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RHEUMATOID ARTHRITIS OF THE CERVICAL SPINE

AN ANALYSIS OF 333 CASES

BY

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A retrospective survey of 845 patients with rheumatoid arthritis seen at the Queen Elizabeth Hospital, Rotorua, showed that approximately 60 per cent. had signs or symptoms of neck involvement, which varied from mild to severe (Conlon, Isdale, and Rose, 1963). Seven patients had radiological evidence of moderate or severe atlanto-axial subluxation, but it was felt that subluxation was probably more common than these figures indicated, particularly as other surveys by Martel (1961), Bland, Davis, London, van Buskirk, and Duarte (1963), and Serre, Simon, Janicot, and Lévy (1964), using tomography, showed a much higher incidence of atlanto-axial subluxation where this was specifically sought. For this reason a prospective study was planned to ascertain the frequency of this abnormality and other rheumatoid changes, the significance of the degenerative changes seen in these *x* rays, and the frequency with which neurological signs resulted from rheumatoid changes, particularly cervical subluxation.

Material and Methods

In the 12 months starting in October, 1962, 848 patients were admitted to the Queen Elizabeth Hospital, Rotorua. At the time of admission, in addition to routine *x* rays of chest, hands, and feet, a lateral view of the cervical spine in maximum flexion, taken at 6 feet and centred on C2 was obtained. These radiographs were subsequently read independently by two observers, with particular regard to the presence or absence of features previously suggested as common in or characteristic of rheumatoid disease (Bland and others, 1963) and degenerative change. When the two observers disagreed, the films were re-assessed and referred to a further independent observer. The patients were assessed by the American Rheumatism Association criteria for the diagnosis of rheumatoid arthritis. Cases were assigned to the degenerative joint disease group regardless of the site and cause of osteo-arthritic change; thus this group included cases of generalized osteo-arthritis (Kellgren and Moore, 1952), malum coxae senilis, post-traumatic osteo-arthritis, congenital abnormalities with secondary degenerative change, and other secondary degenerative conditions. There was a miscellaneous group of 190 cases of other arthropathies and non-rheumatic conditions.

Correlation was subsequently attempted between the clinical and radiological findings, with particular regard to the presence or absence of various rheumatoid criteria and *x* ray change.

Tomography was not employed, though at times it would have been of great use, and this may have led to some under-emphasis of certain changes, particularly erosion of the odontoid peg and mild degrees of platysbasia.

The usual criterion for atlanto-axial subluxation (Martel, 1961) is an increase in the radiological separation of the odontoid peg and the ventral part of the atlas to greater than 2·5 mm. in females and 3·0 mm. in males. In a number of examples the definition of the two bones was poor, or the separation was greater in the upper as compared with the lower part of the adjacent aspects of these two bones; in doubtful cases subluxation was held not to be present.

Definition of apophyseal joint changes also presented difficulties, and these were not recorded as eroded or blurred where doubt existed.

Particular regard was paid to the presence or absence of osteophytes accompanying loss of disk space (Sharp, Purser, and Lawrence, 1958), but frequently osteophytes were not found at one level, though obviously present at another in the same *x* ray.

Peripheral hand and foot *x* ray changes were classified in five grades: normal; osteoporosis only; small multiple erosions; large multiple erosions; and gross widespread destructive changes of "mutilans" type.

For the purpose of analysis, the latex test results were similarly grouped into 1 in 40 or under (= normal); 1 in 40 or 1 in 80; 1 in 160 or 1 in 320; and above this.

Results

Of 848 patients, 333 (103 male and 230 female) had rheumatoid arthritis (classical 233; definite 85; probable 15), and 325 (135 male and 190 female) were placed in the degenerative joint disease category (Table I).

Of the 325 osteo-arthritic patients, 173 had symptoms referable to the neck, but 296 (91 per cent.) had *x*-ray evidence of degenerative change, the incidence of such change being related to age (Table II).

Of 333 patients in the rheumatoid group, 295 (88 per cent.) had symptoms referable to the neck, and 211 showed changes which were thought to be typical of degenerative arthritis with loss of disk space, osteophytes at the same level, or apophyseal degenerative change. Changes categorized as due to the rheumatoid arthritis were seen in 167 patients (50 per cent.); fifty showed no abnormality on *x* ray, but there was no relation between the absence of radiological change and the absence of symptoms. Of 38 with no symptoms, only sixteen had normal *x* rays. The degenerative changes are classified by age in Table III (overleaf).

