A REVIEW OF RHEUMATOID CERVICAL INSTABILITIES REQUIRING SURGERY INCLUDING NEWER FIXATION METHODS

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ABSTRACT:

Study Design: *50 rheumatoid patients requiring cervical spine surgery for instabilities were retrospectively reviewed.*

Objectives: *A retrospective review of our patient population and surgical outcome to determine if utilizing standard wiring procedures are comparable to previously published reports.*

Summary of Background Data: *Cervical spine instability has been shown to occur early in the course of rheumatoid disease (6, 45, 46, 48, 49). The instability produced, combined with proliferation of synovitic tissue (pannus), may compress the spinal cord, nerve roots, and vertebral arteries resulting in pain and neurological abnormalities. Primary treatment in rheumatoid arthritis of the spine is directed towards prevention of neural compromise and for this reason surgical arthrodesis is advised when instability is present.*

Results: *27 patients had sufficient documentation for inclusion. Some had newer methods of fixation including plates and screws. Mean follow-up was 28 months. Our series demonstrated similar outcome for wiring procedures with 81% bony fusion rate and no neurological deterioration. 11% developed subaxial instability following upper cervical spine procedures.*

Conclusions: *Newer methods of fixation were helpful in treating more complicated cases including multilevel involvements, deformity and higher grade instability.*

Key Words: *Cervical spine, Instability, Rheumatoid arthritis, Arthrodesis*

INTRODUCTION

Rheumatoid arthritic involvement of the cervical spine has been reported to occur in 19-88% of rheumatoid patients (2, 7, 39-42, 45, 47, 50, 51). Neurological complications arise from basilar impression (BI) (57, 58), atlantoaxial instability (AAI) (56), and subaxial instability (SAI) (1-4, 19, 20, 33, 38, 44). Cervical spine instability has been shown to occur early in the course of the disease (6, 45, 46, 48, 49). The instability produced, combined with proliferation of synovitic tissue (pannus), may compress the spinal cord, nerve roots, and vertebral arteries resulting in pain and neurological abnormalities. Primary treatment in rheumatoid arthritis of the spine should be directed towards prevention of neural compromise and for this reason surgical arthrodesis is advised when instability is present. Once signs of myelopathy appear, the prognosis is extremely poor and if not surgically treated, death commonly occurs within a year from the onset of mylopathy (6, 13-15, 20, 24, 25, 27, 28, 30-32, 37, 40, 43, 44, 52-56). This paper describes various standart wiring procedures utilized by the authors and demanstrates that newer methods of fixation can be helpful in treating more complicated cases including multilevel instability and deformity.

METHODS

50 rheumatoid patients with cervical spine instability were treated at Spinal Associated of North Central Florida, Gainesville, Florida and Florida Orthopedic Institute, Tampa, Florida, between the dates of February 1989 and February 1992. Radiographic criteria described by White & Panjabi (17, 18, 20) were used for defining anterior/posterior instability in the subaxial spine. Horizontal AP subluxations >3.5 mm and angular differences between levels of >11° were considered unstable. Atlantoaxial subluxations were defined as preodontoid (atlantodens) interval (ADI) >3mm and not fixed on flexion extension x-rays. Basilar impression or invagination i.e., cranial settling, was defined by Chamberlain's Line and Wachenhein's Line. Additional diagnostic tests for basilar invagination as well as brainstem and/or spinal cord compression included magnetic resonance imaging, cervical tomography, and myelographic CT scanning. Indications for surgery included pain, neurological deficit (actual or

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impending) and instability. Instability was the most common indicator for surgery. All patients, preoperatively, presented with some degree of pain. 3 patients (11%), exhibited signs of myelopathy. The mean age was 58 years (range 13 to 89). There were 4 males (15%) and 23 females (85%).

All patients underwent complete medical evaluations prior to surgical intervention. Gardner Wells tongs were used intra-operatively only for grossly unstable spines and for basilar impression. Intraoperative spinal cord monitoring (i.e., somatosensory evoked potential) was also provided. Posterior cervical fusion between C1 & C2 was carried out utilizing sublaminar wires beneath C1 and spinous process wires into and around C2 and either outogenous or allogenic corticocancellous grafts. Porterior occipitocervical fusions at times required partial removal of the posterior rim of the foramen magnum and removal of the posterior arch of C1. This was followed by a posterior occipitocervical fusion with either autogenous or allogenic corticocancellous bone graft and posterior cervical wiring. More recent procedures have utilized posterior cervical plates instead of wiring. Subaxial subluxation was treated with interspinous process wiring, posterior cervical lateral mass plating, or anterior cervical plating. Methyl methacrylate was not utilized in this study.

