Rheumatology 2002;41:910–916

Surgical treatment of the rheumatoid cervical spine in patients aged 70 years or older

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Abstract

Objective. To investigate whether surgery is appropriate for elderly rheumatoid arthritis patients who are already approaching their statistical life expectancy.

Patients and methods. The subjects were 10 patients who underwent cervical spine surgery for rheumatoid arthritis at an age of over 70 yr. The pain grade and neurological deficit class according to Ranawat, peri-operative complications, causes of death and pre-operative cardiopulmonary function were assessed.

Results. Good pain relief was achieved. Relief of pain enabled the patients, who could not sit up even in bed because of intolerable neck pain, to ride in a wheel chair without using a neck collar. Only one death was related to surgery. Pre-operative cardiopulmonary function was not significantly different compared with that of elderly patients undergoing other surgical procedures.

Conclusion. Surgery is a valuable option for the management of elderly patients with rheumatoid cervical spine since it can improve the quality of life.

KEY WORDS: Rheumatoid arthritis, Cervical spine, Surgical treatment, Posterior fixation, Elderly patients, Quality of life, Activity in daily living.

It is well known that the mortality rate of people with rheumatoid arthritis (RA) is higher than that of the general population. Wållberg-Jonsson concluded that the vast majority of published studies confirm an increased mortality rate in RA [1], while the review by Guedes showed that the life expectancy was shortened by 5–10 yr in most reports [2]. It is also well recognized that severe RA of the cervical spine, with changes such as atlanto-axial subluxation, vertical subluxation or sub-axial subluxation, can induce intolerable neck pain and debilitating neurological symptoms. Although surgical intervention is widely performed for such destructive cervical disease, these procedures have problems even in younger patients, including a high peri-operative death rate, a short post-operative life expectancy, a high rate of non-union, various peri-operative complications, and the occurrence of subluxation at the level adjacent to the fusion [3–17]. Because of these inherent problems and limitations, it is still unknown whether cervical spine surgery is of any value in elderly RA patients who may not have long to live.

Some recent papers have reported the results of surgery for degenerative spinal disease such as cervical spondylotic myelopathy in the elderly [18, 19], but no previous study has focused exclusively on elderly RA patients receiving surgery for the cervical spine. Although the literature on cervical spine surgery for RA includes some patients over 70 yr old [3–17, 20–38], few papers have provided a detailed description of each case. Therefore, it is generally impossible to know how many elderly patients were included in each series and what their results were like, while the number of elderly patients was very small in the studies that provided detailed information.

RA is a systemic disorder, so assessment of cardiopulmonary function is an important part of the pre-operative work-up. Whether elderly RA patients have significantly worse cardiopulmonary function than other elderly patients is another question that needs to be addressed.

This is the first study to evaluate surgery for patients aged 70 yr or older with rheumatoid cervical spine. Emphasis was placed on assessment of pre-operative cardiopulmonary function as well as the surgical outcome, in order to determine whether surgery is a suitable option for elderly RA patients with cervical disease and to clarify its limitations and problems.

Patients and methods

A total of 62 patients underwent surgery for rheumatoid cervical spine at our institution between 1989 and 1998.

Submitted 13 September 2001; revised version accepted 7 March 2002.

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Table 1. Clinical profile

Case	Age at surgery (yr)	Age at onset (yr)	Disease duration (yr)	Follow-up (months)		Stage	Number of previous DMARDs[a]	Duration of most recent DMARD therapy (months)	Dose and duration of most recent steroid therapy (months)[b]
1	70	64	6	17	D	III	3	16	5 mg (12)
2	71	65	6	45	D	III	At least 2	4	5 mg (8)
3	71	50	21	40	A	IV	1	24	–
4	72	66	6	60	A	II	1	30	–
5	73	68	5	86	D	II	1	60	–
6	73	55	18	20	D	IV	At least 2	Unknown	5 mg (unknown)
7	73	57	16	64	D	IV	At least 3	48	15 mg (36)
8	77	70	7	1	D	IV	1	36	10 mg (36)
9	77	50	27	47	A	IV	At least 2	49	–
10	78	64	14	88	D	III	At least 2	60	–
Mean	73.5	60.9	12.6	46.8					

[a]Including the most recent drug.
[b]Equivalent to predonisolone.
D, dead; A, alive.

Among them, 10 patients were aged 70 yr or older at the time of surgery (group A). These patients ranged from 70 to 78 yr old, with a mean age of 73.5 yr. There were nine women and one man.