Analysis of Rheumatoid Changes

The incidence of certain rheumatoid abnormalities are shown in Table IV (overleaf), the most frequent being changes in the apophyseal joints, most often between the second and third vertebrae. These at times were definitely eroded, and on other occasions showed a local osteoporosis and blurring. Osteoporosis was seen in 69 patients and was frequently localized to a segment of the spine, usually in the upper spine. End-plate erosion was seen in 48 patients and was frequently multiple.

The most striking abnormality was the presence of subluxation (Fig. 1, overleaf). This most frequently occurred between the atlas and axis and separation of more than 2·5 mm. in females and 3 mm. in males was found in no less than 84 (25 per cent.) of the whole series.

TABLE I
CERVICAL SPINE ABNORMALITY IN 848 PATIENTS

Diagnosis		Number of Cases	Cervical Symptoms	*X*-ray Changes			Sex		Total
				Rheumatoid Arthritis	Osteo-arthritis	None	Male	Female	
Rheumatoid Arthritis	Classical Definite Probable	233 85 15	295	167	211	50	103	230	333
Osteo-arthritis		325	173	—	296	29	135	190	325
Other	Ankylosing Spondylitis Still's Disease Possible Rheumatoid Arthritis Reiter's Syndrome Other	22 23 21 19 105							190

TABLE II
DEGENERATIVE CHANGE RELATED TO AGE

Diagnosis			Osteo-arthritis					Rheumatoid Arthritis				
Age (yrs)			39 and Under	40 to 49	50 to 59	60 and Over	Total	39 and Under	40 to 49	50 to 59	60 and Over	Total
Total Cases			14	29	83	199	325	40	65	109	119	333
With Degenerative Joint Disease			6	11	5	7	29	34	41	31	17	122
Not Affected			8	18	78	192	296	6	24	79	102	211
Degenerative Joint Disease	Level	Intervertebral Apophyseal	15 4	40 11	169 43	538 243		4 4	41 11	144 20	198 65	
	Mean No.	Intervertebral Apophyseal	1·1 0·3	2·1 0·6	2·2 0·55	2·7 1·25		0·1 0·1	1·3 0·2	1·4 0·2	1·8 0·6	
Osteoporosis			—	—	—	44	44 (14 per cent.)	1	4	21	43	69 (21 per cent.)

TABLE III
DEGENERATIVE CHANGES AT INTERVERTEBRAL AND APOPHYSEAL JOINTS, BY AGE

Diagnosis		Osteo-arthritis				Rheumatoid Arthritis			
Age (yrs)		Under 50	50 to 59	Over 59	Total	Under 50	50 to 59	Over 59	Total
Total Patients		43	83	199	325	105	109	119	333
With Osteo-arthritic Changes		26	78	192	296	30	79	102	211
Not Affected		17	5	7	39	75	30	17	122
Intervertebral Degenerative Changes excluding "disk narrowing with no osteophytosis"	1/2	1	2	2	5	—	1	1	2
	2/3	—	8	30	38	1	2	8	11
	3/4	8	18	81	107	5	19	22	46
	4/5	12	29	108	149	6	17	33	56
	5/6	20	66	169	245	19	56	83	158
	6/7	14	46	148	208	14	49	71	134
Apophyseal Degenerative Changes	2/3	11	27	111	149	4	12	20	36
	3/4	1	4	58	63	5	5	15	25
	4/5	—	3	34	37	3	1	16	20
	5/6	2	5	24	31	3	—	10	13
	6/7	1	4	16	21	—	2	4	6
Subluxation (minor) related to Degenerative Joint Disease	2/3	—	3	21	24				
	3/4	—	6	37	43				
	4/5	3	3	28	34				
	5/6	1	5	6	12				
	6/7	—	1	2	3				

