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G. M. Malik

K. K. Wu

J. I. Ausman

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A New Surgical Approach to Stabilizing C₁₋₂ Subluxation in Rheumatoid Arthritis†

R.A. de los Reyes, MD,* G.M. Malik, MD,* K.K. Wu, MD,** J.I. Ausman, MD, PhD*

Atlanto-axial subluxation in patients with rheumatoid arthritis presents a difficult therapeutic problem. Because of their underlying disease, these patients do not tolerate the heavy orthotic devices or prolonged periods of immobilization associated with traditional methods of surgical fu-

sion. This paper describes a surgical technique which allows early mobilization and minimal external fixation. The results from a series of ten patients in which this technique was used are also discussed.

Atlanto-axial subluxation is frequently associated with severe rheumatoid arthritis (RA), but its incidence varies with patient selection, referral pattern, and diagnostic technique. From 25 to 34% of "unselected" rheumatoid patients seen in the clinic have been reported as having a 3 mm or more separation of the odontoid from the posterior surface of the anterior arch of C₁ (1,2). An incidence as high as 70% has been reported in patients selected because of neck discomfort and/or severe disease (3). Atlanto-axial subluxation frequently causes pain and occasionally even death due to high cervical cord or medullary compression (4,5), as well as to vertebral artery thrombosis (6).

Despite the morbidity associated with this problem, operative intervention has, in the past, been undertaken only with great reluctance because of the high morbidity associated with prolonged immobilization of the rheumatoid patient. Although usually neurologically intact (7), these patients present in fairly advanced stages of their disease with its attendant osteopenia and generalized debilitation. They do not tolerate heavy orthotic devices or prolonged periods of immobilization well.

The ideal treatment for this condition would therefore provide maximal internal stabilization with minimal external fixation, as well as a short convalescent period with early mobilization. We believe that posterior cervical (C₁₋₂) fusion with a bicortical "H" strut iliac bone graft fulfills these criteria. The following reports on the results of our series.

Materials and Methods

Series

Ten patients with severe rheumatoid arthritis (seven women, three men) underwent fusion between April 1976 and September 1979 (Table I). The most common presenting complaint was neck pain (70%), followed by paresthesias in the upper and/or lower extremities (50%) and gait difficulty (30%). It should be noted (Table I) that the symptoms had been present in most cases for several months before the diagnosis was made.

Preoperative preparation

Each patient was placed in the Gardner-Wells tongs on admission, and proper reduction of the subluxation was checked with a cross-table lateral cervical spine film. In addition to the routine preoperative preparation, supplemental corticosteroids were administered, since most patients were receiving steroid therapy for rheumatoid arthritis. Each patient was taken to the operating room in traction and intubated awake to avoid further neurologic injury from neck manipulation. After anesthesia had been induced, the patient was carefully rolled over to the prone position on the operating table while the neck was held in extension by manual traction. The traction apparatus was then placed over the anesthesia screen in order to maintain the patient's neck in extension during the operation (Fig. 1).

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* Department of Neurological Surgery, Henry Ford Hospital

** Department of Orthopaedics, Henry Ford Hospital

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Address reprint requests to Dr. de los Reyes, Department of Neurological Surgery, Henry Ford Hospital, 2799 W Grand Blvd, Detroit, MI 48202