The average length of follow-up was 46.8 months, with a range of 1–88 months. The age of onset for RA ranged from 50 to 70 yr, with a mean age of 60.9 yr, and the duration of the disease ranged from 5 to 27 yr, with a mean of 12.6 yr. Most of the patients had been treated with disease-modifying anti-rheumatic drugs (DMARDs) and steroids. The number of previously used DMARDs and the most recent dose and duration of steroid therapy are shown in Table 1. The pre-operative Steinbrocker classification of RA [39] was stage II in two patients, stage III in three patients, and stage IV in five patients (Table 1).

According to Ranawat's classification [17], nine of the 10 patients had a pain grade of 2 or 3 (Tables 2 and 3). Grade 2 pain indicates that relief requires the wearing of a neck collar, while grade 3 pain persists despite the use of a collar. All of the seven patients with grade 3 pain could not ride in a wheel chair because of their severe neck pain. Eight of the 10 patients had class III neurological deficits (Tables 3 and 4), which signifies objective weakness and long-tract signs [17]. The class IIIA patients could still walk, but the class IIIB patients were not ambulatory.

Table 5 shows the surgical procedures. All patients had subluxation at the atlantoaxial and/or subaxial level, and all but one patient underwent posterior surgery. Laminoplasty was performed in two patients and occipitocervical (O-C) or occipitothoracic (O-T) fusion was done in the remainder. The extent of fusion was decided from the extent of cervical spine involvement by RA. Laminectomy was performed when necessary.

Clinical assessment

The following clinical parameters were assessed: (i) pain grade and neurological deficit class; (ii) using Ranawat's classification, the severity of pain and neurological deficits were assessed before surgery, after surgery, and at final follow-up; (iii) peri-operative complications and causes of death; (iv) pre-operative cardiopulmonary function. Lung function was assessed from the per cent vital capacity (%VC) and the per cent forced expiratory volume in 1 s ($FEV_{1.0}$%). Echocardiography and/or electrocardiography were used to assess cardiac function retrospectively.

Table 2. Pain grade before and after surgery and at the final assessment

Pre-operative pain grade	Post-operative pain grade				Follow-up pain grade			
	3	2	1	0	3	2	1	0
3			2	5	1		3	3
2		1	1			1	1	
1				1				1
0								

The patient who died 1 month after surgery is shown as having unchanged pain (grade 2).

Statistical analysis

The %VC and the $FEV_{1.0}$% were compared statistically among the following three groups: (i) Group RA-C was the 10 patients in this study; (ii) Group RA-J was 16 elderly RA patients who underwent other surgery (total knee and/or hip replacement). There were three men and 13 women, with an average age at surgery of 73.8 yr (range 70–83 yr); (iii) Group non-RA was 34 elderly patients who underwent surgery for cervical spondylotic myelopathy. There were 19 men and 15 women with an average age at surgery of 74.3 yr (range 70–83 yr).

These three groups were compared statistically using one-way ANOVA after Bartlett's test verified that there was no significant difference in variance between each group.