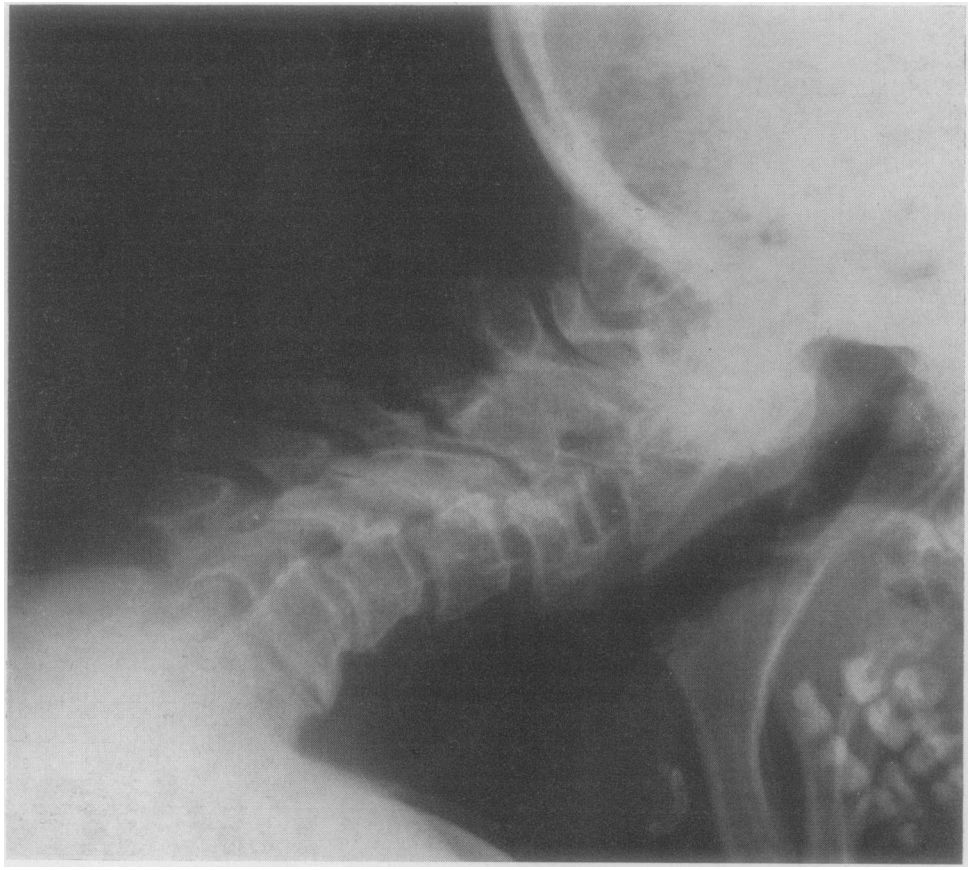

Fig. 1.—A case of classical rheumatoid arthritis, showing cervical subluxation, end plate erosions, and apophyseal joint erosion.

TABLE IV
RHEUMATOID FEATURES OF CERVICAL SPINE *X* RAYS

Group	Queen Elizabeth Hospital	Martel (1961)	Serre and Others (1964)
No. of Cases	333	34	60
X-ray Technique and View	Lateral Flexion	Lateral Flexion/Extension Tomograms	Tomograms
Symptoms	295	34	41
Atlanto-axial Subluxation	84 (25 per cent.)	24 (73 per cent.)	23 (38 per cent.)
Serial Subluxation	23	5	4
Osteoporosis	69	*	*
Odontoid Erosion	8	12	41
Platysbasia	1	10	13
Erosion Vertebral End-plates	48	4	*
Erosion Spinus Processes	8	8	*
Ankylosis	4	7	*
Apophyseal Joint Erosion or Blurring	106	*	*
Disk Narrowing without Osteophytosis	59	*	*
Normal X-ray	50	*	*

* Not stated.

Serial subluxation of the upper cervical vertebrae was found much less frequently but was at times marked.

In the osteo-arthritic patients subluxation of this degree was not seen, though minor changes were common (Table III), and there were no examples of atlanto-axial subluxation. The infrequent examples of serial subluxation in osteo-arthritics were always very slight, involving no more than two segments, and usually immediately above, or less commonly below or between, areas of marked degenerative change (Fig. 2).

