Cervical Spine Arthrodesis in Rheumatoid Arthritis: A Long-Term Follow-Up

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Forty-one patients with rheumatoid arthritis involving the cervical spine had a posterior cervical arthrodesis. They were followed for a minimum period of seven years. The diagnoses prior to surgery included cranial settling, atlantoaxial subluxation, subaxial subluxation, and any combination of these three. All patients had posterior arthrodesis, with or without methylmethacrylate, and iliac crest autogenous bone graft. In addition, one patient had an anterior vertebrectomy, and two had transoral resection of the odontoid.

Follow-up consisted of a subjective questionnaire, standard radiographs, and physical examination, including a neurologic exam. This information was compared to preoperative data available in the patient's medical record, postoperative data, and the information obtained in a similar study undertaken in 1987.

At the time of follow-up, thirteen patients were known to be dead. One patient could not be located. Of the remaining twenty-six patients, eighteen underwent the full examination, including physical exam and radiographs. The remaining nine patients were contacted and interviewed, but were unavailable for exam and radiographs. All patients considered the operation a success. Only one patient at follow-up had a non-union. This was stable over time. No patient had a deterioration in neurologic function. There was no significant degeneration or instability seen at levels adjacent to the fused segments as compared to the rest of the cervical spine.

Posterior cervical spine arthrodesis for rheumatoid involvement of the neck is a safe, efficacious procedure with no significant deterioration of effects over time.

INTRODUCTION

This study is a retrospective review of the long-term efficacy of posterior cervical arthrodesis in rheumatoid arthritis. Our previous report of this group of patients detailed the preoperative indications for the procedure and the nature of the surgery itself [1]. The goals of this study were to follow critically the outcome of the surgery at eight to thirteen years, with particular attention paid to continued relief of symptoms and patient satisfaction, stability of the fusion, complications of the surgery, and progression of rheumatoid disease and instability at levels adjacent to the fused level(s).

METHODS

From August 1980 to November 1985, forty-one consecutive patients underwent posterior cervical spine fusion for conditions related to rheumatoid arthritis at the University of Iowa Hospitals and Clinics. All procedures were performed by a single surgeon (C.R.C.). The indications for surgery included pain, instability, neurologic compromise, and impending neurologic involvement. Surgery was performed for cranial settling in seven patients, atlantoaxial subluxation in twenty-one, subaxial subluxation in three, and a combination of these disorders in nine. Treatment consisted of posterior fusion in

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all patients; occipital-cervical in sixteen (39%), atlantoaxial in twenty (49%), and subaxial fusion in five (12%). The minimum follow-up was seven years, with a range of seven to twelve years. There were no deaths within the first year post surgery; however, at the time of latest follow-up, thirteen patients are known to be deceased. One patient was not contacted. Of the remaining patients, eighteen were interviewed, examined, and x-rayed. The remaining nine patients were contacted and interviewed, but were not available for examination.

Present follow-up consisted of evaluating current symptoms, with emphasis on neurologic and local symptoms. All patients were asked to rate their level of discomfort on a visual analog scale, with a rating from one to ten assigned based on their analog assessment. They were asked to describe subjective information about their preoperative state. Appendix 1 is a copy of our subjective questionnaire and the record of physical exam. All examinations were performed by a single examiner not previously involved in the care of any of the subjects. This information was compared to the information gained from the same group of patients in 1987, as part of our previous study. The consistency of answers to questions regarding preoperative state provides some validation of the retrospective recall of symptoms.

Based on the neurological exam, the patients were divided into three classes, based on the criteria of Ranawat et al. [2]: Class I, no neurologic deficit; Class II, subjective weakness with hyperreflexia or dysesthesia, and Class III, objective weakness and long tract signs. Class III was subdivided into Class IIIA (able to walk) and Class IIIB (unable to walk based on quadripareisis).

Radiographs were obtained in the AP plane and in full flexion and extension in the lateral plane. These were compared to x-rays taken pre-operatively, post-operatively, and in 1987. Measurements of cranial settling included Chamberlain's line, Wackenheim's line, the station of the atlas, and the measurement described by Ranawat [2]. Although many patients had tomograms of the upper cervical spine pre-operatively to evaluate cranial settling, these were not routinely obtained post-operatively. Erosion of the odontoid was present in many patients, making visualization of this structure difficult or impossible in six (33%) patients. The distance of Ranawat and the distance from the base of the axis to Chamberlain's line were followed as valid measures of further settling [3].

