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Clinical and Radiological Evaluation of the Spine Due to Rheumatoid Arthritis

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Abstract 104 patients with rheumatoid arthritis were studied to evaluate clinical symtoms, signs and radiographic findings of the spine. 55 of 104 had radiographical abnormal findings in the cervical spine. In the upper cervical spine, atlanto-axial subluxation, vertical subluxation, odontoid erosion and other findings were found in many cases. Instability index and minimal sagittal diameter of the spinal canal at the atlanto-axial joint were closely related to development of neurological sympyoms and signs. In the middle and lower cervical spine subaxial subluxation was one of the significant findings, and less than 13 mm of dynamic sagittal diameter of the canal was also related to development of myelopathy. In the thoracic and lumbar regions back pain was the frequent symptom, and osteoporosis, narrowing of the disc, erosion of apophyseal joints and compressive deformity of the vertebral bodies were the common findings found in radiography. Symptoms and findings arising from the thoracic and lmbar spine were not rarer than that they were thought before. But it is still difficult to define these symptoms and findings due to arthritic changes.

Key Words: Rheumatoid arthritis, Spine, Neck pain, Cervical myelopathy, Subluxation of the spine

I. Introduction

Inflammation due to rheumatoid arthritis (RA) affects not only joints of the extremities but also those of the spine. There are 135 joints in the spine including 112 synovial joints. The spine can be, therefore, one of the frequently affected structures in RA. Involvement of the cervical spine in RA has been published in the literature and is now well recognized. By radiological investigations cervical lesion due to RA has been found to be roughly of 50-80 [1)2)]% of patient's group. The lesion consists of mostly erosion of the odontoid process and subluxation of the atolanto-axial joint, the atlanto - occipital joint and the subaxial articulations. Symptoms arsing from cervical leison are mostly neck pain and/or headache. Destructive changes of bones and joints in RA at the cervical spine may lead to neurological deficits due to compression or vascular insuffiency of the spinal cord and /or brain stem, up to severe dysfunction including teteraplegia and sudden death. However, detailed analysis of the symptoms is not well reported yet.

In contrast to the involvement in the cervical spine, that of thoracic and lumbar spine has recieved little attention. And there have been only a few reports so far concerning the

involvement of the thoracic and lumbar spine.

The reason is that few symptoms are believed to arise from the levels of the thoracic and lumbar spine in RA. But in the author's experience the symtoms are not rarer than that mentioned above. The symptoms are mostly back pain or low back pain, although they are not severe or serious, and spinal cord lesion is rare.

This study is undertaken to document the clinical features and radiologic changes of the spine due to RA, considering the cervical spine as well as at the thoracic and lumbar spine.

II. Materials

One hundred and four patients of RA in author's clinic were the objects of this study (Table 1). They all belonged to classical or definite RA as outlined in the American Rheumatism Association (ARA) criteria. There were seventy nine women and twenty five men, ranging in age from 28 to 76 years (average 55.3 years old). The duration of disease varied from 11 months to 37 years (average 13.3 years). According to the criteria of Steinbrocker, Stage I consisted of 12, Stage II of 27, Stage III of 37 and Stage IV of 28 patients.

III. Methods

Each patient's clinical features were analyzed from the view points of both subjective symptoms related to involvement of the spine by direct questioning of the patient and objective signs including neurological examination.

Plain radiographs of the cervical, thoracic and lumbar spine were taken within a short period. When there were doubts about the findings of the lesions, tomography and/or computed tomography (CT) were employed in addition to plain radiographs.

To the cervical and lumbar spine, 6 views of radiographs, which were an antero-posterior (A-P), bilateral oblique and three lateral (in flexion, neutral and extention positions) projections, were taken regularly. Often A-P projection through the open mouth to the upper cervical spine was added. To the thoracic spine A-P and lateral projections were taken.

☆ radiological criteria

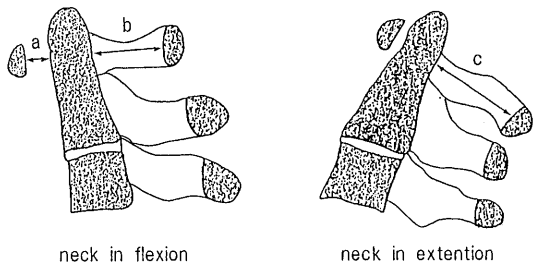
Atlanto-axial subluxation (AAS) was defined on the lateral view as a distance greater than 3 mm separation from the anterior surface of the odontoid to the midpoint of the posterior aspect of the anterior arch of the atlas (ADI), with the neck in flexion. ADI was measured in both flexion and extension positions of the neck, and instability index (I.I.) was calculated as shown in Fig. 1. Vertical subluxation (VS) was recorded as

Table 1 Materials (104 cases)

Sex	:	Male 25, Female 79
Age	:	28y.~76y. (average : 55.3y.)
Duration of disease	:	11m.~37y. (average : 13.3y.)
Stage	:	I 12, II 27 III 37, IV 28
Therapy	:	NSAIDs 27, Gold 27, Au 12, D-P 21, CCA 8, Steroid 5, Others 4
Labo. data	:	RA;(−)3, (+)41, (2+)60 CRP;(−)3, (±)6, (+)9, (2+)17 (3+)37, (4+)≧32 ESR;14~151 mm/hr. (average : 75.6 mm/hr.)