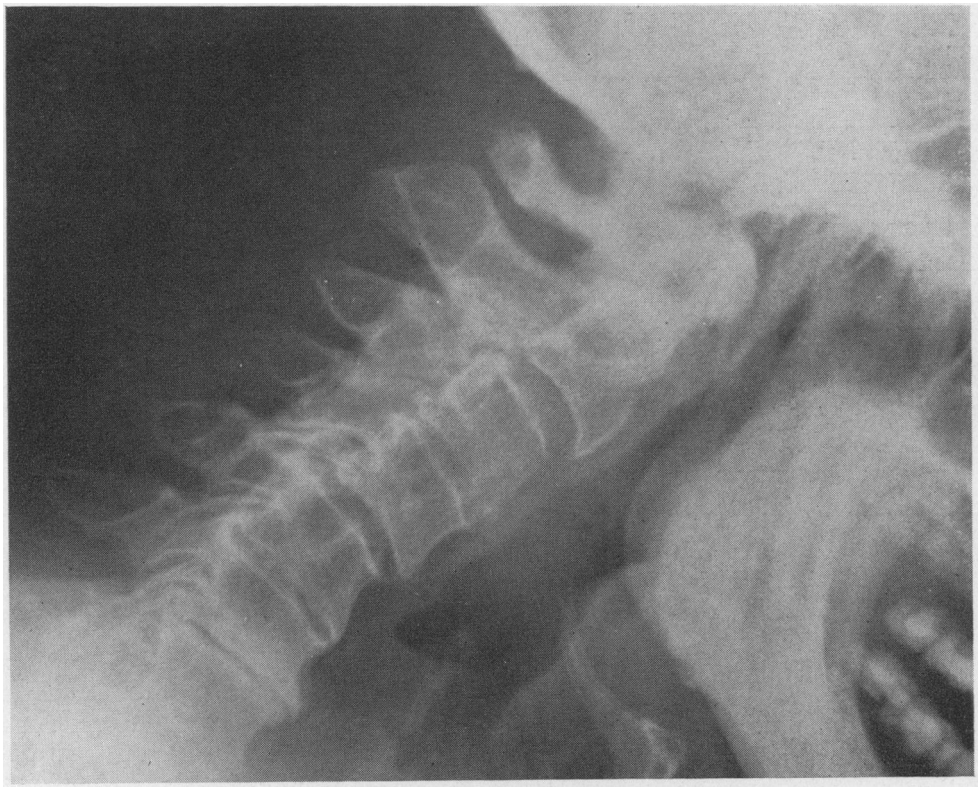

Fig. 2.—A case of generalized osteo-arthritis, showing intervertebral disk changes, minor subluxation, and osteophytosis.

The clinical data of patients showing atlanto-axial subluxation (A.A.S.) were analysed (Table V), and this most characteristic of the rheumatoid findings cited by Martel, was found to be statistically related to joint instability (of knees, wrists, and elsewhere); subcutaneous nodules; positive latex-agglutination test; and severity of peripheral *x* ray changes. No significant relationship was demonstrated with sex, oral corticosteroid therapy, duration of disease, or classification of rheumatoid arthritis as classical, definite, or probable. Particularly striking was the relationship between A.A.S. and marked joint destruction, whether patchy or generalized as "arthritis mutilans".

Neurological Changes (Table VI).

There were no cases of disabling neurological abnormality. Upper motor neurone signs and

TABLE V

ATLANTO-AXIAL SUBLUXATION IN RHEUMATOID SUBJECTS RELATED TO OTHER DATA

Subluxation..		Present	Absent	Total	$\chi 2$ and Probability
Joint Instability		50	94	144	$\chi 2 = 12{\cdot}13$; $n = 1$; $P < 0{\cdot}0005$
Subcutaneous Nodules		34	67	101	$\chi 2 = 5{\cdot}47$; $n = 1$; $P < 0{\cdot}02$
Latex Test	Under 1/40	19	70	89	$\chi 2 = 12{\cdot}78$; $n = 4$; $P < 0{\cdot}02$
	1/40, 1/80	8	35	43	
	1/160/320	19	64	83	
	640 1280	14	41	55	
	Over 1/1280	24	39	63	
Hand and Foot *X* ray no Change		9	69	78	$\chi 2 = 20{\cdot}58$; $n = 4$; $P < 0{\cdot}0005$
Osteoporosis Dubious Erosions		9	52	61	
Small Multiple Erosions++		28	63	91	
Large Multiple Erosions		16	31	47	
Widespread Destructive Changes (Mutilans)		22	34	56	
Female Sex		57	173	230	$\chi 2 = 0{\cdot}078$; $n = 1$; P: n.s.
Oral Corticosteroids		16	43	59	$\chi 2 = 0{\cdot}136$; $n = 1$; P: n.s.
A.R.A. Classification	Classical	62	171	233	$\chi 2 = 0{\cdot}994$; $n = 2$; P: n.s.
	Definite	18	69	85	
	Probable	4	11	15	
Duration (yrs)	<5	25	105	130	$\chi 2 = 4{\cdot}618$; $n = 2$; P: n.s.
	5-9	19	54	73	
	10+	40	90	130	
Total		84	249	333	