Atlantoaxial stability was measured with the pre-odontoid interval and the post-odontoid interval, in both flexion and extension. Subaxial subluxation was measured using the criteria described by White et al. [4]. Instability was defined as anterior-posterior translation of greater than 3.5 mm in flexion and extension.

RESULTS

At the time of follow-up thirteen patients had died. None died within the first year post-surgery. One died one week following revision surgery more than five years after the index procedure. The other twelve patients died of unrelated causes. One patient was not located for follow up. Of the remaining survivors, eighteen underwent a full evaluation, including physical examination and x-rays. The other nine patients were contacted and interviewed, but were not examined or x-rayed. The results of the study are summarized in Table 1.

We considered the patients improved if their pain score was three or more points (on a ten point scale) improved from preoperative pain, neurologic status was improved or unchanged, and if the patient considered the operation a success. Patients with significant complication were considered failures.

All patients considered the operation a success. Of those who had painful symptoms pre-operatively, all had significant post-operative relief. Only one patient had return of
Table 1.

| Pt # | Indications | Neuro class | Fusion status | Clinical status | Length followed | Fusion status | X-ray |
|------|-------------|-------------|---------------|-----------------|----------------|---------------|-------|
| 1    | X X I I U I | 9y 6m       | yes           | yes             |
| 2    | X X II      |             |               |                 |
| 3    | X X I       |             |               |                 |
| 4    | X X I I U NC| 12y 1m      | yes           | yes             |
| 5    | X II II U NC| 13y 5m      | yes           | yes             |
| 6    | X X II U W  | 8y 4m       | yes           | yes             |
| 7    | X X IIIA II U I | 7y 5m | yes | yes |
| 8    | X X I I U I | 7y          | yes           | yes             |
| 9    | X I         |             |               |                 |
| 10   | X II        |             |               |                 |
| 11   | X X III III |             |               | died            |
| 12   | X X X II NU| 8y 7m       | yes           | yes             |
| 13   | X X II      |             |               | died            |
| 14   | X X II I F NC| 10y 9m     | yes           | yes             |
| 15   | X II        |             |               | died            |
| 16   | X I         |             |               | died            |
| 17   | X X II      |             |               | died            |
| 18   | X X IIIA    |             |               | died            |
| 19   | X X X II    |             |               | died            |
| 20   | X X IIIA II U W-WD | 9y 6m | yes | yes |
| 21   | X X II      |             |               | died            |
| 22   | X X II      |             |               | died            |
| 23   | X X II      |             |               | no              | no            |
| 24   | X X II      |             |               | 6y 6m           | died at RS    |
| 25   | X II II F NC| 8y 10m      | yes           | yes             |
| 26   | X X X IIIA |             |               | no              | no            |
| 27   | X X X II U I| 7y 3m       | yes           | yes             |
| 28   | X I I U NC  | 9y 11m      | yes           | yes             |
| 29   | X X I       |             |               | no              | no            |
| 30   | X X I I U NC| 12y          | yes           | yes             |
| 31   | X X I I U NC| 9y 5m       | yes           | yes             |
| 32   | X I         |             |               | no              | no            |
| 33   | X II        |             |               | died            |
| 34   | X X X II    |             |               | no              | no            |
| 35   | X I I U NC  | 9y 11m      | yes           | yes             |
| 36   | X X II U I  | 7y 11m      | yes           | yes             |
| 37   | X X II      |             |               | died            |
| 38   | X X IIIA II U I | 10y 11m | yes | yes |
| 39   | X X I       |             |               | no              | no            |
| 40   | X X I I U I | 9y 7m       | yes           | yes             |
| 41   | X X II      |             |               | died            |

Key: Post-op means at the time of latest follow-up, U, union; NU, non-union; NC, no change; W, worse; I, improved; W-WD, worse with wound drainage; F, fibrous; RS, revision surgery.
pain over time; however, even that patient feels that the pain is less than it was before surgery. The most common complaint, expressed by all patients to some degree, was loss of neck motion. Only two patients, however, felt that this was a functional impairment. Both noted that the activity that this affected most was driving a car. One felt that she was no longer able to drive as a result. On examination, no patient had significant decrease in range of motion from 1987 to the present.

Two patients developed superficial wound infections in the early postoperative period. One of these developed a chronic draining sinus which required debridement and myocutaneous flap coverage. Other complications included non-A non-B hepatitis contracted from a transfusion, transient hemiparesis in one patient, and erosion of methylmethacrilate into the occiput in one patient requiring revision surgery.