NSAIDs : non steroidal anti-inflammatory drugs. Gold : gold sodium thiomalate.
Au : auranofin. D-P : D-penicillamine. CCA : lobenzarit disodium.
Others : tiopronine, bucillamine, methotrexate.

These data were evaluated whem radiological findings were assessed.



a : atlanto-dental interval(ADI)
b : minimal canal diameter(min.d.)
c : maximal canal diameter(max.d.)

Instability index was calculated as $\frac{\text{max.d.} - \text{min.d.}}{\text{max.d.}} \times 100(\%)$

Fig. 1 The radiological measurements used in the assessment of the upper cervical spine.

present if the tip of the odontoid lay more than 5 mm above the line drawn from the upper surface of the posterior edge of the hard palate to the most caudal point of the occipital bone.

Subaxial subluxation was recorded as present if displacement between adjacent vertebral bodies was more than 1 mm or more than 15% of the antero-posterior vertebral body diameter using the grading of Smith[3] et al.

Ⅳ. Results

1) clinical feautures (Table 2)

At the cervical region, out of 104 patients, nuchal pain was found in 68 (65.4%), neck stiffness in 60 patients (57.7%) and occipital pain in 54 (51.9%). One patient with AAS had an episode of vertigo. In objective signs, limitation of neck motion was found in 29 patients (27.9%), tenderness around the neck in 26 (25%), hyper-reflexia at the extremities in 35 (33.7%) pathological reflex in 3 (2.9%) and weakness of the extremities in 6 (5.8%). Sharp-Purser test, in which the flexed head is forced to extension while the spinous process of C 2 is held fixed, was positive in 22% of 50 patients with AAS. One patient, suffered a cord injury by tripping on a step, resulting tetraplegia. As a whole, 31% of patients with radiographic abnormalities of the cervical spine had no symptoms and signs.

Table 2 Subjective and objective symptoms related to the spine.

Cervical	spine		
	Nuchal pain	: 68 cases	(65.4%)
	Occipital pain	: 54	(57.7)
	Hyper-reflexia	: 35	(33.7)
	Limitation of neck motion	: 29	(27.9)
	Tenderness	: 26	(25)
	Weakness of limbs	: 6	(5.8)
	Pathological reflex	: 3	(2.9)
	Vertigo	: 1	(0.96)
	Tetraplesia	: 1	(0.96)
Thoracic	spine		
	Back pain	: 37	(35.6)
	Tenderness	: 14	(13.5)
	Radiating pain	: 8	(7.7)
	Scoliosis	: 8	(7.7)
Lumbar	spine		
	Back pain	: 46	(44.2)
	Radiating pain	: 20	(19.2)
	Tenderness	: 48	(46.1)
	Limitation of lumbar motion	: 56	(55.3)
	Scoliosis	: 8	(7.7)

In the thoracic region back pain was the most frequent symptom and was found in 37 patients (25.6%). Radiating pain to the chest was in 8 (7.7%), including two patients with herpes zoster. Objective signs were less common than in the cervical region, and were found in 14 patients. Of these, tenderness over the thoracic spine was in 14 (13.5%) and scoliosis in 8 (7.7%). Neurological deficits referable to the thoracic spine were not found.

In the lumbar region low back pain was the common symptoms, and was found in 46 patients (44.2%). Radiating pain to the leg was in 20(19.2%), and the pain tended to be seen most frequently in the L 5-S 1 lumbar nerve distribution. On examination tenderness over the lumbar spine was found in 48 patients (46.1%), limitation of lumbar motion was in 56(53.8%) and scoliosis in 8 (7.7%). Urinary-bowel disturbance was not found.

2) radiographic findings(Table 3)

In the upper cervical spine, 55(52.8%) out of 104 patients had radiographic abnormal findings. Of these, 50 patients (48%) showed AAS, including anterior AAS in 39(37.5%), downward in 4 (3.8%) (Fig. 2), lateral in 4

Table 3 Radiological changes of the spine in 104 RA patients.

Upper cervical spine		
Atlanto-axial subluxation (AAS)		
anterior AAS	: 39 cases	(37.5%)
lateral AAS	: 4	(3.8)
downward AAS	: 4	(3.8)
posterior AAS	: 2	(1.9)
rotatory AAS	: 1	(0.96)
Vertical Subluxation	: 18	(17.3)
Occipito-atlanto erosion	: 24	(23.1)
Lateral atlanto-axial erosion	: 40	(38.5)
Odontoid erosion	: 37	(35.6)
Thin dens	: 7	(6.7)
Middle and lower cervical spine		
Subaxial subluxation	: 18	(17.3)
single level	: 11	(10.6)
multiple levels	: 7	(6.7)
End plate erosion	: 16	(15.4)
Apophyseal fusion	: 5	(4.8)
Thoracic spine		
Osteoporosis	: 46	(44.2)
Compression fracture	: 19	(18.3)
Costvertebral erosion	: 12	(11.5)
Scoliosis	: 8	(7.7)
Lumbar spine		
Osteoporosis	: 46	(44.2)
Disc narrowing	: 34	(32.7)
Compression fracture	: 21	(20.2)
Vertebral destruction	: 2	(1.9)
Vertebral subluxation	: 4	(3.8)
Anterior wear of vertebral body	: 15	(14.4)
Apophyseal destruction	: 23	(22.1)
Scoliosis	: 8	(7.7)

(Fig 3), posterior in 2 and rotatory in 1. VS was found in 18 patients (17.3%), occipito-atlanto erosion in 24 (23.1%), lateral atlanto-axial erosion in 40 (38.5%), odontoid erosion in 37 (35.6%) and thin dens in 7 (6.7%).