RESULTS

23 patients (85%) exhibited atlantoaxial instability either alone or in combination with other reheumatoid instabilities. 8 patients (30%) had evidence of basilar impression and 12 (44%) subaxial instability. (See Table 1)

Table 1: Preoperative Diagnosis

Instability	Patients	Percent
AAI only	12	44%
SAI only	4	15%
AAI + BI	3	11%
AAI + SAI	3	11%
AAI + BI + SAI	5	19%

There were no intraoperative or follow-up deaths on the 27 patients included in this study. 17 (63%) of the patients had posterior cervical arthodesis; 6 (22%) posterior occipitocervical fusion; 3 (11%) anterior cervical fusion and 1 (4%) had combined anterior-posterior approach. Overall, 22 (81%) of the fusions healed by osseous union and 5 (19%) healed by fibrous union or nonunion: 2 of these patients continued to improve clinically and 2 required reoperation, 1 for progressive subaxial instability and 1 for failure of fusion. The average age of the patients was 58 years (range 13-89). 85% (N=23) were female. Mean follow-up was 24 months with a range of 15 months to 51 months. Postoperatively there was no neurological deterioration. 11% (N=3) of the patients developed subaxial instability following an upper cervical spine procedure. One patient underwent anterior cervical fusion (ACF) at C3-6 and 5 months later developed SAI at C6/7 necessitating extension of the fusion to include this level. Following the surgery, good clinical improvement was achieved. Another patient developed progressive subaxial instability following a posterior cervical fusion with wiring at C1/2 but did not wish any further surgery. The third patient, following PCF C1-C2, developed non-union with broken wire and underwent PCF C1-C2 with wire and progressed to bony union and clinically improved. Pseudarthrosis occurred only in posterior cervical fusions at C1/2 with wire fixation. Autogenous bone graft was utilized in each. No pseudoarthrosis occurred in either anterior or posterior cervical plating and screw procedures. 85% (N=23) of the patients felt that they were better following surgery. 4% (N=1) was worse but improved following a second procedure. 11% (N=3) were unchanged, however, one of these developed a subsequent subaxial instability and noted improvement following a second surgery. Therefore, after all surgeries were completed and evaluated, 96% (N=26) were improved postoperatively. Average fusion time was 5 months. Complications included wire breakage in 3 patients (11%) and 1 loose screw and unilateral fractured plate in one patient (4%). There were no patients who experienced neurological deterioration postoperatively.

DISCUSSION

In our own series we find that our patients are typical with respect to demographic data and outcome parameters when compared to other reports in the literature. Our 7 to 1 female to male ratio differs from the traditional 2 to 1 ratio (16, 21-24, 34-38). Our age group averaging 58 years old falls within the expected range of 4th to 6th decade. Surgical outcome was considered good with greater than 89% of the patients im-

Table 2: Patient Data

PRESURGICAL						SURGICAL			
Patient	Age	Sex	Instability	Neurologic Status	Pain	Approach	Surgery	Fixation	Graft
1	58	F	AAI/SAI	No myelopathy	+	posterior	POCF 0-C2	wire	Auto
2	62	F	AAI/BI/SAI	No myelopathy	+	posterior	POCF 0-C7 Lam C1	wire	Both
3	89	F	AAI/SAI	No myelopathy	+	posterior	POCF 0-C7	wire	Auto
4	70	F	AAI/BI	No myelopathy	+	posterior	POCF 0-C2	wire	Both
5	13	F	SAI	No myelopathy	+	posterior	PCF C3-C7	wire	Auto
6	54	F	AAI/BISAI	No myelopathy	+	posterior	PCF C2-C7	wire	Auto
7	78	M	AAI	No myelopathy	+	posterior	PCF C1-C4	wire	Both
8	57	F	AAI	No myelopathy	+	posterior	PCF C1-C3	wire	Auto
9	67	M	AAI	No myelopathy	+	posterior	PCF C1-C3	wire	Both
10	47	F	AAI	No myelopathy	+	posterior	PCF C1-C2	wire	Auto
11	71	F	AAI	No myelopathy	+	posterior	PCF C1-C2	wire	Auto
12	50	F	AAI/BI	No myelopathy	+	posterior	PCF C1-C2	wire	Auto
13	73	F	AAI	No myelopathy	+	posterior	PCF C1-C2	wire	Auto
14	56	M	AAI	No myelopathy	+	posterior	PCF C1-C2	wire	Both
15	71	F	AAI/SAI	No myelopathy	+	posterior	PCF C1-C2	wire	Both
16	63	F	AAI	myelopathy	+	posterior	PCF C1-C2	wire	Auto
17	58	F	AAI	No myelopathy	+	posterior	PCF C1-C2	wire	Both
18	58	F	AAI	No myelopathy	+	posterior	PCF C1-C2	wire	Auto
19	59	F	AAI/BI/SAI	No myelopathy	+	posterior	PCF 0-C7	wire	Auto
20	60	F	AAI/BI/SAI	No myelopathy	+	posterior	PCF C1-C5	wire/screw	Auto
21	57	F	AAI/BI/SAI	No myelopathy	+	ant/post	POCF O-6/ACF	wire	Allo
22	70	M	AAI	myelopathy	+	posterior	POCF 0-C5	wire	Allo
23	67	F	SAI	No myelopathy	+	anterior	ACF C4-C5	wire	Allo
24	35	F	SAI	No myelopathy	+	anterior	ACF C3-C6	wire	Allo
25	35	F	SAI	No myelopathy	+	anterior	ACF C3-C7	wire	Allo
26	58	F	AAI/BI	No myelopathy	+	posterior	POCF 0-C4	wire	Both
27	58	F	AAI	No myelopathy	+	posterior	PCF C1-C2	wire	Auto

proved, an 81% fusion rate, and very few complications. This is consistent with fusion rates from other studies (21-24, 34-38).