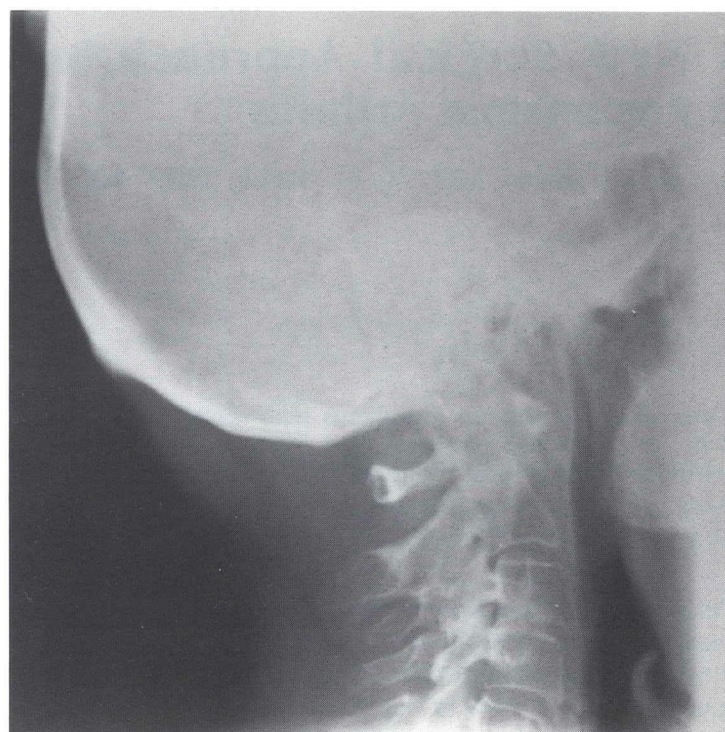


Fig. 1

Preoperative Lateral Cervical Spine Radiograph
Left: Flexion view; note atlanto-axial subluxation. Right: Extension view; note lack of complete reduction of patient's subluxation, even in full extension.

TABLE I

Ten Rheumatoid Arthritis (RA) Patients* with C₁₋₂ Subluxation

	Average	Range
Age	58 yrs	51-68 yrs
Follow-up	15 mos	6-72 mos
Duration of RA	18 yrs	10-25 yrs
Duration of symptoms	8 mos	4-18 mos
Subluxation	9.2 mms	6-13 mms

* 7 women, 3 men

Surgical technique

A midline incision is made from the external occipital protuberance to the spinous process of C₄. After the paraspinal muscles have been stripped from the posterior arch of the atlas and spinous process and laminae of the axis, the bony surfaces are roughened with a bone rasp or airpowered burr. A notch approximately 5 mm deep is made at the superior base of the spinous process of C₂ with narrow beak rongeurs, and a hole is made through the same spinous process slightly above the notch with a sharp, right-angled awl. A transverse incision is made on the periosteum of the dorsal surface of the arch of C₁. By means of a sharp curette, the periosteum is reflected inferiorly and

superiorly and is then separated from the ventral surface of the arch of C₁. This provides a dual layer of tissue (periosteum and dura) between the arch of C₁ and the spinal cord that permits a loop of 20 gauge stainless steel wire to be passed upward under the posterior arch of the atlas (Fig. 2). The bicortical iliac bone graft (Fig. 3) is removed after the abdominal, iliacus, and gluteal muscles have been stripped from their attachments to the upper, inner, and outer surfaces of the ilium. Four notches are cut on the graft in order to allow a close fit between graft, wire, and the posterior elements of C₁ and C₂. The wire is looped around the graft (Fig. 2), and the ends are either passed through the hole in the spinous process of C₂ and tightened or joined to a second wire passed through the same hole and then tightened into place (Figs. 4,5). Cancellous bone chips are then packed into the crevices under the iliac graft, and the incisions are closed in the usual manner.

Results

Originally, patients were kept in traction for one week postoperatively, but this time has gradually been shortened to 24-48 hours, after which ambulation is encouraged with a cervical collar in place. Morbidity in this series has been limited to two wound infections (one hip wound, one

cervical wound), both of which responded to antibiotics. The operative reduction remained intact. There have been no mortalities.

After surgery, all ten patients were symptomatically improved, and their neurological deficits stabilized or improved, particularly with regard to neck pain. Improvement in gait was more difficult to ascertain because most of these patients had multiple joint involvement.

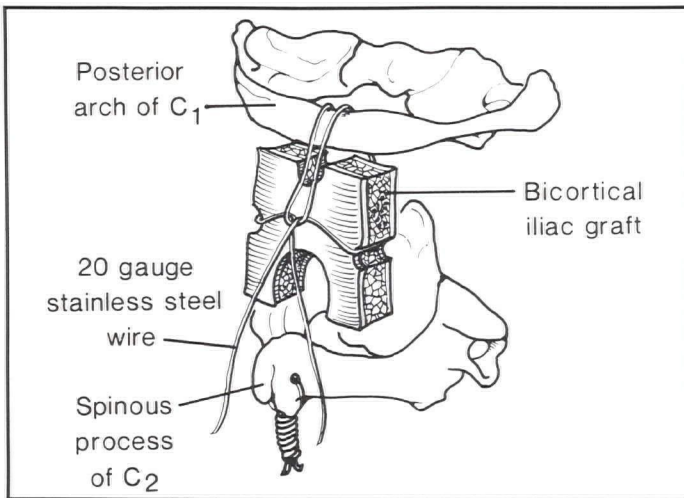


Fig. 2

Enlarged view of C₁ and C₂ showing technique of wire looping and graft placement.