In the middle and lower cervical spine, subaxial subluxation occurred in 18 patients (17.3%), in which subluxation was found at a single level in 11 and at multiple levels in 7. Subluxation was seen at the level of C2-C5, in which two levels were involved in 5 patients and three levels in 16 patients (15.4%), with narrowing of the disc space in a majority. Fusion of the apophyseal joints was found in 5 patients (4.8%).

In the thoracic spine (Fig. 4.5), osteoporosis was the prominent finding, and was found in 46 patients (44.2%).

Erosion of the cost-vertebral joints (Fig. 6), which was considered as a characteristic finding in RA, was found in 12 patients (11.

Fig. 2 Downward luxation.
The anterior of the atlas is tilted downwards in front of the axis. In this case, subaxial subluxation of C3 is also seen.

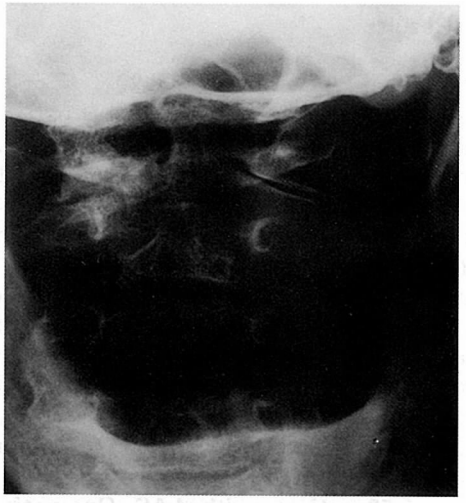


Fig. 3 Lateral subluxation.
If the destruction of the lateral part of C1 in one side, lateral subluxation occures.

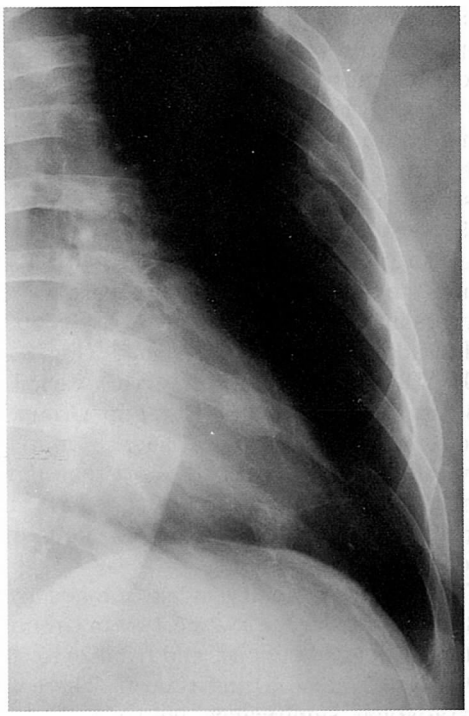


Fig. 4 Pathological fracture of the ribs.
The cause of back pain can be due to pathological fracture of the ribs.

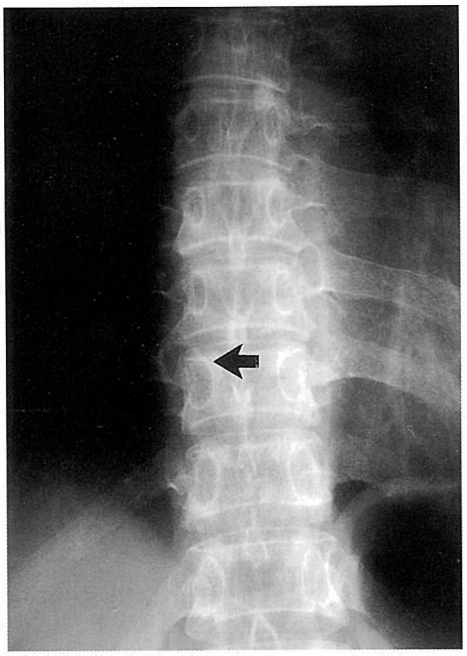


Fig. 6 Costvertebral erosion.
In this case, costvertebral erosion is seen in Th 11.

