SURGICAL STABILISATION OF THE RHEUMATOID CERVICAL SPINE

A REVIEW OF INDICATIONS AND RESULTS

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We have reviewed 32 patients with rheumatoid disease of the cervical spine who underwent a total of 40 operations aimed at correcting instability and improving any associated neurovascular deficit. Apart from four patients with intractable pain, the main indication for surgery was progressive neurological impairment.

Of the 32 primary operations, 19 (60%) were successful; the remainder failed to achieve their objective and there were two deaths in the immediate postoperative period. Of eight secondary operations performed for recurrence of symptoms or failure to relieve cervical myelopathy, only four were successful. Of nine operations for bony decompression to relieve cord compression from irreducible subluxation, only four were successful. The overall results show a success rate of 57% and a failure rate of 35% with early operative mortality in 8%. Indications for operation are discussed and earlier diagnosis is considered to be the key to improved results.

The cervical spine may become unstable as a result of rheumatoid disease of the vertebral synovial joints. The exact incidence is difficult to determine, but it has been suggested that 25% to 30% of patients admitted to hospital with rheumatoid arthritis have radiological involvement of the cervical spine (Mathews 1969). The atlanto-axial level is most commonly involved with a lower incidence in the subaxial joints and intervertebral discs (Sharp and Purser 1961; Ornilla, Ansell and Swannell 1972).

Cervical instability can occur early in the course of the disease and may have a variable outcome (Winfield et al. 1981). The main pathomechanical basis of this instability is the ligamentous laxity and bone destruction produced by synovial proliferation at the facet joints and bursal sacs, but the exact pathology of the destruction of the intervertebral discs and the vertebral bodies remains controversial (Ball 1958; Martel 1977). Other noticeable features are marked osteoporosis and the absence of reactive new bone formation. The clinical syndromes

which develop depend on the level of involvement, the severity of the instability and the extent of any neurological deficit.

The earliest symptoms are usually pain and neck stiffness. Pain frequently results from irritation of the second cervical root; classically this involves the occiput and the upper cervical spine and is made worse by sudden or jarring movements. Unilateral atlanto-axial subluxation may cause fixed rotational deformity and stiffness. Vertical subluxation of the odontoid peg is usually painless, but subaxial subluxation is usually accompanied by both pain and stiffness. The assessment of the degree of neurological involvement is made difficult by the extent of the arthritis and the consequent muscular atrophy and joint deformities. The severity of such neurological involvement does not necessarily correspond to the degree of subluxation; a high index of suspicion is needed to detect neurological deterioration.

The surgical management of symptomatic instability is now well established, but has a varying degree of success. The main indications for surgery are progressive neurological impairment and progressive radiographic instability; occasionally operation is required for intractable pain which continues despite adequate conservative treatment (Ranawat et al. 1979; Hamblen 1983). The primary aims of operation are the stabilisation of the cervical spine in as normal a position as possible, and the relief of cord compression and associated neurological impairment. Relief of pain and mechanical symptoms is usually more satisfactory than neurological recovery; any delay in diagnosis will

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diminish the chances of a satisfactory outcome (Conaty and Mongan 1981).

Of the operations which have been used, anterior cervical fusion has very limited application; it may give disappointing results (Ranawat et al. 1979). Posterior interspinous fusion is more effective in relieving pain and neurological impairment (Cregan 1966; Ranawat et al. 1979), whilst occipitocervical fusion is used less frequently (Hamblen 1983). Decompressive laminectomy is sometimes considered to be necessary to relieve pressure on the spinal cord from an irreducible bony subluxation, but its exact place in management and its effectiveness have been questioned (Conaty and Mongan 1981).

We have reviewed the indications for operation and the results obtained in patients treated in Glasgow over an eight-year period, in an attempt to define the clinical criteria which could predict the outcome of surgical treatment.

PATIENTS AND METHODS

We carried out a retrospective review of 32 patients with rheumatoid arthritis who had had a total of 40 operations to control symptomatic cervical instability; these were performed at three centres in Glasgow between 1974 and 1982. There were 24 women and eight men with a mean age of 60 years (range 46 to 74 years) and a mean duration of disease of 18 years (range 2 to 40 years). The average length of follow-up was five years, with a range of 2 to 9 years.

