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ORIGINAL ARTICLE

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Prevalence of cervical lesions in rheumatoid arthritis: cross-sectional study on 263 patients

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Abstract Spinal lesions in upper and sublaxilar cervical vertebrae were studied radiologically in 263 patients (25 men and 238 women) with rheumatoid arthritis (RA). Their average age was 58.9 years, and their disease duration was ranged from 6 months to 24 years (mean 13 years). Functional lateral views of the cervical spine were made. Atlantaxial subluxation (AAS) and vertical subluxation (VS) were evaluated as upper cervical lesions. Subaxilar subluxation (SAS) and endplate erosion were evaluated as subaxilar cervical lesions. One hundred and seventy-eight (67.7%) of the patients had a cervical lesion. Upper and subaxilar cervical abnormalities were recognized in 136 (51.7%) and 113 (43.0%) patients, respectively. There was no linkage between upper and subaxilar cervical lesions. While the prevalence of these lesions increased with time, the frequency was found to be over 50% within only 5 years from onset in patients with mutilating deformity. This prevalence tended to be associated with disease activity.

Key words Rheumatoid arthritis · Cervical lesion · Atlantoaxial subluxation · Subaxial subluxation · Vertical subluxation

Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory disease in which all synovial joints are affected. The cervical spine is also involved in many patients. Radiological abnormalities of the upper cervical spine are detected in 49% to 70% of patients[1,2] and of the subaxilar spine in about 20%.[2,3] Cervical involvement usually causes few neurological manifestations for a long time except for neck pain or crepitation around the neck. However, once distinct neurological symptoms such as muscle weakness and sensory disturbance develop, they may progress, resulting in loss of activity and death in the worst cases.[4] Although recovery from disabilities in the extremities is expected by prosthetic implantation or other surgical approaches, an optimal indication for surgery on the cervical spine has been controversial.[5] Therefore, it is important to check when and how the cervical spine is involved during the natural course of RA. Disease duration, as well as disease activity, are related to the progression of cervical lesions,[6] so it is necessary to find clinical factors that affect them. Adequate longitudinal observation is the best way to conduct research on the cervical spine in RA, but it is not easy. We studied as many patients as possible to find the frequency of cervical lesions and their relation to disease activity in patients with RA.

Materials and methods

Two hundred and sixty-three patients (25 men and 238 women) who fulfilled the ACR criteria for RA[7] were enrolled in this study. Their mean age was 58.4 years (range 24–69 years), and their average disease duration was 13 years (range 6 months to 24 years). According to Steinbrocker's classification,[8] 43 patients were at stage I, 35 at stage II, 54 at stage III, and 131 at stage IV, and 38 patients were in class I, 114 in class II, 98 in class III, and 13 in class IV. According to our records, two patients complained of dysesthesia of the hands and four patients complained of neck pain, while no patients showed spinal cord signs.

A functional lateral view of the cervical spine was made. In the upper cervical spine, atlantoaxial subluxation (AAS) was defined as when the atlantodental interval (ADI)[9] exceeded 3 mm, and vertical subluxation (VS) as when the perpendicular distance (PD)[10] was less than 13 mm. In subaxilar cervical lesions, subaxilar subluxation (SAS) was defined as when 3 mm or more anterior subluxation was detected in any of the functional views. Endplate erosion of the cervical body (Fig. 1) was also detected. Patients were

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Table 1. Prevalence of upper cervical lesions in patients with RA

	No lesions	AAS alone	VS alone	AAS + VS
No. of patients	127 (48.3%)	57 (21.7%)	25 (9.5%)	54 (20.5%)
Mean disease duration (years)	9.3	15.5	17	17.5

ASS, atlantoaxial subluxation; VS, vertical subluxation

Table 2. Prevalence of subaxial lesions in patients with RA and involved segments

	SAS	Endplate erosion
No. of patients	37 (14.1%)	115 (43.7%)
C2/3	3	34
C3/4	10	59
C4/5	24	72
C5/6	14	61
C6/7	7	47