TABLE 3. Details of patients in the literature aged 70 yr or above

Reference	Elderly/total RA patients	Pain				Neurological deficit			
		Age	Pre	Post	Final	Pre	Post	Final	Follow-up (months)
[40]	0/13								
[38]	1/15	74	2 ~ 3[a]	2 ~ 3[a]	ND	IIIA[a]	IIIA[a]	ND	0.5
[17]	6/33	80	2	2	ND	IIIB	IIIA	ND	48
		77	2	0	ND	II	II	ND	84
		70	2	1	ND	IIIB	IIIA	ND	24
		70	2	2	ND	II	II	ND	36
		71	2	2	ND	I	I	ND	78
		85	3	3	ND	I	I	ND	36
[48]	1/28	73	3[a]	2[a]	ND	ND	ND	ND	2
[37]	2/38	70	ND	ND	ND	IIIA	IIIA[a]	ND	36
		71	ND	ND	ND	II	I[a]	ND	24
[41]	0/7								
[36]	1/11	72	3	1	ND	II	II	ND	41
[42]	0/12								
[34]	2/14	78	2 ~ 3[a]	2 ~ 3[a]	ND	IIIA[a]	II	ND	25 D
		72	2 ~ 3[a]	2 ~ 3[a]	ND	IIIA[a]	IIIB[a]	ND	6
[33]	1/29	72	1 ~ 3[a]	ND	0[a]	IIIA[a]	ND	I[a]	60
[46]	0/6								
[47]	0/14								
[32]	1/13	76	2[a]	0[a]	ND	I[a]	I[a]	ND	ND
[15]	3/41	73	ND	ND	ND	II	II	ND	66
		82	ND	ND	ND	II	I	ND	33 D
		73	ND	ND	ND	II	II	ND	26
[10]	4/38	74	ND	ND	ND	II	I	ND	46 D
		77	ND	ND	ND	I	I	ND	46 D
		72	ND	ND	ND	I	I	ND	14 D
		74	ND	ND	ND	I	I	ND	94 D
[30]	2/26	71	ND	ND	ND	IIIB	I	ND	60 D
		74	ND	ND	ND	IIIA	I	ND	36 D
[29]	3/19	73	2	1	ND	I	I	ND	ND
		71	2	0	ND	I	I	ND	ND
		71	2	0	ND	II	I	ND	ND
[12]	1/19	78	1	0		II	II		12
[9]	6/42	70	ND	ND	ND	IIIA	II	ND	54
		75	ND	ND	ND	IIIB	IIIB	ND	17 D
		75	ND	ND	ND	IIIA	IIIA	ND	20 D
		71	ND	ND	ND	II	I	ND	100
		70	ND	ND	ND	IIIB	II	ND	26
		79	ND	ND	ND	IIIB	IIIB	ND	1 D
[4]	5/16	72	2	1	ND	IIIB	IIIA	ND	46 D
		74	2	ND	ND	IIIB	ND	ND	1 D
		70	0	0	ND	IIIA	I	ND	25 D
		77	0	ND	ND	IIIB	ND	ND	3 D
		73	1	0	ND	IIIA	IIIA	ND	12
[23]	2/6	74	2	ND	0	II	ND	II	36
		71	3	ND	0	IIIB	ND	IIIA	30
[49]	0/16								
Mizutani [present study]	10/62	70	3	0	1	IIIB	IIIA	IIIA	17 D
		71	1	0	0	IIIA	IIIA	IIIA	45 D
		71	3	0	0	I	I	I	23
		72	3	0	0	IIIA	II	II	42
		73	3	1	1	I	I	I	86 D
		73	3	0	0	IIIB	IIIB	IIIB	18 D
		73	2	1	1	IIIA	II	II	64
		77	2	2	ND	IIIB	IIIB	ND	1 D
		77	3	1	3	IIIA	II	IIIB	29
		78	3	0	1	IIIA	II	II	88 D

ND, not documented; D, died.
[a]Not described precisely using Ranawat's classification and estimated by the authors from the data reported.

Results

Pain

Table 2 shows the severity of pain before and after surgery as well as at the final assessment. After surgery, the severity of pain was improved by three grades in five patients, two grades in two patients, and one grade in two patients. At the final assessment, the severity of pain was classified as either grade 0 or 1 in all but one of the surviving patients. This patient had exacerbation of pain because a pseudarthrosis had developed. Thanks to their reduced pain, all of the surviving patients could ride in a wheel chair.

Neurological deficit

Table 4 shows the neurological deficits before and after surgery as well as at the final assessment. The two patients who had no neurological deficits before surgery (class I) maintained their unimpaired status throughout the follow-up period. Among the other eight patients with neurological deficits, the severity of the deficits improved by one grade in five patients. At the final assessment, however, one of these five patients had worsened from class II to class IIIB. In this patient, the main cause of deterioration was actually bilateral gonalgia caused by loosening of total knee replacement.

Table 4. The neurological deficit class before and after surgery and at the final assessment

Pre-operative neurological deficit class	Post-operative neurological deficit class				Follow-up neurological deficit class			
	IIIB	IIIA	II	I	IIIB	IIIA	II	I
IIIB	2	1			2	1		
IIIA		1	4		1	1	3	
II								
I				2				2

The patient who died 1 month after surgery is shown as having no change of neurological deficit class (class IIIB).

Complications and causes of death

Bacterial meningitis ($n = 1$) and wound infection ($n = 2$) were the complications that were directly attributable to surgery. The wound infection responded to intravenous administration of antibiotics, and further surgical intervention was not needed. The meningitis was eventually fatal. However, other deaths during follow-up were not directly related to surgical intervention (Table 6).

Cardiopulmonary function

Table 7 summarizes the pre-operative cardiopulmonary function, while Figs 1 and 2 show the %VC and $FEV_{1.0}$%, respectively. The average $FEV_{1.0}$% and %VC were not statistically different in each group. Electrocardiograms showed ST changes and bundle branch block in some patients. Echocardiography was not done routinely, but showed a reduced ejection fraction in two patients.