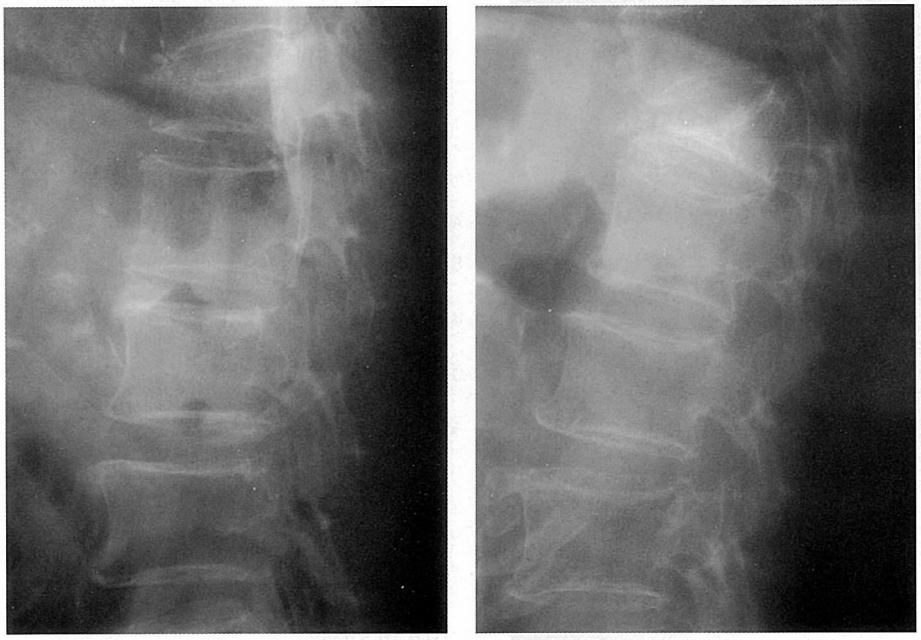


Fig. 5 Compression fracture of Th 12.
In this case, compression fracture occured without obvious trauma and the change progressed in three months.

5%), frequently at the levels of 1st, 11th and 12th. Scoliosis was in 8 (7.7%) and compressive deformity of the vertebral body in 19 (18.3%).

In the lumbar spine, osteoporosis was also the common findings and was found in 46 patients (44.2%). Narrowing of the disc space was in 34 (32.7%), anterior wear of the vertebral body in 15 (14.4%), destructive changes of the apophyseal joints in 23 (22.1%). Compressive doformity of the vertebral body probably due to fracture was found in 21 patients (20.2%), in which most cases were over 60 years old and seemed to be closely related to senile and/or rheumatoid osteoporosis (Fig.7).

3) relation between neurological features and radiological measurements

39 patients with anterior AAS (atlanto-axial subluxation) were divided into two groups according to the severity of the neurological findings. Groups I, in which there were no neurological symptoms and signs, and only tingling in their hands were noticed, consisted of 30 patients. Group II, in which apparent neurological symptoms and signs such as hyperreflexia, sensory deficits and/or motor weakness were found, of 9 patients. There was no statistical significance between the two groups about their age and sex distribution.

But statistical significance was found in the duration of the disease ($p<0.01$), in which the average duration of disease was 10.3 years in Group I and 14 years in Group II.

In radiographic measurements (Fig. 8. 9. 10), ADI (atlanto-dental interval) varied 4-8 mm (average 5.5 ± 1.4mm) in Group I and 6-15 mm (average 10.6 ± 3.3 mm) in Group II. Patients with ADI more than 10mm tended to develop neurological deficits, but three patients with ADI less than 10mm also had neurological deficits.

The I.I.(instability index) ranged from 3.3 to 26.1% (average 15.2 ± 5.4%) in Group I (no neurological deficit), and from 20 to 50% (avarage 32.6 ± 9.5%) in Group II. There was a statistical significance between the two groups ($p<0.01$). The minimal diameter, which reflects space available for the spinal cord, ranged from 15 to 29mm (19.4 ± 3.5mm) in Group I and from 10 to 16mm (13.6 ± 1.9 mm) in Group II ($p<0.01$).

In the middle and lower spine 18 patients with subaxial subluxation were also divided into two group depending on severity of neurological symptoms and sings. Group A

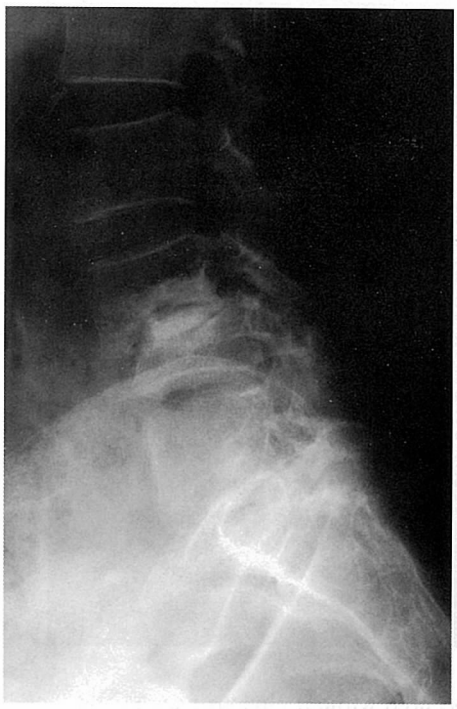
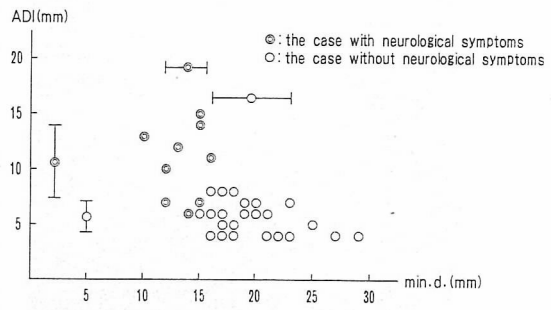
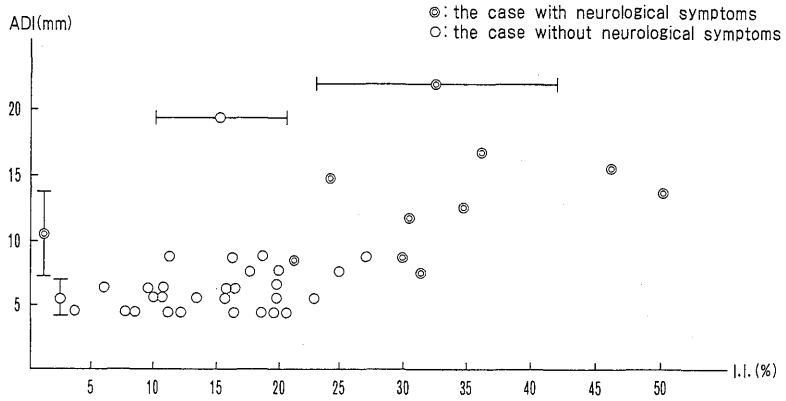


