CERVICAL SPINE INSTABILITY IN RHEUMATOID ARTHRITIS

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We present a study of 30 fusion operations in 26 rheumatoid arthritics with cervical spine instability. Atlanto-axial instability was present in 15, of whom 12 were fused; three had cord involvement and all made a partial or complete recovery following fusion. Cranial settling necessitated cranio-cervical fusion in four patients; all fused, and one with myelopathy was relieved. Subaxial instability required fusion in seven cases; two postoperative deaths followed the only two anterior interbody fusions. Posterior fusion was successful in the other five, with remission of neurological compromise in the three with myelopathy and one with radiculopathy.

We conclude that neurological compromise in an unstable but mobile rheumatoid cervical spine can usually be brought to remission by immobilisation alone, so decompressive procedures are unnecessary in the first instance.

Controversy still surrounds the management of instability of the cervical spine in rheumatoid arthritis. Thus Read and Mennen (1983) argued that atlanto-axial instability should be sought and routinely fused before anaesthesia is undertaken for major limb surgery, for fear of cord damage during intubation; and Crockard et al. (1985) advocated anterior transoral decompression with removal of the odontoid process and surrounding granulations, followed by posterior fusion, for rheumatoid atlanto-axial instability with myelopathy. However, the world mortality figures (10 to 42%) are surprisingly high and an aura of gloom prevails in the literature; "... for progressive neurological impairment early surgery may be the only solution, for all its hazards and disappointments" (Zoma et al. 1987).

It was views such as these which provoked this present study, which set out to answer three questions:

1. What are the indications for fusing an unstable rheumatoid cervical spine?
2. When there is cord compression, is surgical decompression really necessary, in addition to fusion?
3. What should the morbidity and mortality figures be?

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0301-620X/88/5180 \$2.00

J Bone Joint Surg [Br] 1988;70-B:702-7.

PATIENTS AND METHODS

A retrospective study was undertaken of 30 cervical fusion operations performed in 26 patients with instability caused by rheumatoid arthritis. The patients represent 3.1% of the total rheumatoid population registered at our Arthritis Unit. The level of involvement is shown in Table I: four had cranial settling, 15 atlanto-axial instability and seven subaxial instability. Follow-up was from six months to 20 years (mean five years). Comprehensive clinical notes and radiographs enabled accurate assessment to be made of all cases before, during and after surgery. Two postoperative deaths occurred but all other patients were personally assessed by one of the authors (MT) who was not involved in management. Our report will concentrate on vertebral level, neurology, fusion method and results.

Atlanto-axial instability (15 patients). Thirteen patients had anterior subluxation with a 4 to 14 mm gap between the dens and the anterior arch of the atlas on flexion lateral radiographs (Fig. 1). One had posterior subluxation; the anterior arch of the atlas had slipped backwards over the severely eroded dens. One had lateral dislocation. Intractable occipital pain was the commonest indication for fusion (nine cases), followed by cord compression (three), trigeminal pain (two), and a relatively symptom-free 12 mm subluxation in one.

The primary method of fusion in 12 cases was by the standard Gallie (1939) atlanto-axial wiring over a cancellous graft as described by McGraw and Rusch in 1973 (Fig. 1). Patients left hospital on the 7th to 14th postoperative day wearing either a SOMI cervical brace or a halo-body jacket. Surgical decompression was never attempted. The remaining three cases had primary occipitocervical fusion because of inaccessibility, fra-

Fig. 1

Fig. 2

Figure 1 – Atlanto-axial subluxation measuring 6 mm, still persisting three years after a successful Gallie fusion. Figure 2 – Six atlanto-axial subluxations had cranio-cervical fusion. Fixation was by means of a small T-plate fixed to the skull with three screws and attached to the spine of the axis with screws and/or wire. The indication for the more extensive fusion in this case was fixity of the posterior arch of the atlas to the skull, making Gallie wiring at this level unsafe.

Table I. Level of instability related to neurological involvement before operation

Level of instability	Number of patients	Root compression	Cord compression	Trigeminal dysaesthesia
Cranial settling	4	2 (C2)	1	
Atlanto-axial instability	15	12 (C2)	3	2
Anterior (13)				
Posterior (1)				
Lateral (1)				
Subaxial instability	7	1 (C5)	4	
Total	26	15	8	2

Table II. Grading of cord involvement

Grade	Findings
0	No cord involvement
1	Paraesthesia in extremities Extensor plantar reflex hyper-reflexia
2	Muscle weakness
3	Quadripareisis, bedbound

gility or fixity of the posterior arch of the atlas.

Results. At follow-up all the patients had survived. Nine of the 12 Gallie fusions had united, usually in a subluxated position (Fig. 1). Three failed to unite, one after a second attempt; these were revised to occipitocervical fusion using cancellous strips with fixation by means of a small plate screwed to the skull and screwed or wired to the spine of the axis (Fig. 2). The technique is described on page 708 of this issue. Of these revisions, two succeeded but one still failed to unite. All three primary occipital fusions united.