Discussion

The 10 patients in this study are, to our knowledge, the largest single series of patients aged over 70 yr with surgically treated RA cervical spine. From the extensive literature on rheumatoid cervical spine surgery, we selected the reports in which the age at operation of each patient was shown along with the outcome. None of the published reports describe a large number of high-age patients undergoing spinal surgery for RA (Table 3) [4, 9, 10, 12, 15–17, 29, 30, 32–34, 36–38, 40–43]. One possible reason for the small numbers reported is the shortened life expectancy associated with RA, but the surgical results for such elderly patients have consequently not been clarified.

The life expectancy of RA patients is 5–10 yr less than that of the general population [2]. This fact, along with the risks of major cervical spine surgery, has discouraged many rheumatologists from referring elderly patients to spinal surgeons. However, our elderly patients with severe rheumatoid cervical spine did not have significantly inferior pre-operative lung function to two other groups of elderly patients and their cardiac

Table 5. Details of the surgical procedures

Case	Cervical disorder	Surgical procedure	Extent of fusion	Instrumentation	Bone graft	Laminectomy	Remarks
1	AS + VS + SAS	O-C fusion	O-C7	Y	N	N	Bone cement
2	SAS	Laminoplasty	C3-C6	–	Y (gutter)	–	
3	AS (non-reducible)	O-C fusion	O-C3	N	Y	N	
4	SAS	Laminoplasty	C2-C7	–	Y (gutter)	–	
5	SAS	Ant. decomp. and fusion	C3-C6	–	Long strut	–	
6	AS + VS	O-T fusion	O-T1	Y	N	N	HA-block
7	AS + VS + SAS	O-C fusion	O-C6	Y	N	C1	Bone cement
8	AS (non-reducible)	O-C fusion	O-C3	Y	Y	C1	
9	AS + VS	O-C fusion	O-C2	N	Y	C1	
10	AS + VS	O-C fusion	O-C4	Y	N	C1	Bone cement

AS, atlanto-axial subluxation; VS, vertical subluxation; SAS, subaxial subluxation; O-C, occipitocervical; O-T, occipitothoracic; Y, yes; N, no; HA; hydroxyapatite; Ant. decomp., anterior decompression.

function was also sufficient to allow these patients to undergo surgery.

The peri-operative death rate after cervical spine surgery for RA has been reported to range from 4 to 17% [4, 5, 8, 12–14, 17, 27, 36, 37]. The 1-month mortality rate in our series was 10% (1/10 patients), which is comparable with that reported previously, regardless of differences in age.

In a 10-yr follow-up study, Santavirta [10] reported that the mean post-operative survival time was 4.2 yr and Kudo [30] reported a similar survival period of 41.2 months. In our series, despite the advanced age of the patients, the mean survival was 45.9 months. These results suggest that high age itself is not a negative factor for post-operative survival after rheumatoid cervical spine surgery.

When RA is complicated by cervical involvement, persistent pain can cause severe discomfort for patients and can markedly reduce their level of activity. In fact, all seven of our patients in Ranawat's grade 3 pain could not sit up and could not ride in a wheel chair because of their severe neck pain. Conservative therapy involves the use of a cervical collar, but many RA patients have severe deformity of the wrists and fingers, and thus cannot put on this type of orthosis unaided, while others simply refuse to wear the device. Surgical relief of their neck pain can result in a dramatic improvement of daily activities and the quality of life. In all but one patient,

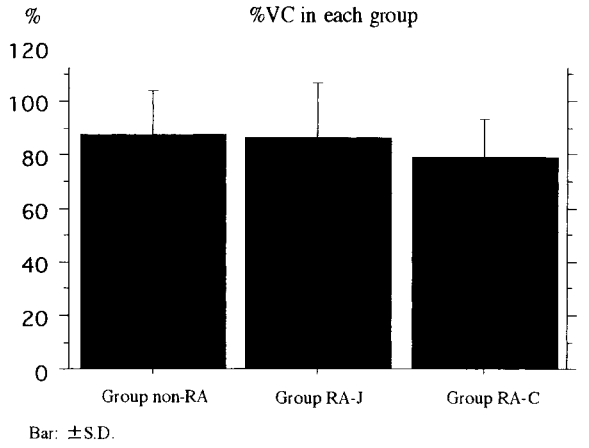

FIG. 1. %VC in each group.