Fig. 7 Vertebral body destruction.



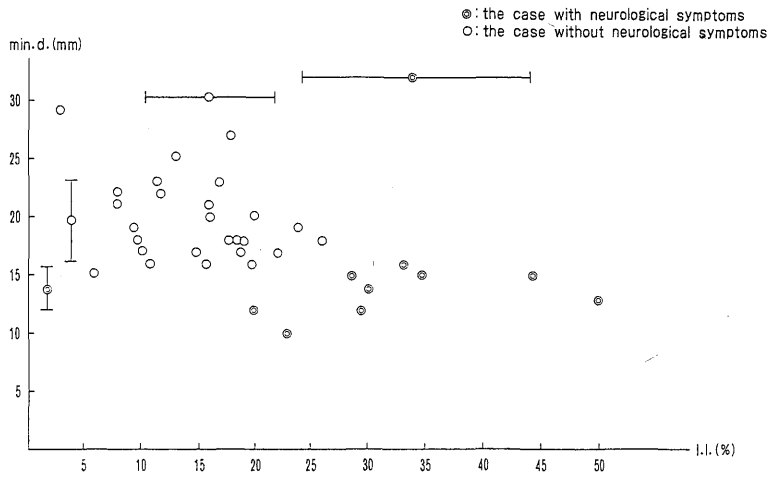
There were statistical significances between two groups about ADI ($p<0.01$) and about min.d. ($p<0.01$). But there was not uniform distribution in ADI ($p<0.05$).

Fig. 8 Relationship between ADI and minimal canal diameter.



There were statistical significances between two groups about ADI ($p<0.01$) and about I.I. ($p<0.01$). In the significances level less than 5%, there was not uniform distribution in ADI. It could not defined that the distribution was not uniform in I.I. ($p<0.01$).

Fig. 9 Relationship between ADI and Instability index (I.I.).

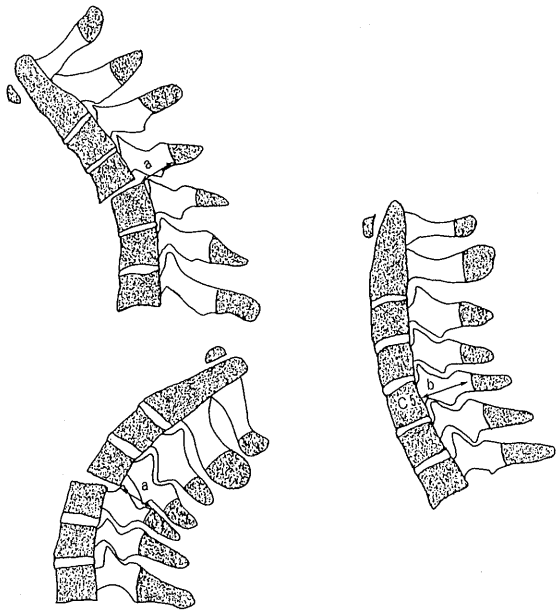


There were statistical significances between two groups about I.I. ($p<0.01$) and about min.d. ($p<0.01$).

Fig. 10 Relationship between minimal canal diameter and Instability index.

consisted of 15 patients without neurological deficits, and Group B of 3 with neurological deficits. There was no significant difference between the two groups in regard to age distribution and the duration of the disease.