TABLE VI

NEUROLOGICAL ABNORMALITY IN RHEUMATOID ARTHRITIS AND OSTEO-ARTHRITIS, BY AGE, AND DURATION OF DISEASE (YRS)

Patients			*X*-ray Changes				Age (yrs)			Duration of Rheumatoid Arthritis (yrs)			Total
			Nil	Rheumatoid Arthritis	Osteo-arthritis and Rheumatoid Arthritis	Osteo-arthritis	30-50	50-59	60 +	0-5	5-9	10 +	
Rheumatoid Arthritis	With upper motor neurone signs	No.	4	4	12	3	6	8	9	6	6	11	23
		%	8	6	12	3	6	6·5	7·5	5	8	8	7
	Total		50	72	95	116	105	109	119	130	73	130	333
Osteo-arthritis	With upper motor neurone signs	No.	—	—	—	18	1	3	14				18
		%	—	—	—	6	2	3·5	7				5·6
	Total		29	—	—	296	43	83	199	—	—	—	325

diminished vibration sense in the lower lmbs were found in 23 cases of rheumatoid arthritis, of whom four showed no radiological abnormality. Of these 23 cases, eleven showed A.A.S., including four in which this was the only radiological sign. The presence of neurological changes was not related to age or duration of rheumatoid arthritis.

Upper motor neurone signs were less frequent among the osteo-arthritic cases (Table VI), but of the 105 patients over the age of 69, eleven (10·5 per cent.) were affected.

Disk Changes

Intervertebral disk changes with osteophytes were found in the great majority of the osteo-arthritic group. With the rise in age not only did a higher percentage of patients show these radiological changes but the number of levels involved in each patient also rose. Apophyseal joint involvement of a degenerative type was also more frequent with increasing age (Table II).

In the rheumatoid patients the incidence of degenerative changes of this type was considerably lower and less closely related to age.

Contrary to the findings of Sharp, Purser and Lawrence (1958), the level of intervertebral degenerative changes of the two groups of patients was comparable (Table III), the C5-6 articulation being the most frequently involved, while apophyseal changes were seen most commonly in the C2-3, C3-4 lateral joints.

Disk narrowing without osteophytes was very uncommon on the osteo-arthritic patients, but was seen in 59 rheumatoid patients, in fifteen of them at multiple levels (Table VII).

TABLE VII

333 RHEUMATOID PATIENTS SHOWING DISK NARROWING WITHOUT OSTEOPHYTOSIS, BY AGE

Level	Age (yrs)			
	Under 50	50 to 59	Over 59	Total
C 2/3	1	2	6	9
C 3/4	2	17	13	22
C 4/5	1	1	15	17
C 5/6	—	8	16	24
C 6/7	—	2	4	6

End-plate erosion was seen in 48 rheumatoid patients and in a small number of osteo-arthritics, where these changes, usually at the lower levels, were associated with marked loss of disc space and considerable osteophytosis.

As expected, osteoporosis was much more marked in the rheumatoid patients, being evident in 21 per cent. of the whole group in persons of all ages. In the osteo-arthritic group osteoporosis was seen only in persons above the age of 60 (Table II).

