kerrison punch in order to facilitate the passage of wires. Caution must be exercised in removing a portion of C-3 since this is generally a small lamina and may be easily broken. No intradural opening is made.

Fusion

A No. 20 stainless-steel wire is passed beneath the laminae of C-1, C-2, and C-3 on each side, care being taken not to damage the dura (Fig. 2 A). Since the dislocation has already been reduced, there is little danger of damage to the intradural elements.

A No. 18 stainless-steel wire is then passed beneath the lamina of C-1 on both sides (Fig. 2 B). This No. 18 wire is then
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Fig. 1. Reduction of fracture and initial exposure.

twisted around the lamina to prevent its slipping toward the midline; the lamina of C-1 at times has a cartilaginous fusion and the wire may slip through this loose union. The two wires are brought around behind the heavy spinous process of C-2, twisted, and tied. A distance of about 1 cm is left between the laminae of C-1 and C-2. A check x-ray film is made to show the position.

After C-1 has been wired to C-2, the iliac or rib grafts are notched as necessary and laid in place. The notches may be made in the edges to make the grafts fit more snugly. Cancellous bone is placed in contact with the laminae and spinous processes to effect a fusion. The No. 20 wires are then tied around these grafts on both sides to produce a further solid support at the immediate time of operation and in the subsequent process of healing. Additional chips of bone may be placed in the gutters lateral to the grafts (Fig. 2 C).