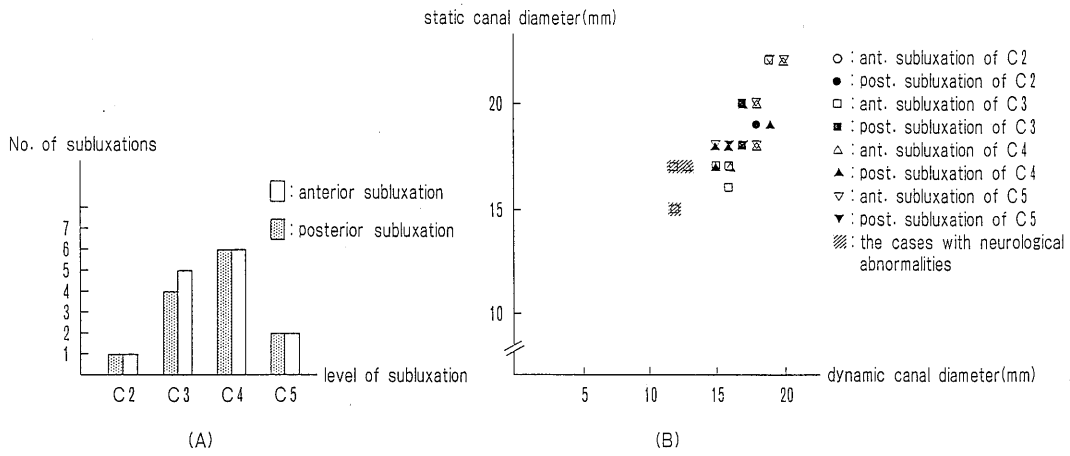
Sagittal diameter of the spinal canal was measured both in static (in neutral position) and in dynamic (minimal diameter in flexion -extension position) (Fig.11). The static diameter ranged from 17 to 22 mm (18.5 ± 1.2 mm) in Group A and from 15 to 17 mm (16.3 ± 1.2 mm) in Group B, indicating no statistical difference between the two groups ($p<0.05$). The dynamic diameter ranged from 15 to 22 mm (16.8 ± 1.4 mm) in Group A and from 12 to 13 mm (12.3 ± 0.6 mm) in Group B, indicating that there was statistical significance between the two groups ($p<0.01$). All



a : dynamic anteroposterior canal diameter.
b : static anteroposterior canal diameter.

Anteroposterior canal diameters were measured for static on neutral position at C5 level and for dynamic on flexion or on extension position as illustrated at subluxation level.

Fig.11 Measurements of static and dynamic anteroposterior canal diameter.



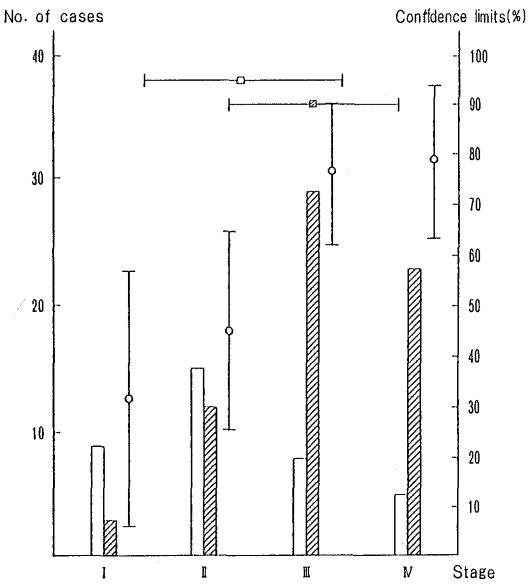
A: Subaxial subluxation was frequently seen at C3 and C4.
B: Relation between static and dynamic canal diameters.
In the cases with neurological abnormalities, the dynamic canal diameter was less than 13 mm. There was statistical significance between two groups with dynamic canal diameter ($p<0.05$).

Fig.12 The distribution of subaxial subluxation and the relation between static and dynamic canal diameters.

patients with neurological deficits had less than 13 mm of dynamic sagittal diameter (Fig.12).

V. Discussion

Rheumatoid inflammation begins initially at the synovial joints. The spine has many synovial joints, therefore, the spine is frequently affected by RA (Fig.13). The cervical spine has 32 synovial joints, and more particularly in the upper cervical spine. The thoracic and lumbar spine are also involved, and are more frequently affected than it was



□: without radiological abnormalities in the cervical spine
n=37 Stage=2.243±0.983

▨: with radiological abnormalities in the cervical spine
n=67 Stage=3.075±0.831

○: confidence limits(c.l.) at each Stage($p<0.05$)
Stage I : 0.055<c.l.<0.572
Stage II : 0.255<c.l.<0.647
Stage III : 0.618<c.l.<0.902
Stage IV : 0.631<c.l.<0.940

There was statistical significanse between the involvements of the cervical spine and the peripheral joint Stage ($p<0.01$).
Confidence limits were also calculated at each Stage ($p<0.05$).
In Stage III and in IV, more than 60% of patients had cervical involvements statistically.

Fig.13 Relation between peripheral joint Stage and involvements of the cervical spine.

thought to have been before. In the radiographic analysis of the cervical spine in this study, 55% of 104 patients had abnormal findings in the upper cervical spine, in which subluxation was the most prominent feature in the various findings. There were 37.5% of AAS (atlanto-axial subluxation), 17.3% of VS (vertical subluxation), 3.8% of lateral subluxation and 1.9% of posterior subluxation. Subaxial subluxation is in 11.5%.