SAS, subaxial subluxation

Fig. 1. Endplate erosion of the cervical spine in RA. The irregular surface of the vertebrae and a narrowing of the disc space without osteophytes can be seen (*arrow*)

Table 3. Linkage of upper and subaxial cervical lesions in patients with RA

Upper lesions	Subaxial lesions		
	None	SAS	Endplate erosion
Present	128 (63.1%)	28 (75.6%)	67 (58.3%)
AAS	52	7	18
VS	24	8	16
AAS + VS	52	13	33
None	75 (36.9%)	9 (24.3%)	48 (41.7%)
Total	203	37	115

Values given are numbers of patients
AAS, atlantoaxial subluxation; VS, vertical subluxation; SAS, subaxial subluxation

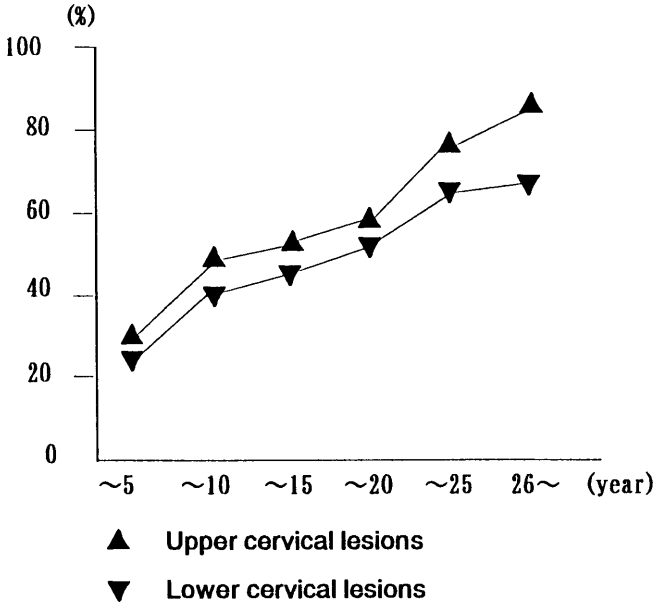

Fig. 2. Prevalence of upper and subaxial cervical lesions in RA. Prevalence increases with time in both the upper and subaxial cervical spine

classified into a mutilating group and a nonmutilating group according to whether the radiological findings showed massive bone absorption in any of the affected joints. The prevalence of upper and subaxilar cervical lesions between these two groups were compared. Finally, we investigated the relationship between cervical lesions and clinical manifestations such as disease duration, stage, class, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) at the examination. Statistical analyses were performed by Student's *t*-test and the χ^2-test.

Results

Prevalence of cervical lesions

One hundred and seventy-eight (67.7%) patients had one of each cervical lesion at the examination. Upper cervical lesions were detected in 136 (51.7%) patients: AAS alone in 57 (21.7%) patients, VS alone in 25 (9.5%) patients, and a combination of both in 54 (20.5%) patients (Table 1).