Two thirds of the patients were known to be seropositive. In the only seronegative patient in the series, the disease had started in childhood. Eleven patients were taking steroids at the time of operation or within the three months preceding it, but 17 patients had no history of steroid treatment. Only five patients had a history of trauma which could have damaged the cervical spine. Most operations were performed for progressive and symptomatic neurological impairment associated with spinal instability.

Twenty-eight of the patients had presented with a neurological deficit, 14 of them also had neck pain. The neurological deficit was arbitrarily graded as mild, moderate or severe on the basis of motor weakness, sensory loss and ability to walk (Table I). The neurological deficit was mild in 11 patients, moderate in six and severe in 11, while the indication for operation in the four other cases was severe occipitocervical pain without neurological impairment. Three types of radiological instability were distinguished; all patients had one or more. These were: 1. Atlanto-axial subluxation exceeding 3 mm in flexion (Sharp and Purser 1961). 2. Vertical subluxation of the odontoid peg of more than 4.5 mm beyond McGregor's line or any projection above McRae's line (Hamblen 1983). 3. Subaxial subluxation of more than 1 mm between the anterior profiles of two

adjacent vertebrae on a radiograph taken in flexion (Meikle and Wilkinson 1971).

Atlanto-axial subluxation alone was seen in 12 patients and vertical subluxation of the odontoid peg was noted in a further three cases; subaxial subluxation was present in nine patients and was combined with atlanto-axial subluxation in another eight. A total of 13 myelograms and two CT scans were performed to assess the patency of the cervical canal. Some degree of spinal canal obstruction was demonstrated in 11 patients, while technical difficulties in the other two patients led to unsatisfactory results. One CT scan confirmed narrowing of the canal at C3-4 level, and the other excluded pseudarthrosis in the fusion mass between the atlas and axis.

Table I. Classification of the neurological deficit in rheumatoid disease of the cervical spine

Mild	Mild motor weakness Mild sensory impairment Walking not compromised
Moderate	Lower motor neurone lesion with or without upper motor neurone involvement Posterior column deficit Transient brain-stem deficit Needs walking aids
Severe	Severe weakness or paralysis Persistent brain-stem deficit Loss of sphincter control Unable to walk

Management. Skull traction was employed before operation in 24 patients and three patients needed a halo jacket to control instability and relieve pressure on the spinal cord. Conventional skull calipers were used with clinical and radiological monitoring of alignment and traction weight. Most patients were nursed in a split cardiac bed, which was found to be tolerated better than a Stryker frame.

Operation. The primary objectives of operation were to correct spinal malalignment and secure stability; nine patients also had decompressive laminectomy. The indications for decompression were: failure to obtain neurological improvement with pre-operative traction; failure to reduce persistent subluxation, particularly due to fixed ankylosis at C1-2; and vertical subluxation of the odontoid which was causing severe foraminal obstruction.

Anterior fusion, using a dowel interbody technique, was employed for only one patient; this failed to relieve neurological impairment and posterior decompression with interspinous fusion was required later.

Posterior atlanto-axial fusion by iliac bone graft with wiring of the atlas to the axis was used for isolated atlanto-axial instability. When subaxial instability was also present, the involved levels were included in a longer posterior fusion.

Occipito-cervical fusion was used for instability of the

upper spine in many of the earlier cases, but later it was used less frequently. In this procedure the fusion mass included the occiput, with corticocancellous bone graft anchored by wires to burr holes in the basi-occiput (Hamblen 1967). Immediate stability was achieved in five cases by the use of acrylic bone cement to reinforce the wiring (Brattström, Elner and Granholm 1973).

Posterior interspinous fusion, a relatively simple technique, was used for subaxial instability. Wires were either passed through drill holes at the base of the decorticated spinous processes or looped around the rawed laminae on each side of the midline. Cancellous bone strips and chips were laid on the rawed surfaces to provide rapid fusion.