The incidence of cervical involvements in RA is reported as 50[1] to 80[2]%, depending on the group of patients, in which the severity of RA, the duration of the disease and/or other factors differ slightly. AAS is reported to be a common feature[4)5)] in cervical involvement by RA, and in this study the incidence was nearly the same as with other reports[1]. The mechanism of AAS is thought to be mainly due to loosening or rupture of the transverse ligament of the atlas, which holds the odontoid process of the axis, and erosion or destruction of the odontoid process. The transverse ligament becomes edematous due to synovitis of the adjacent joints. The edema can cause pathological laxity of the ligament. In addition, rheumatold granulation or fibrinoid necrosis may also destroy the ligament[4]. Rheumatoid pathology extends to the odontoid process, making it erosive and finally destroying it. In the odontoid process erosive changes can be observed by plain radiography or tomography predominantly at the apex and the base of the dens. Analysis of 7 patients with thin dens in this study showed that there were 3 erosive changes at the apex and 5 at the base. Damage of the ligaments and the joints promotes subluxation of the atlanto-axial joint. Vertical subluxation is usually due to destruction of the lateral parts of atlanto-axial joint. When the destruction occurred predominantly in one side, lateral subluxation may develop or be associated with AAS. During the course of this study, 8 patients developed vertical subluxation. Of these 2 arose from previously normal joints and 6 from AAS originally. It thus appears that vertical subluxation usually proceeds from AAS.

In the subaxial region the common radiographic findings are narrowing of the disc space, erosion of the vertebral end-plate,

erosion of the apophyseal joint and subluxation. Disc space narrowing were predominantly found at the level of C2-3 and C3-4 in this study, and this supports the Sharp's[7] results. As to the relation between joint erosion and subluxation, erosions of the vertebral end-plate were found in similar frequency with both the subluxation group (34%) and the non-subluxation group (32%), while erosion of the apophyseal joints were found predominantly in the subluxation group (60% in subluxation group and 35% in non-subluxation group). This indicates that erosion of the apophyseal joint is more susceptible to induce subluxation ($p<0.01$).

From the clinical aspects of cervical lesions many of the patients suffered from pain and mobility disturbance. Nuchal pain was the most common complaint and was noticed in 65% in the author's cases. But the pain was non specific and often transient. Occipital pain was found in 52% and was considered mainly due to C1-2 lesion by AAS, VS or other joint involvements.

Important attention should be given to spinal cord symptoms and signs arising from instability or subluxation of the rheumatoid spine. Several cases of sudden death in rheumatoid involvent of the cervical spine have been reported[8][9]. In this study no patients died due to cervical involvement, but one patient suffered from tetraplegia from a fall. This is an example that patients with rheumatoid involvement of the cervical spine are vulnerable to catastrophic injury from minor trauma (Fig.14). Interestingly, cervical cord lesion is reported to be found also in patients of RA without subluxation or instability of the cervical spine (Fig.15). Enchroachment of the cord by rheumatoid granulation, compression of of the cord by protruded disc materials or other factors are the causes of cervical myelopathy.

However, it is also clear from this study that radiographic abnormal findings may be present without any symptom. 31% of asymptomatic patients have cervical abnormal findings in radiographs, and 18 patients with AAS and 8 patients with VS have no symptoms and signs referable to the cervical spine. There are several explanations for this discrepancy between the radiographic

Fig.14 A case of cord injury.
In this case, AAS and VS are seen with neck malalignment.

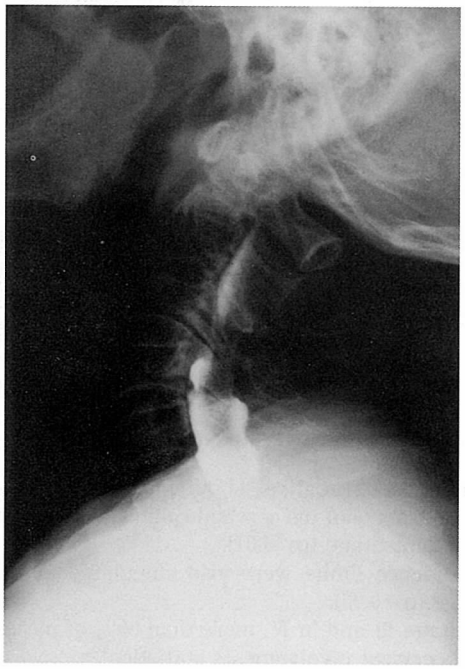


Fig.15 A case of myelopathy.
Cervical myelopathy can occur without radiological abnormality.

severity and neurological signs. The spinal canal for the cervical cord may be relatively wide either in normal variation or as the result of bone erosion. Shortening of the eroded odontoid process can prevent serious compression to the brain stem. When the subluxation occurs gradually, adaptation of the surrounding tissues may occur.

In this study the degree of AAS did not always correlate to neurological deficits. I.I. (instability index) and minimal diameter were useful parameters to detect or predict appearance of cervical myelopathy.

In the middle and lower cervical spine, subluxation or instability is also the main cause for myelopathy (Fig.16). Sagittal diameter of the spinal canal at the site of lesion is often reported as an important factor to cord compression[10)11)]. In this study 18 patients had subaxial subluxation, in which only 3 patients had neurological symptoms. The degree of static sagittal diameter was not related to existence of cervical myelopathy, but dynamic sagittal diameter of less than 13 mm played a dominant role in causing neurological symptoms.

In the thoracic spine, structual support by the rib cage makes arthritic deformity or subluxation a care condition. In this series marked deformity of the thoracic spine was not found. Osteoporosis was the most common feature, but it was difficult to define as a characteristic feature of RA.

