ONE-STAGE TRANSORAL DECOMPRESS
AND POSTERIOR FIXATION IN
RHEUMATOID ATLANTO-AXIAL SUBLUXATION

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An operation which combined anterior transoral decompression with posterior occipitocervical fixation was used in 68 rheumatoid patients with irreducible anterior neuraxial compression at the craniocervical junction. Fibre-optic laryngoscopy with nasotracheal intubation was less hazardous than tracheostomy. The patients underwent surgery in the lateral position to allow access both to the mouth and to the back of the neck without moving the head. Specially designed instruments allowed visualisation from the front without dividing the soft palate. Posterior stabilisation was achieved by a preformed contoured loop fixed to the occiput, the atlas and the axis by sublaminar wires. The procedure allowed immediate mobilisation and had a very low morbidity in such ill patients.

In rheumatoid arthritis (RA), subluxation at the atlanto-axial joint is commoner than at any other joint in the neck though neurological complications occur in relatively few patients (2.5% of those with long-standing disease) (Garrod 1890; Boyle 1971). However, when such complications do occur the outlook is bad (Nakano 1975; Winfield et al 1981). In one study, half the patients with signs of cord compression died within a year (Marks and Sharp 1981) and, in a report compiled from autopsy material, it was estimated that 50% to 100% of all sudden unexplained deaths in rheumatoid patients were due to medullary compression from upward translocation of the odontoid peg (Redlund-Johnell 1984).

There are a variety of treatment options including application of a cervical collar, recumbency with skull traction, external fixation with a halo and body cast, posterior internal fixation (Cregan 1966; Newman and Sweetnam 1969; Conaty and Mongan 1981) and transoral decompression (Crockard 1985; Menezes et al 1985; Crockard et al 1986; Menezes and VanGilder 1988). Our present policy has developed through the conventional approaches and from dissatisfaction with the complications and hazards of these standard management policies (Meijers et al 1984). In our hands, satisfactory reduction of vertebral migration by 10 days of skull traction has not been as successful as suggested by Menezes and VanGilder (1988) and, as recumbency is associated with its own morbidity in this disease (Meijers et al 1984), we have largely abandoned the procedure. There have been fewer complications and better long-term results in those in whom we performed the one-stage procedure described here than in those who had a two-stage operation or posterior fixation alone. Clearly, selection of suitable candidates and careful evaluation of results is important and we have addressed those matters elsewhere (Hunter et al 1990).

METHODS

Selection of patients. The combined operative procedure was chosen for patients with cord or brain stem deformity in association with 1) irreducible atlanto-axial (AA) subluxation 2) a significant anterior soft tissue mass (pannus) and/or 3) vertical migration of the dens (Fig. 1). In those with reducible AA subluxation, a posterior fixation alone was performed. The situation was assessed by dynamic computed myelotomography and/or magnetic resonance imaging.

Pre-operative assessment. Careful general medical assess-
Often anaesthesia is essential before planning surgery as many of these patients are systemically ill. Mouth opening is important for anaesthesia as well as surgery (Calder 1987). An interdental distance of less than 25 mm will necessitate a mandibular split to gain surgical access. A further reduction to 15 mm will require nasotracheal intubation under topical anaesthesia (Lancet 1987).

Anaesthesia. As with our surgery, the anaesthetic technique has been modified with experience (Calder 1987); tracheostomy is now rarely used. Tracheal intubation is often difficult in these patients and is most easily accomplished using a fibre-optic laryngoscope (Messeter and Pettersson 1980). A metal-reinforced nasotracheal tube (Mallinkrodt Ltd) is passed over the fibre laryngoscope while the patient breathes halothane in oxygen. During the most difficult parts of the surgical decompression, the patient should breathe spontaneously, first because it is the most reliable guide to medullary compression, and secondly because extradural venous bleeding may thereby be reduced. After surgery, the patient breathes through a CPAP circuit until extubation, usually for 24 to 48 hours.

Fig. 1
Magnetic resonance image showing marked brain-stem and cord compression by rheumatoid pannus and odontoid subluxation. Despite marked erosion of the dens there is nevertheless severe compression, and posterior fusion alone is hazardous in such a case.

Surgical technique

Positioning. Great care is taken to avoid pressure areas on deformed limbs. Thin skin is liable to degloving injury if handled roughly.

For the transoral procedure, some lateral rotation provides a comfortable position for the seated operator and allows blood and washings to drain out of the operative field (Fig. 2). The head can often be extended which improves exposure and 'brings down' a translocated dens, obviating the need for surgical removal of the anterior rim of the foramen magnum.

The head is held in a Mayfield skull clamp. Care is taken to place the pins to allow access both anteriorly and posteriorly. Tilting the table laterally allows optimal positioning for the patient and the surgeon. During the posterior fixation, the lateral table tilt is reversed and the neck is placed in slight flexion but without changing the overall alignment. The lateral position presents the surgeon with unfamiliar anatomical relationships, both from the front and from the back, but the position saves much operating time and is better tolerated by the patient.