The pre-operative neurologic status remained unchanged or improved post-operatively in all patients who were examined. One patient became increasingly myelopathic two years after a C1-2 fusion; however, this has remained stable over 6 years. An extensive work-up was negative, and his myelopathy was not believed to be related to the surgery. It has remained stable over six years. One patient had some CS radicular pain eight years after surgery at C1-2. This patient, also the one who redeveloped neck pain, had a stable nonunion which was asymptomatic until that time. No other patient had a deterioration in neurologic function over time.

Radiographically, only the one patient had a nonunion. Fifty percent of those patients with an occipitalcervical, atlantoaxial, or high subaxial fusion developed some subluxations at more caudal levels. None, however, were clinically important (greater than 3.5 mm) and none required treatment. There was no significant difference in the incidence or severity of subluxations at the level directly below a fused segment versus the rest of the cervical spine. In addition, there was no increased incidence of degenerative changes at levels adjacent to fusions in comparison to the rest of the cervical spine.

DISCUSSION

Earlier studies, including the earlier report of this group of patients, have indicated that posterior arthrodesis of the cervical spine is an effective, safe management option for instability related to rheumatoid arthritis. The indications, procedures, and outcomes have been well described [5]. Our previous report [1] expressed concerns about non-union at higher level fusions and development of subluxations at lower levels. While the earlier report included a higher incidence of non-union or delayed union at higher level fusions, the longer term follow-up in this report shows that this is not a progressive problem over time. Only one of the eighteen patients with follow up x-rays had a nonunion (6%). This patient was identified in the earlier study as having a nonunion which was stable over time. In addition, the earlier report expressed concerns about the development of instability caudad to the fusion level. While subaxial subluxation and degeneration was noted to some degree in virtually all subjects, it was not more evident at the levels adjacent to the fusion.

These longer term results are more optimistic than our earlier report of follow-up on this group of patients. It may be that over time the death of a significant number of our study group (30%) selected out the healthier patients who were relatively predisposed to a more favorable long term outcome. Regardless, this study shows that patients who have cervical instability as a result of rheumatoid arthritis can benefit from posterior cervical arthrodesis. In addition, this validates earlier claims that this is a relatively safe procedure when performed in the proper patient population. The benefits of the surgery seem to be stable over the long term.
Appendix 1

Clinical Assessment Form

Examiner_________________________ Date_________________________
Patient#_________________________ Name_________________________
Hosp#___________________________
Current joints involved:________feet________hands________hips
________knees________shoulders

Current symptoms:

Current Meds:

Current symptoms:
crepitus________ vertigo________
occipital pain________ drop attacks________
motor weakness________ visual disturbances________
bladder dysfunction________ dysarthria/dysphonia________
impended doom c flexion________ dysesthesias________
difficulty walking________ dysphagia________
neck pain________ paresthesias________
other________

Comments:

Patient Responses:

Neck Pain Pre-Op

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Neck Pain Post-Op

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Neck Pain Now

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Have you needed other surgery on your neck?
Are you happy with the result?
Were you happy after the surgery?
Were you ever on the following medication?
  Gold________ Steroids________
  Methotrexate________ NSAIDS________

Physical Exam:

  motor: CN
         UE
         LE
  sensory: CN
           UE
           LE
           F/E
  muscle spasm:
  ataxia:
  muscle atrophy:
  point tenderness:
  reflex:
  neck ROM:
  RLB/LLB:
  RAR/LAR:
  resp depression:
  other:

Comments:
REFERENCES

1. Clark, C. R., Goetz, D. D., and Menezes, A. H. Arthrodesis of the cervical spine in rheumatoid arthritis. J. Bone and Joint Surg. 71-A:381-392, 1989.
2. Ranawat, C. S., O'Leary, P., Pellici, P., Tsairis, P., Marchisello, P., and Dorr, L. Cervical spine fusion in rheumatoid arthritis. J. Bone and Joint Surg., 61-A:1003-1010, 1979.
3. El-Khoury, G. Y., Wener, M. H., Menezes, A. H., Dolan, K. D., and Kathol, M. E. H. Cranial settling in rheumatoid arthritis. Radiology 137:637-642, 1980.
4. White, A. A., III, Johnson, R. M., Panjabi, M. M., and Southwick, W. O. Biomechanical analysis in clinical stability of the cervical spine. Clin. Orthop. 109:85-96, 1975.
5. Wertheim, S. B. and Bohlman, H. H. Occipitocervical fusion. Indications, technique, and long-term results in thirteen patients. J. Bone and Joint Surg. 69-A:833-836, 1987.