The rheumatoid process in the thoracic spine seems to advance very slowly. In this series those who had radiographic findings in thoracic spine had more than 13 years of average disease duration, and seldom gave rise to major or serious symptoms probably because of the supporting structure of the rib cage. Back pain was the most common symptom, and was found in 36% of the patients in author's study. They were treated conservatively, such as wearing a corsett or rest for a short time, with good results. Lober[12)] et al mentioned that rheumatoid nodular lesion might occasionally develop in the marrow of the vertebral plates. In the author's cases, one patient who showed a compressive deformity of the vertebral body without obvious cause, had progressive radiographic collapse within three months. This case may support Lober's view. The patient died of amyloidsis, but the autopsy could not be done.

In the lumbar spine, osteoporosis, wedge shaped deformity of the vertebral body and narrowing of the disc space were found in many patients in this series. However, as well as the change of the thoracic spine, these findings could not be considered as specific in RA. Lawrence[13)] et al found an increased incidence of subluxation, disc narrowing, apophyseal destruction and osteoporosis in

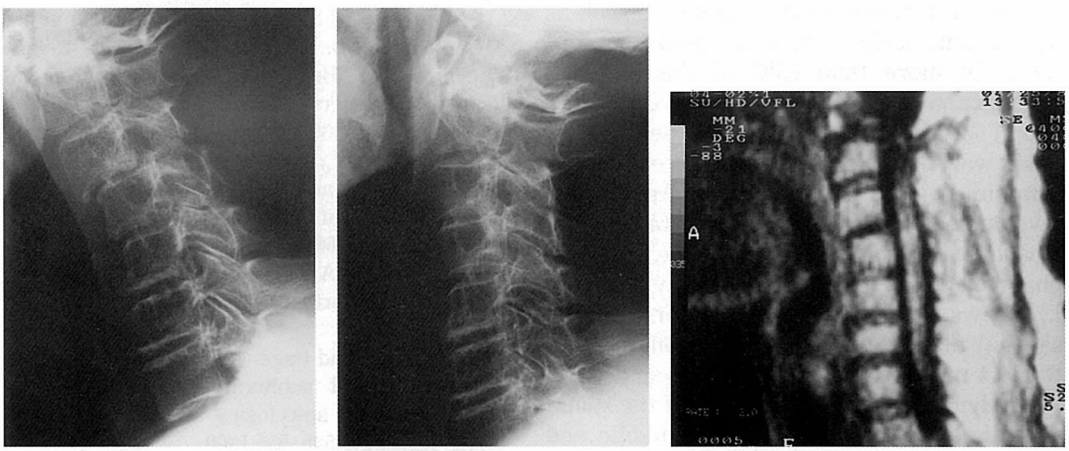


Fig.16 A case of myelopathy.
In this case, anterior subluxation of C3 is seen and MR imaging reveals the cord compression.

RA patients compared with control subjects, and thought that rheumatoid change were present in the lumbar spine of 5% of males and 3% of females. Precise diagnosis of rheumatoid disease in the lumbar spine needs further histological examination. In this series no histological examination was done, but two patients' findings suggested that inflammatory process of RA might extent from apophyseal joints to adjacent intervertebral discs.

Neurological symptoms and signs are caused in several ways, although the frequency is not high. Hauge[14] reported three cases of cord compressive lesion at the level of the lumbar spine. Friedman[15] found and intraspinal rheumatoid nodule which compressed the fifth lumbar and first sacral nerve roots. In the author's experience nearly 20% of patients with radiating pain to the lower limb was observed. The pain was mostly distributed at the level of L5 and S1 nerve root areas. But pain arises from various causes, and it is also difficult to define the specificity of the cause to RA. Further examinations including autopsy cases are needed to clarify pure rheumatoid involvements in the spine.

VI. Conclusion

Clinical and radiographic evaluation was performed on 104 patients with RA with special reference to the spinal involvements. In the cervical spine local symptoms such as nuchal pain, occipital pain and headache were found in more than 65% of the patients. Radiographic abnormal findings were observed in 53% of the patients. Of these findings, AAS was the most frequently seen, and it sometimes progressed to VS. Apophyseal involvements also played an important role in development of subluxation. In the radiographic measurements when instability index (I. I.) shows more than 20% and/or minimal sagittal diameter of the spinal canal is less than 14 mm at the upper cervical spine, and when dynamic sagittal diameter of the spinal canal is less than 13 mm at the middle and lower cervical spine, the cervical cord tends to be compressed and the possibility of neurological dificits developing, tends to be higher.

In the thoracic and lumbar spine back pain was the common symptom and was found in about 40% of the patients. Many patients with back pain had extensive, active and erosive RA. Radiographic abnormal fingings were observed in 44%, including osteoporosis and narrowing of the disc. Costvertebral joints were also involved in 11.5% of the thoracic spine. Low back pain was sometimes associated with radiating pain to the limb. The pain was mostly distributed at levels of L5 and S1 nerve roots area. But it is still difficult to define these symptoms and findings to be caused by rheumatoid arthritis, and further examinations are needed, especially on involvements in the thoracic and lumbar spine.

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