Postoperative splintage was provided by continuing skull traction for a further two weeks during wound healing. If neurological impairment persisted or if the fusion had been less than satisfactory, skull traction was continued for up to six weeks. Skull caliper traction was generally employed because general arthritic involvement makes the use of halo traction more difficult. However, halo traction has the significant advantage of allowing the patient to be mobile at an earlier date and its use is recommended when it can be tolerated, as in four patients in this series. When traction was removed patients were fitted with a moulded Plastazote cervicodorsal jacket which had reinforcing strips anteriorly and posteriorly to support the chin and occiput. When there was radiological evidence of early incorporation of the graft this was replaced by a shorter moulded collar which was worn until bony union was complete in another four to six weeks.

RESULTS

Of the 32 patients in the study, two were excluded from review. They had died in the first two weeks after operation, one from bronchopneumonia with pseudomembranous colitis and one following a myocardial infarction. A third patient died 12 hours after a second stabilisation operation because of uncontrolled intra-abdominal bleeding from the donor site for an iliac bone graft. The cause of death in all three patients was confirmed at autopsy.

The remaining 30 primary procedures include only one anterior fusion, which required the early addition of posterior fusion with laminectomy to achieve neurological relief and satisfactory stability (Table II). Posterior fusion was carried out as a first procedure in 16 patients. Pain relief and neurological improvement was achieved in nine patients (56%) and the graft became incorporated in eight (50%), but the subsequent formation of a pseudarthrosis in the ninth case did not result in neurological deterioration. Of the seven failed posterior fusions three had had additional decompressive laminectomy. In one patient, solid fusion was achieved with

Table II. Primary fusion operation and the outcome in 30 cases

Type of fusion	Radiographic		Clinical		Total
	Fusion	Failure	Success	Failure	
Anterior interbody	1			1	1
Posterior	8	4	7	5	12
Posterior with laminectomy	1	3	2	2	4
Occipitocervical	8	4	10	2	12
Occipitocervical with laminectomy		1		1	1

Table III. Secondary operations and their outcome in eight patients

Interval after primary operation	Level	Outcome	Walking ability
1 year	New C3-4	Success	One stick
11 months	New C5-6	Failure	Chair-bound
2 months	Recurrent at C1-2	Success	One stick
18 months	Recurrent at C1-2	Success	Walking frame
10 months	New C3-4	Death	—
12 months	Recurrent at VSL	Failure	Chair-bound
4 years	Recurrent at C1-2	Failure	Walking frame
2 weeks	Repeat fusion at C2-4	Success	Two sticks

VDL, vertical subluxation of the odontoid

improvement in neurological deficit despite the need for an extensive laminectomy.

Occipitocervical fusion was required in 13 patients; 10 of them (77%) had pain relief and neurological improvement. Successful fusion was obtained in eight (62%), but symptoms were relieved in three patients whose fusion failed. Combined posterior decompression was carried out in only one of this group, but this patient had graft resorption and an unsuccessful outcome. Five primary decompressive laminectomies were undertaken with fusion; two patients had satisfactory results, but three had a poor outcome and only one patient achieved a solid fusion.

The four patients operated on for cervical pain alone all had total relief of their symptoms after occipitocervical fusion in three and atlanto-axial fusion in one. The clinical outcome in patients with neurological abnormalities depended on the severity of the initial deficit. Success was more common in those with mild or moderate deficits, but there was a high failure rate (87%) in those with severe neurological abnormality (see Table IV). Of the eight failures in patients with severe deficit, five had had stabilisation for subaxial subluxation, one for atlanto-axial subluxation and two for vertical subluxation of the odontoid peg. It was noted that both early postoperative deaths were of patients with severe neurological deficit.

Eight secondary or revision operations were re-

quired (Table III); five were for the failure of the original procedure and three for the stabilisation of increased subluxation at a different level (Figs 1 and 2). One patient died, four had satisfactory results and there were three failures. The outcome of all 32 primary procedures and of all 40 operations is shown in Table V.

Complications. Graft fracture and resorption (Figs 3 and 4) occurred in nine patients, but in three this did not prevent a successful clinical outcome. In one other patient a graft fractured two months after an atlanto-axial fusion; a second operation was required to extend the fusion to the occiput and achieve success. In five patients graft failure was associated with clinical failure, one fracture occurring four years after the primary operation.