Neurological examination (Fig. 3) was often hard to interpret because painful joints compromise motor power and joint stiffness inhibits reflexes. Before operation, 12 had pain and dysaesthesia in the distribution of the great occipital nerve; three had long tract signs (two of them were quadriparetic), two had pain and dysaesthesia in the ophthalmic division of the trigeminal nerve. Myelography confirmed cord compres-

Fig. 3

Eight patients with myelopathy graded according to Table II. AA, atlanto-axial instability; CS, cranial settling; SA, subaxial instability. The upper cross-hatched line denotes one patient who had posterior decompression in addition to fusion. The lower cross-hatched line represents the patient who died after anterior decompression and fusion for rigid subluxation at C5/6. All others gained their improvement on immobilisation, and maintained it with posterior fusion alone.

Fig. 4

Fig. 5

Figure 4 – Magnetic resonance image showing the eroded and posteriorly displaced dens, surrounding granulations, and compression of the cord in a patient suffering from long tract signs. Figure 5 – McGregor's baseline from hard palate to occiput. Upward projection of the dens over 5 mm above this line is often hard to interpret, but descent of the anterior arch of the atlas across the line is easily seen and is diagnostic of cranial settling.

sion in the early cases but was not done in later cases. Recently, magnetic resonance imaging has clearly demonstrated cord compression by a combination of bony and soft tissue impingement (Fig. 4). Before operation we used one to two weeks of traction by halter or halo; cord function returned in all cases.

At follow-up examination, all were walking and their neurological signs had remitted except for residual slight spasticity with extensor plantar reflexes in one. All had lost their occipital or trigeminal pain.

Cranial settling (four patients). Because cranial settling describes accurately the morbid anatomical state, this term is preferred to alternatives such as "basilar impression" and "upward translocation of the dens". The collapse is due to erosion and partial disappearance of the atlanto-occipital and atlanto-axial juxta-articular bone. Cranial settling was said to be present when the dens projected upwards 5 mm or more above McGregor's line which is drawn from the basi-occiput to the hard palate on a lateral radiograph (Fig. 5). Plain radiographs are hard to interpret and lateral tomography is usually required.

Results. All four patients' had occipito-cervical fusion by cancellous onlay grafts with plating. After operation they were allowed up in a SOMI brace or halo-body brace. All four united without incident.

Two patients had greater occipital nerve dysaesthesia and one had quadriplegia (Fig. 3). All made a full functional recovery following fusion, but the one that presented with myelopathy retained brisk tendon jerks and minimal spasticity.

Subaxial instability (seven patients). These patients

usually had forward subluxation measuring 20 to 50% of a vertebral body diameter, due to combinations of facet and disc erosions. Subluxations were often multiple. Four patients had long tract signs, two of these being quadriparetic; one had radiculopathy of the fifth nerve root. Myelography in earlier cases (Fig. 6) and MRI more recently confirmed the presence of cord compression.

Results. Three methods were adopted for fusion. Two patients had anterior interbody fusion and both died. The first of these had severe systemic weakness from 20 years of corticosteroid medication. She died from aspiration pneumonia unresponsive to antibiotics. The second death was in a patient who was quadriparetic from osteophytic encroachment at C4/5 with stiff segments above and below. The paresis was of 15 months duration and had not been relieved by two weeks of pre-operative halo traction. Anterior discectomy and osteophyctomy was followed by Robinson fusion. Post-mortem examination showed pulmonary oedema, possibly from over-transfusion. These two postoperative deaths were the only ones in this series.

Two patients had three-segment fusion with posterior plating and trans-pedicular screws. Both fused, one reduced and the other in a resubluxated position (Fig. 8). Three had standard posterior fusion by wiring, two involving two segments (Fig. 9) and one four segments with PMMA cement augmentation following posterior decompression (Fig. 7). All three fused in a reduced position.

Of the three cord-compromised patients who survived, two who were spastic but still just ambulant made a full functional recovery (Fig. 3). The remaining one

Fig. 6

Fig. 7

Figure 6 – Myelogram showing minimal displacement. Grade 4 long tract signs are shown to be due to an obstruction at C3/4. There had been premonitory cord signs for three months, and paraparesis for two days before myelogram and surgery. Figure 7 – After simple laminectomy performed by a neurosurgeon, posterior fusion was done by cancellous grafting. Fixation was by wiring from C2 to C5, reinforced by PMMA cement. Fusion was successful and the neurological signs reduced to Grade 1 at one year.

Fig. 8

Fig. 9

Figure 8 – Solid fusion in a position of slight redisplacement following Roy Camille plating and transpedicular screwing for anterior subluxation of the third on the fourth cervical vertebra. Figure 9 – Recent atlanto-axial fusion one year after successful posterior wiring fusion of C4 up to C5. We find simple interspinous wiring to be the most satisfactory.

had been bedridden from quadriplegia for two months before operation and recovered to walk with slight residual spasticity. The patient with C5 root entrapment made a motor recovery to strength 4+ while retaining a depressed biceps reflex.