Table 4. Cervical lesions and clinical manifestations

	n	Disease duration (years)	Stage I	Stage II	Stage III	Stage IV	Class I	Class II	Class III	Class IV	CRP (mg/dl)	ESR (mm/h)
AAS												
(+)	109	16.5	7 (6.4%)	10 (9.2%)	19 (17.4%)	73 (67.0%)	8 (7.3%)	40 (36.7%)	52 (47.7%)	9 (8.3%)	2.2 ± 2.4	43.1 ± 24.8
(−)	154	10.6	36 (23.4%)	25 (16.2%)	35 (22.7%)	58 (37.7%)	30 (19.5%)	76 (49.4%)	44 (28.6%)	4 (2.6%)	1.7 ± 2.3	44.1 ± 27.0
		$P < 0.05$			$P < 0.001$				$P < 0.001$		ns	ns
VS												
(+)	79	17.4	1 (1.3%)	5 (6.3%)	10 (12.7%)	63 (79.7%)	2 (2.5%)	26 (32.9%)	41 (51.9%)	10 (12.7%)	2.2 ± 2.1	48.8 ± 26.0
(−)	184	11.1	42 (22.8%)	30 (16.3%)	44 (23.9%)	68 (37.0%)	36 (19.6%)	90 (48.9%)	55 (29.9%)	3 (1.6%)	1.8 ± 2.4	41.6 ± 25.8
		$P < 0.05$			$P < 0.001$				$P < 0.001$		$P < 0.05$	$P < 0.01$
SAS												
(+)	37	18.4	1 (2.7%)	5 (13.5%)	5 (13.5%)	26 (70.3%)	1 (2.7%)	18 (48.6%)	14 (37.8%)	4 (10.8%)	2.1 ± 2.2	53.6 ± 26.4
(−)	226	12.2	42 (18.9%)	30 (13.3%)	49 (21.7%)	105 (46.5%)	37 (16.4%)	98 (42.9%)	82 (36.3%)	9 (4.0%)	1.9 ± 2.4	4.2 ± 25.7
		$P < 0.001$			$P < 0.05$				ns		ns	$P < 0.001$
Endplate erosion												
(+)	115	17.6	10 (8.7%)	9 (7.8%)	22 (19.1%)	74 (64.3%)	8 (7.0%)	44 (38.3%)	53 (46.1%)	10 (8.7%)	2.4 ± 2.8	52.3 ± 26.3
(−)	148	10.2	33 (22.3%)	26 (17.6%)	32 (21.6%)	57 (38.5%)	30 (20.3%)	72 (48.6%)	43 (29.1%)	3 (2.0%)	1.6 ± 2.0	38.3 ± 24.4
		$P < 0.01$			$P < 0.001$				$P < 0.001$		$P < 0.05$	$P < 0.001$

AAS, atlantoaxial subluxation; VS, verticular subluxation; SAS, subaxial subluxation
[a]Comparison was made between groups with and without cervical lesions

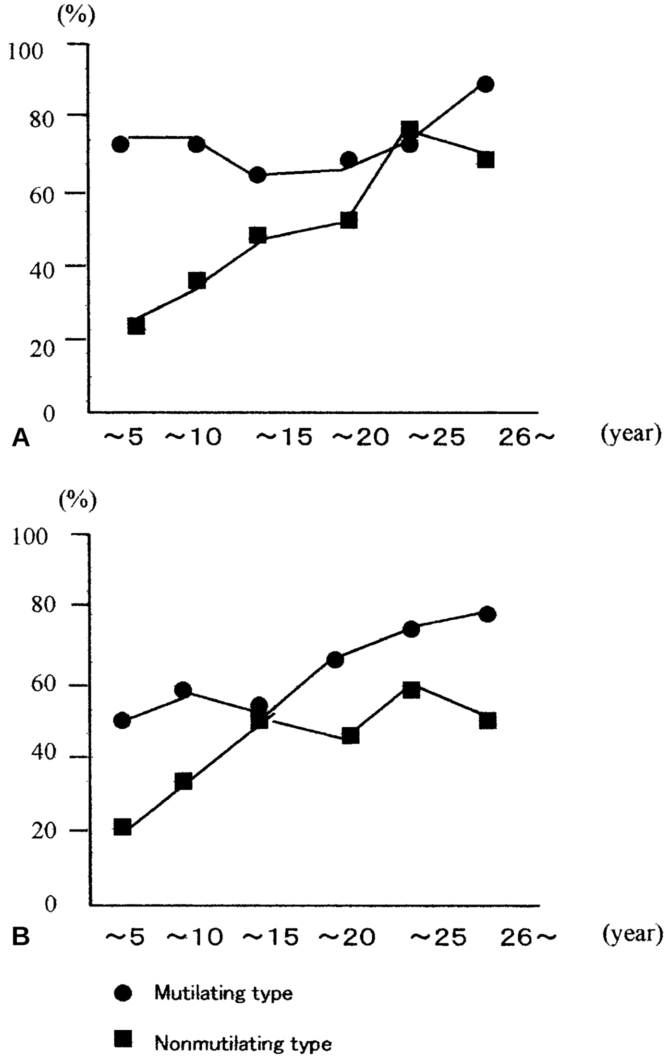

Fig. 3. Prevalence of cervical lesions in mutilating and nonmutilating RA patients. **A** Upper cervical lesions. **B** Subaxial cervical lesions

One hundred and twenty-five (47.5%) patients had subaxilar cervical lesions: SAS in 37 (14.1%) patients (with the most common segment being C4/5, in which 24 patients showed subluxation), and endplate erosion in 115 (43.7%) patients (with the most common segment also being C4/5) (Table 2).