Although we have a limited number of cases utilizing newer methods of fixation, we have found that these procedures are useful in treating rheumatoid patients with cervical instability (21, 22). Advantages include better fixation, particularly over multiple levels, and less reliance on postoperative orthoses (i.e., halo braces). The most distinct advantage is realized when treatment of more difficult surgical cases is undertaken in patients with multilevel involvement, high grade instabilities, osteopenic bone, and who require decompressive laminectomies and/or corpectomies. Surgical outcome in our series is similar to others reported in the literature and probably better for the more difficult cases (21-24, 34-38). The main disadvantage is that anterior and posterior cervical plating systems are technically more difficult and may increase operative time. Additional patients have been accumulated since this review utilizing the newer methods of fixation and, although we have insufficient follow-up at this time, our results continue to be satisfactory and confirm the conclusions outlined above.

CONCLUSIONS

Our series of rheumatoid patients with cervical instability are typical when compared to other reports in the literature with respect to patient population. The patients in our series who had surgical wiring procedures had outcomes which were similar to previously published reports. Newer methods of surgical stabilization utilizing plates and screws offer potential advantages because of better fixation to bone even in the

Table 2: Patient Data (Continued)

PRESURGICAL			SURGICAL			
Follow up	Fusion	Fixation	Neurologic	Pain	Subsequent	Complications
(months)			Status		SAI	
42	Bony (6 m)	intact	stable	improved	—	—
21	Bony (9 m)	intact	stable	improved	—	—
17	Bony (4 m)	intact	stable	improved	—	—
24	Bony (3 m)	intact	stable	improved	—	—
22	Bony (10 m)	intact	stable	improved	—	—
19	Bony (7 m)	broken (7 m)	stable	improved	+	broken wire
20	Bony (8 m)	intact	stable	improved	—	—
36	Bony (24 m)	intact	stable	improved	—	—
20	Bony (3 m)	intact	improved	improved	—	—
48	Bony (34 m)	broken (2 m)	stable	improved	—	—
50	Bony (3 m)	intact	stable	improved	—	—
38	non (6 m)	broken (6 m)	stable	improved	(6m postop) +	required 2nd surgery
33	Bony (6 m)	intact	stable	improved	—	—
30	non	intact	stable	worse	—	required 2nd surgery
24	Bony (12 m)	intact	stable	improved	—	—
23	fibr.	intact	improved	improved	—	—
20	Bony (5 m)	intact	stable	improved	—	—
15	fibr.	intact	stable	improved	—	—
27	Bony (4 m)	intact	stable	improved	—	—
22	Bony (5 m)	intact	stable	same	—	—
30	Bony (18 m)	intact	stable	improved	—	—
35	Bony (23 m)	intact	improved	improved	—	—
24	Bony (3 m)	intact	stable	improved	—	—
18	Bony (5 m)	intact	stable	same	(5m postop)+	required 2nd surgery
17	Bony (6 m)	intact	stable	improved	—	—
51	Bony (39 m)	intact	stable	improved	—	—
30	fibr.	intact	stable	improved	—	—

* Bony = Bony union (fused), * Fibr. = (Stable), * Non = (Pseudarthrosis; unstable)
See table 3 for breakdown of repeat surgeries

Table 3: Repeat Surgery

Patient	Surgery	Fusion / Fixation	Subaxial Instability	Repeat Surgery	Second Surgery Result
6	PCF C2-C7 wire	Bony Union	Yes	Refused Surgery	Refused Surgery
12	PCF C1-C2 wire	Nonunion/wire broken	Yes	PCF C1-C2 wire	Improved Bony Union
14	PCF C1-C2 wire	Nonunion	No	PCF C1-C2 wire	Improved Bony Union
24	ACF C3-C6 Plates	Bony Union	Yes	ACF C3-C7 Plates	Improved Bony Union

presence of osteopenia, less reliance on postoperative orthoses, and better surgical treatment of more difficult cases. Posterior cervical plating procedures have a distinct advantage over posterior wiring techniques when spinous process and lamina are removed, missing, or incompetent. The main drawback is that the surgeon must be sufficiently trained to perform these technically demanding procedures.

Risks are comparable and therefore the advantages far outweigh the disadvantages. These techniques are necessary for the spinal surgeon who treats patients with rheumatoid instability of the cervical spine because they provide a new dimension and depth to his surgical armamentarium, especially when addressing more difficult cases with multilevel involvement, high grade instability and/or deformity.

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