Exposure of the posterior pharynx. Early in our experience the soft palate was always divided but in later cases it was retracted into the nasopharynx using a Jacques catheter. Soft palatal resuture was then unnecessary but the limited exposure was a considerable disadvantage.

More recently a transoral retractor has been devised which allows elevation of the soft palate and, at the same time, holds the nasogastric and nasotracheal tubes out of the surgical field (Fig. 3). The circumoral 'halo' allows an additional suction catheter and an extra fibre light to be placed and held in position by the universal locking devices. Lateral retraction of the incised pharyngeal wall is also by toothed, angled retractors. Their broad blades provide soft tissue protection during the use of the air drill. Combined with the tongue blade and the palatal retractors these provide a 'wall of steel' around the operative site to protect against inadvertent instrument slippage. There are additional appliances which can be used if the soft and hard palates need to be divided to expose the clivus. Since this equipment became available (Codman and Shurtleff Ltd), we have not had to divide...
the soft palate for access below the anterior rim of the foramen magnum.

Transoral surgery. Following infiltration with lignocaine 0.5% and adrenaline 1:200 000, a midline incision over the anterior tubercle of C1 allows exposure. About 14 mm of anterior arch is removed by air drill and the dens and/or pannus is exposed. The soft tissue is removed by cautery and with rongeurs, and the odontoid peg is defined. The dens is hollowed out with a 3 mm cutting burr and the cortical bone thus exposed is removed with a diamond drill. The apical and/or alar ligaments can then be divided (Fig. 4). The combination of neck extension and firm traction usually allows complete removal of the dens without excision of the anterior rim of the foramen magnum (Crockard 1988). Decompression is judged adequate when the dura pulsates freely. Removal of bone and soft tissue is continued laterally until the lateral curvature of the dural sac is identified. Occasionally, when the tectorial membrane is fibrosed and calcified this must be incised and removed to decompress the dura. Small angled curettes, Hardy 1 and 2 mm transphenoidal punches and a transoral bayonet dissector are helpful at this stage. If there is a dural tear, thrombin/fibrin glue, Surgicel and a fat graft are used in combination to close it, and a lumbar drain is inserted to reduce CSF pressure. The pharynx is closed in two layers with interrupted 3/0 Vicryl sutures (Ethicon).

Posterior fixation. With the patient still in the lateral position, the table is tilted away from the surgeon. Some neck flexion is useful during the initial exposure and passage of wires; the neutral position is adopted as the wires are tightened on the loop.

A midline skin incision allows exposure of the occiput and the arches of C1, C2 and C3. Occasionally, if there is additional subaxial subluxation further levels are prepared. Enough ligamentum flavum is removed to allow the easy passage of 20-gauge doubled wires. Two instruments are available to dissect this plane at C1 and subaxially (Codman and Shurtleff Ltd) and the dura is protected from the wires by passing them in the instrument’s groove. Four 3 mm burr holes are made in the occiput, to allow two wires to be passed through the bone and around the Hartshill–Ransford loop on each side (Fig. 5). This manoeuvre is considerably easier and safer than attempting to pass wires around the rim of the foramen magnum. There are several sizes of loop and the most suitable is chosen for the individual. The ‘flare’ in the vertical struts is designed to prevent further translocation and may cause some distraction. Minor modifications in the loop’s shape can be effected using standard scoliosis instrumentation. The cervical ‘legs’ are cut to lie just below the lowest level of fixation.

Initially we used iliac crest grafts with a view to fusion but in these rheumatoid patients the incidence of non-union was so high that the additional trauma to an
already ill patient did not seem justified. We now aim at fixation without bony fusion.

**Postoperative care.** The details of postoperative care have been reported elsewhere (Calder 1987; Crockard 1988).

**RESULTS**

**Immediate complications.** Of the 68 patients subjected to this procedure, four died within the first month (6% operative mortality). In one, cord damage occurred during the posterior fixation. Two developed mesenteric artery thrombosis with gut infarction and one died of septicaemia.

There were few serious complications of the anterior surgery, and no major wound problems. Bleeding from the vertebral artery occurred on two occasions but was controlled by bone wax packing with no late sequelae. CSF leaks were seen in six patients with non-fatal meningitis in two. Chest infections were relatively common; one in four patients required intensive physiotherapy and antibiotics.

**Outcome.** Apart from the four who died, three patients were made neurologically worse. In the other 61 patients, there was a striking improvement in one-third and slight improvement in the others. In the light of the natural history of the disease process, with its otherwise inevitable neurological deterioration, we consider these results to be acceptable but still with some room for improvement.

**Conclusions.** The method of head fixation avoids hazardous movement of the neck during the period of least stability, following the transoral procedure. The lateral position, providing access anteriorly and posteriorly, reduces the risks of moving the patient and saves time. The authors recommend the use of their technique in appropriate patients.

The authors are grateful to Michelle Green for her services.

The authors do not choose to respond to the request for a statement on potential conflict of interest.

**REFERENCES**