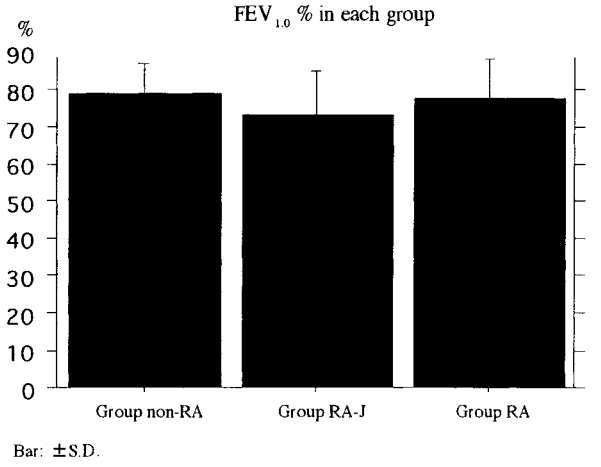

FIG. 2. $FEV_{1.0}$% in each group.

TABLE 6. Complications and causes of death

Case	Complications	Causes of death	Death after operation (months)
1	None	Heart failure	17
2	Gastric ulcer	Venous thrombosis	45
3	Halo pin infection	–	Alive
4	None	–	Alive
5	None	Myocardial infarction	86
6	Leg oedema	Heart failure	18
7	Perforation of colon Late wound infection	Debility	64
8	Meningitis	Multiple organ failure following meningitis	1
9	Renal failure	–	Alive
10	None	Cerebral infarction	88

TABLE 7. Pre-operative cardiopulmonary function

		Lung function		Heart function	
Case	Age at surgery (yr)	%VC	$FEV_{1.0}$%	ECG	Echo (ejection fraction)
1	70	77	72	WNL	Reduced
2	71	110	78	WNL	WNL
3	71	76	80	ST change	NA
4	72	81	73	ST change	WNL
5	73	87	80	ICRBBB	NA
6	73	55	93	WNL	Reduced
7	73	80	89	CRBBB	WNL
8	77	79	69	WNL	WNL
9	77	77	85	WNL	WNL
10	78	69	59	WNL	WNL
Mean	73.5	79.1	77.8		

%VC, % vital capacity; $FEV_{1.0}$%, % forced volume for 1 s; ECG, electrocardiogram; Echo, echocardiogram; WNL, within normal limits; NA, not available; ICRBB, incomplete right bundle branch block; CRBBB, complete right bundle branch block.

the severity of pain was either grade 0 or 1 at the final assessment and a cervical collar is not required for grade 0 or 1 pain. In one patient, pseudarthrosis caused the exacerbation of neck pain. Thus, if bone fusion is achieved, patients are not likely to experience much pain subsequent to surgery.

Recent reports about elderly patients have shown a good outcome of surgery for conditions such as femoral neck fracture and cervical spondylotic myelopathy [18, 19, 44]. In the orthopaedic and trauma fields, no orthopaedic surgeon would now be content to let elderly patients with femoral neck fractures become bed-ridden, and more and more spine surgeons are operating on elderly myelopathy patients. It is beyond dispute that once a patient becomes bed-ridden, the general physical condition deteriorates rapidly. Appropriate surgery can prevent this.

Casey reported that no benefit was obtained except pain relief by surgical treatment of patients in Ranawat class IIIB [5]. In contrast, we would emphasize the potential importance of surgery for class IIIB patients. The quality of life and daily activities that can be performed are quite different between wheel chair-bound and bed-ridden patients. Once their neck pain is relieved, patients can use a wheel chair, even if no improvement of neurological symptoms is achieved by surgery. We believe that as the age increases, it becomes even more important to be able to use a wheel chair. This study showed that consistently good relief of severe neck pain was obtained by surgery, which could free elderly patients from their bed-ridden condition.

Advances in peri-operative management, including anaesthetic techniques, and improvements of the operative techniques themselves are also important factors. These advances have made it possible for elderly patients to undergo surgery. For instance, Crockard reported on fibre-optic laryngoscope-associated intubation in 1990 and this is now a widely used technique for RA cervical spine surgery [45]. Reports published in the 1990s have indicated better pain relief than those published in the 1970s or 1980s (Table 3).

We conclude that, whenever feasible, surgery should be considered as an option for maintaining the quality of life and daily activities in elderly RA patients. It is also stressed that rheumatoid cervical spine surgery for the elderly should be performed with a multidisciplinary approach.

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