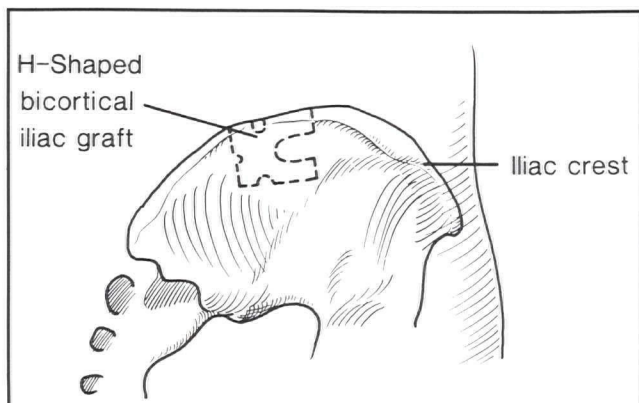


Fig. 3

Donor site for bicortical iliac bone graft.

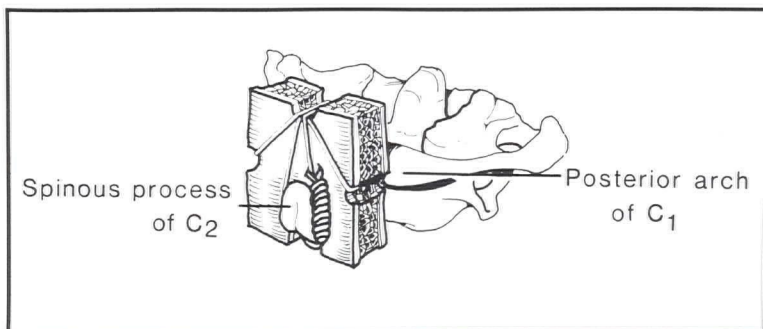


Fig. 4

Bicortical iliac "H" strut graft in place.

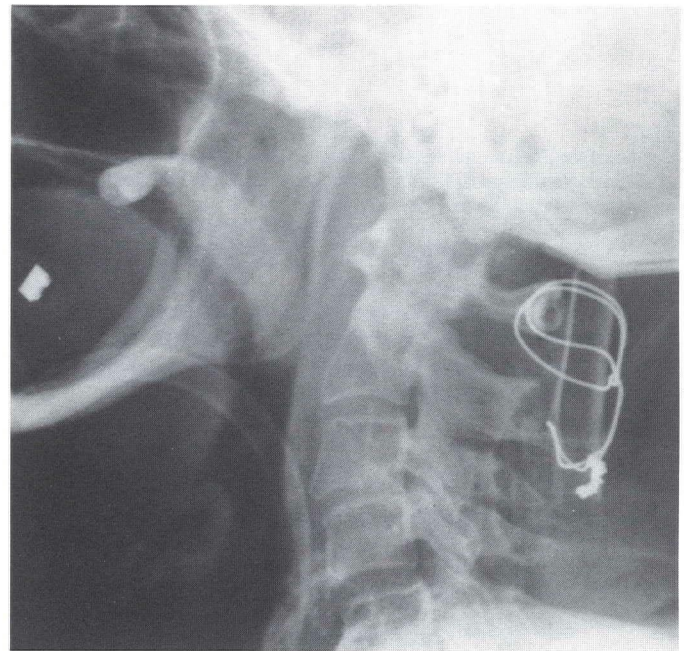


Fig. 5

Postoperative lateral cervical spine radiograph with "H" graft in place; note complete reduction of C₁₋₂ subluxation.

Discussion

Atlanto-axial subluxation in the patient with severe rheumatoid arthritis presents a difficult dilemma. Conservative treatment risks potentially severe neurologic deficit or death, while traditional surgical treatment carries the risk of morbidity due to prolonged immobilization. The technique of C₁₋₂ fusion with a bicortical iliac "H" strut graft offers several advantages.

Although it requires more dissection in the iliac region than a unicortical graft, the added strength (particularly in the osteopenic patient) provides immediate stability and thus early mobilization. While an acrylic fusion procedure would accomplish this goal without the need for a hip incision, the reduction depends on the mechanical integrity of the acrylic and the wire to provide protection for the rest of the patient's life; no eventual bony fusion will occur, as it does with the bone graft. Thus, the bicortical "H" strut graft provides both initial mechanical stability and eventual bony fusion. With early mobilization, morbidity is greatly reduced and, in fact, is more related to infection, probably

as a result of chronic steroid administration. We are currently using prophylactic antibiotic therapy to decrease the incidence of this complication.

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