Out of 178 patients who had at least one cervical lesion, 111 patients (62.4%) had AAS, 79 patients (44.4%) had VS, 37 patients (20.8%) had SAS, and 115 patients (64.5%) had endplate erosion.

In the relationship between upper and subaxilar cervical lesions, 28 (75.7%) out of 37 patients with SAS had upper cervical lesions, including 7 with AAS, 8 with VS, and 13 with both, and 67 (58.3%) out of 115 patients with endplate erosion had upper cervical lesions, including 18 with AAS, 16 with VS, and 33 with both. However, 128 (63.1%) out of 203 patients without subaxilar cervical lesions had upper cervical lesions, indicating no relationship between these two cervical lesions (Table 3).

Prevalence of cervical lesions and disease duration

The prevalence of upper and subaxilar cervical lesions in patients whose disease duration was less than 5 years from onset was 28.5% and 20.7%, respectively (Fig. 2).

Comparison of the prevalence of upper and subaxilar cervical lesions between the mutilating and nonmutilating groups revealed that the former group showed a higher frequency of both cervical lesions in the early stage within 5 years from disease onset. At this stage, 3 out of 4 (75.0%) patients in the mutilating group had subaxilar cervical lesions, and 2 out of 4 (50.0%) patients had upper cervical lesions, while only 25.4% and 19.1% of patients in the nonmutilating group showed upper and subaxilar cervical lesions, respectively (Fig. 3).

Cervical involvement and clinical findings

The prevalence of cervical lesions increased with time, and depended on the severity of the disease as defined by Steinbrocker's classification (Fig. 4). ESR and CRP values were higher in patients with VS, SAS, or endplate erosion. The average age of disease onset was lower in patients with AAS and VS (Table 4).

Discussion

In the upper cervical spine in RA, AAS is caused by destruction of the medial atlantoaxial joint, and VS is caused by collapse of the lateral atlantoaxial joint. The upper cervical lesions are reported to start from reducible AAS changes and then become irreducible, and then VS occurs by destruction of the lateral component of the joints. However, in the present study, 10% of patients had VS alone, while 20% of patients had a combination of AAS and VS. This suggests that the lateral atlantoaxial joint was damaged without horizontal subluxation in some patients.

Involvement of the subaxilar cervical spine in RA includes SAS and erosion of the endplate. SAS is a result of the involvement of the facet joints, inflammation at the attachment of the interspinous ligament, and an extension of inflammation into the disc lesion.[5] Erosion of the endplate is caused by the infiltration of inflammatory tissue from the uncovertebral joint, which is a characteristic structure in the cervical spine.[11] Yonezawa et al.[12] reported that the ADI was significantly smaller in spines with marked anterior slip. The present study suggests no linkage between upper and subaxilar cervical lesions, and it seems that they occur independently.

Large differences regarding the prevalence of cervical lesions in RA have been reported.[1–5,13,14] They ranged from 10% to 70%. These different figures came from the patients studied or the types of cervical abnormalities evaluated.[7] In the present study, the prevalence of cervical lesions was 178 (67.7%): upper and subaxilar cervical lesions were seen in 136 (51.7%) and 125 (47.5%) cases, respectively, in RA patients with 13 years disease duration. As the prevalence increased with time, a detailed longitudinal study is necessary to improve our understanding of these results.