Four patients had wound infection and in three of these there was graft resorption. One patient developed a chronic sinus associated with a retropharyngeal abscess. Antituberculous treatment was required to achieve healing. Two patients had infection of the iliac crest wound, one of them with a chronic sinus which needed prolonged antibiotic treatment. Two patients developed postoperative confusional states which were probably related to transient cerebral ischaemia.

At the time of follow-up 13 deaths were recorded.

Table IV. Outcome related to neurological involvement

Neurological involvement	Patients	Operations	Outcome (number, <i>per cent</i>)		
			Success	Failure	Death
Nil	4	5	5 100	0	0
Mild	11	13	10 77	3	0
Moderate	6	7	6 86	1	0
Severe	11	15	2 13	10	3

Table V. Outcome of 32 primary operations and of these plus eight secondary procedures

Outcome	Primary operations		All operations	
	Number	<i>Per cent</i>	Number	<i>Per cent</i>
Success	19	60	23	57
Failure	11	34	14	35
Death	2	6	3	8

The three early deaths have been detailed above; the other 10 were not directly related to the operation and occurred an average of 30 months after operation, ranging from 3 to 84 months.

Figure 1 – Early lysis of the articular facet joints at C3–4 level, below a successful occipitocervical fusion. Figure 2 – To show gross displacement of C3 on C4 below the fused segment.

Fig. 1

Fig. 2

Figure 3 – Fracture of the graft after occipitocervical fusion has allowed recurrence of atlanto-axial subluxation, and there is a total myelographic block (Fig. 4) at this level.

Fig. 3

Fig. 4

DISCUSSION

It is difficult to define a clear strategy for the surgical management of symptomatic instability in the rheumatoid cervical spine because the results of established procedures are unsatisfactory. This results from many factors, including the generalised inflammatory nature of the disease, lack of awareness of the problem which leads to delay in diagnosis, and the limited availability of orthopaedic and neurosurgical expertise.

In analysing reports of surgical treatment of rheumatoid cervical myelopathy, it must be remembered that most of the patients are poor operative risks and have advanced arthritis and severe neurological involvement. In our series, the most important factor in the success of the operation was the severity of neurological impairment, quite irrespective of the level of cervical involvement. Of those patients with a severe deficit the result was early death or failure in 87%, while 80% of those with lesser grades of neurological involvement had a clinically good result. It was difficult to determine the delay between the onset of symptoms and presentation to the surgeon. In one study there was reported to be a mean delay of 31 weeks between the appearance of the first symptoms and the diagnosis of myelopathy (Marks and Sharp 1981). This period of delay would have undoubtedly influenced the chance of reversal of any neurological deficit by operation.

Solid fusion with incorporation of the iliac bone graft was achieved in 57% of our patients and this was paralleled by an improvement in the clinical symptoms in 63%. Failures were attributed to subluxation at new levels, causing loss of stability at levels below the fusion mass (Hamblén 1983), bone graft fracture and resorption with resultant angulation, pseudarthrosis formation, or recurrence of the original subluxation. At the atlanto-axial joint displacement can recur, even when the bone graft is intact, because collapse of the lateral joints allows further vertical subluxation of the dens.

This study has confirmed that cervical instability is a serious complication of rheumatoid disease and presents major problems of surgical management. Surgical treatment carries a considerable risk of mortality and morbidity, so the wisdom of operating on such patients must be questioned. There is no easy answer, since the alternative conservative approach has also proved ineffective in the face of severe cervical instability. One study reported that all nine patients who did not have an operation died within a year, half of them because of cord lesions (Meijers et al. 1984) and a similar experience has also been reported by Marks and Sharp

(1981). On balance, the early recognition of potentially serious instability of the rheumatoid cervical spine would seem to be the most important factor. Whether an operation is then indicated depends on a clear appreciation of many factors including the general state of the locomotor system, the severity of functional disability, and the extent of the radiographic abnormalities. This can only be achieved by closer cooperation between the physicians and surgeons managing patients with rheumatoid disease.

In conclusion, despite the sometimes discouraging results of operation, a few clear facts emerge. It appears that pain and radiographic instability without neurological deficit rarely require operation but that for progressive neurological impairment surgery may be the only solution, for all its hazards and disappointments. Early diagnosis is the key to the improvement of results.

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