DISCUSSION

Indications for fusion. The incidence of instability has varied from 25% (Conlon, Isdale and Rose 1966) to 52% (Floyd 1985) and the risk of sudden death seems remote unless premonitory cord signs are present (Uddin, Kraus and Kelly 1970; Koota, Isomäki and Mutru 1977; Rasker and Cosh 1981). It follows that not all cases need fusion at sight. We suggest the following indications:

Myelopathy. In accordance with Meijers et al. (1974), we find that progression is almost inevitable once cord compromise is manifest. Our unit has lost two patients while we were hesitating over surgery. Surgery is therefore indicated when long tract signs are established in an otherwise active patient, even if it is only Grade 1 myelopathy. At that stage fusion is safe and delay may be fatal.

Pain. Indications for surgery include progressive pain unresponsive to medication and bracing.

Instability. Instability becomes an important factor at atlanto-axial level only when it exceeds 10 mm and remains mobile. By contrast, subaxial instability carries a greater threat to the cord. It frequently involves multiple levels; if one of these exceeds 20% of a vertebral diameter and is accompanied by escalating pain, the risk of cord compression is greater than that of surgery, so fusion is indicated. The difficult decision then lies between fusing only the worst level or extending it to involve other unstable levels also.

Anaesthesia for other major surgery. Since spinal instability is usually into flexion, careful extension for intubation has been carried out in our unit and was without complication. Our one case of posterior atlanto-axial subluxation was the sole exception. Here we felt that extension could damage the cord, and we did primary craniocervical fusion with intubation by fibre-optic laryngoscope without extending the head.

Surgical decompression. Crockard et al. (1985) highlight the compressive effect of rheumatoid granulations around the odontoid process and urge that both dens and granulations should be removed by a transoral approach prior to posterior fusion. Other decompressive endeavours include removal of the posterior arch of the atlas (Meijers et al. 1974), widening of the foramen magnum (Meijers et al. 1974), laminectomy (Conaty and Mongan 1981) and anterior fusion with osteophylectomy (Crellin, Maccabe and Hamilton 1970). However, it must be remembered that oedema and rheumatoid granulations anywhere in the body subside with immobilisation, so

cord compression from this cause in the cervical spine should do the same once the bony segments are stabilised. Conaty and Mongan (1981) report on five subaxial laminectomies with only one satisfactory result, and Zoma et al. (1987) report that "of nine operations for bony decompression from irreducible subluxation, only four were successful". There is no report of a properly controlled trial in which results of decompression and fusion are compared with those of fusion alone. In our series of eight cord compressions (Fig. 3), one died following anterior osteophylectomy and fusion. The one case in which fusion was preceded by posterior decompression did make an improvement of one grade. This patient was, however, matched by six others who had fusion only and improved their cord function by one grade (three patients), two grades (two patients) and three grades (one patient). Our experience has therefore failed to demonstrate the need for decompression and we recommend the traditional approach of preliminary immobilisation by bracing in ambulant patients, or halo traction in paraparetics, followed by fusion alone. Our best results followed early application of these principles. Posterior fusion at whatever level leaves the door open for later anterior decompression if necessary. The "unsolved case" is the rare one with a rigid spine and long-standing paraparesis from bony compression by an osteophyte or a displaced vertebra. Here preliminary halo traction may fail to relieve cord compression and fusion alone will also fail. Bony decompression at the same session offers the only hope of success, however slender.

Mortality. Our two postoperative deaths represent 8% of our series, compared with the 10% of Zoma et al. (1987) and up to 42% in the other series (Meijers et al. 1974). We believe that the higher figures are inflated by the now obsolete methods of peri-operative care obtaining when the deaths occurred.

Conclusions. Ranawat et al. (1979) gave guidelines for management. We reinforce and expand their recommendations as follows:

1. Early intervention. When early myelopathy manifests, simple fusion is safer than risking irreversible cord damage by delay.
2. Pre-operative tracheostomy was not used in our series but we believe our two deaths might have been prevented by its use. It should be used routinely when grade 3 myelopathy (quadriplegia) has not been relieved by halo traction.
3. Intra-operative hypotension in a quadriparetic is neurogenic and requires vasopressors, not more intravenous fluids.
4. A burr and not an elevator should be used for decorticating the mobile vertebrae for fear of further damaging the cord.
5. Our experience leads us to advise against anterior fusion in rheumatoid arthritis.

6. Postoperative immobilisation impedes access to the respiratory passages: if there is no tracheostomy, extubation must be delayed until the patient is awake and "fighting the tube".

7. The combination of immobilisation and internal fixation must be good enough for the patient to be able to get up on the second or third day – otherwise an enfeebled rheumatoid may never do so.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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