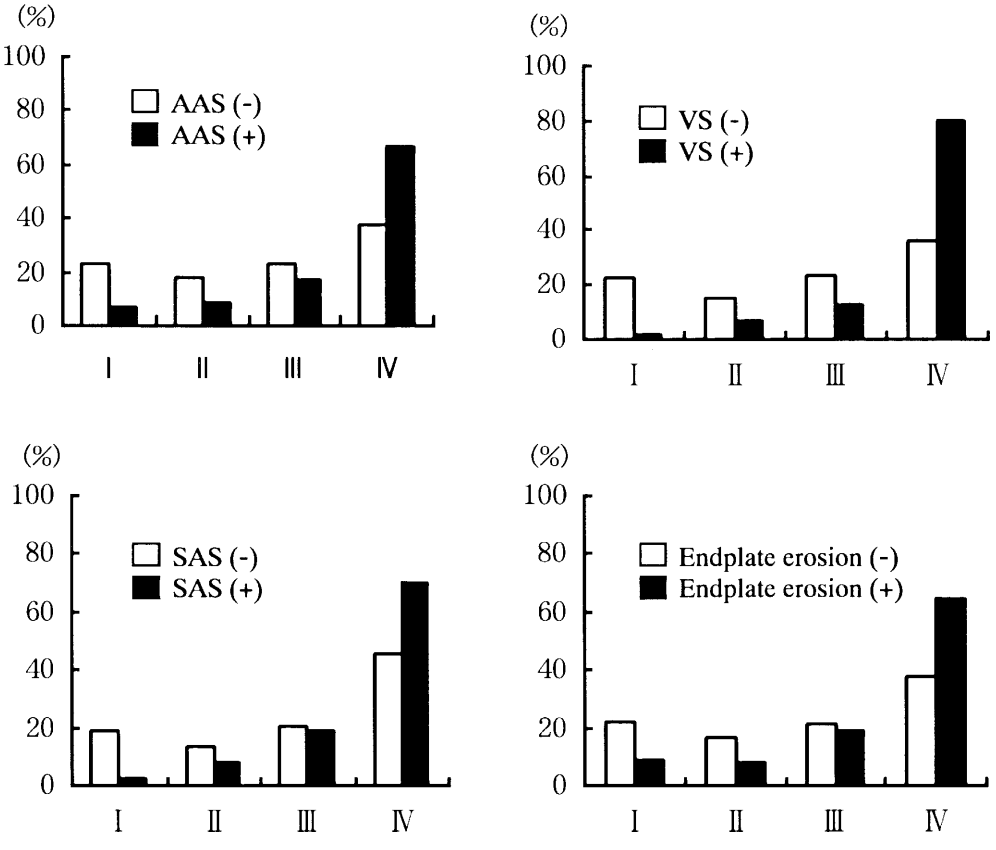

Fig. 4. Prevalence of cervical lesions increases with stage (Steinbrocker's classification)

Paimela et al.[13] carried out a prospective 6.5-year follow-up study and reported that cervical involvement was recognized in 20 out of 67 patients with early RA within 1 year from onset. Winfield et al.[14] reported that 54% of patients with early RA developed cervical involvement after 9.5 years of follow-up, while Oda et al.[2] reported the prevalence of upper cervical lesions as 77.6%. The results of the present study showed that about two-thirds of patients had cervical lesions, and the prevalence increased to 90.1% in the patients whose disease duration was over 21 years.

The prevalence of rheumatoid cervical involvement is affected not only by disease duration, but also by disease activity. Winfield et al.[14] reported that RA patients with progressive erosion in the hands and feet had marked cervical subluxation. Oda et al.[2] also reported that patients with mutilating deformity had severe cervical lesions. In the present study, the prevalence of cervical lesions tended to occur more frequently in the mutilating group, and often within 5 years from onset. ESR and CRP values were higher in patients with VS, SAS, and endplate erosion. However, patients with or without AAS showed no difference in ESR and CRP. We consider that AAS is the earliest sign of cervical lesion in RA[2] before any differences in the inflammatory findings become clear. As the present study was cross-sectional, the observation of each individual for a long period, and an insight into the relationship between cervical lesions and clinical manifestations are needed.

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