Discussion

Of the radiological features suggested as characteristic of cervical involvement in rheumatoid arthritis (Bland and others, 1963; Sharp and others, 1958), vertebral subluxation proved to be the most characteristic and was the most easily recognized. Correlation with those cases of rheumatoid arthritis showing joint laxity and widespread peripheral destructive lesions was striking, but no correlation was found with the exhibition of oral corticosteroids or duration of disease. In contrast to the osteo-arthritic group, where minor subluxations are related to mechanical limitation of movement, rheumatoid subluxation appears to follow the bone and ligamentous destruction due to active inflammatory disease. Our technique of taking lateral radiographs in flexion may have led to an underestimation as compared with studies employing tomography. Our cases were an inclusive group admitted to hospital for active physiotherapy and rehabilitation without bias towards cases showing neurological changes or unusual severity of symptoms of disease activity, and thus may more closely reflect the incidence of neck involvement in rheumatoid arthritis than some earlier studies such as those of Serre and others (1964) and Martel (1961).

While minor subluxations were common in the osteo-arthritic group, serial subluxations and atlanto-axial subluxations were found only in the rheumatoid group. Disk narrowing without accompanying osteophytic changes was seen very infrequently in the osteo-arthritic group but was a relatively common feature of the rheumatoid group. Sharp and others (1958) placed reliance on the narrowing of multiple disk spaces, particularly those between C2/3 and 3/4, but in this series the incidence of disk narrowing, usually accompanied by osteophytic change, was higher in the osteo-arthritic than in the rheumatoid patients, even excluding those over 60 years of age. End-plate erosion was uncommon except in the rheumatoid patients, and erosion of the spinous processes was seen only in eight rheumatoid patients. Congenital abnormality of the neck was equally common in the two groups, and most usually took the form of a hemi-vertebrae (seen on five occasions). Neurological abnormalities were uncommon in both groups, and contrary to expectation did not appear to be closely related to the presence of subluxation. In the osteo-arthritic group the incidence of such signs increases

with age, and 10·5 per cent. of the 105 such patients over the age of 69 showed this abnormality, a figure which compares closely with that of Pallis, Jones, and Spillane (1954) working with a similar age group.

The presence of subluxation did not pose any problems of managment and several of these patients have undergone surgery without difficulty in anaesthesia. We have attempted mobilization of the neck of all patients before operation, and during anaesthesia great care is taken not to flex or extend the neck acutely, particularly during intubation (Isdale, Ridings, and Tapsell, 1964).

As the radiological abnormalities discussed above may occur early in the course of rheumatoid arthritis, such changes may assist in the definite diagnosis of this condition.

Summary

A prospective radiological study of cervical changes in 333 patients with probable, definite, or classical rheumatoid arthritis is reported. Degenerative changes comparable to those seen in the control group of 325 patients with degenerative joint disease were common. Radiological features characteristic of the rheumatoid group were atlanto-axial subluxation, serial subluxation, and disk narrowing without osteophytosis. No great reliance could be placed on the level of disk change when osteophytosis was present.

Cervical subluxation was closely related to peripheral destructive changes and joint instability, and to a less degree with the presence of subcutaneous nodules and a positive of latex test.

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L'arthrite rhumatismale de l'épine cervicale. Analyse de 333 cas

RÉSUMÉ

On rapporte sur les résultats d'une étude radiologique prospective des altérations cervicales chez 333 malades atteints d'arthrite rhumatismale probable, définie et classique. Les altérations dégénératives comparables à celles observées dans le groupe de 325 témoins atteints de maladie articulaire dégénérative furent communes. Parmi les traits radiologiques caractéristiques du groupe rhumatismal on vit la subluxation atlo-axoïde, la subluxation en série et un rétrécissement des disques sans ostéophytose. On ne put juger qu'avec peu de confiance le déplacement du niveau en présence de l'ostéoporose.

La subluxation cervicale fut étroitement associée aux altérations destructives périphériques et à l'instabilité articulaire et, au moindre dégré, à la présence des nodules souscutanés et de la réaction au latex positive.

Artritis reumatoide de la espina cervical. Análisis de 333 casos

SUMARIO

Se relata un estudio radiológico prospectivo de alteraciones cervicales en 333 enfermos con artritis reumatoide probable, definida y clásica. Alteraciones degenerativas comparables a las observadas en el grupo de 325 testigos con enfermedad articular degenerativa fueron comunes. Como rasgos radiológicos característicos del grupo reumatoide se observaron: la subluxación atlanto-axial, la subluxación seriada y el estrechamiento discal sin osteofitosis. Se juzgaron con poca confianza los cambios de nivel en presencia de osteoporosis.

La subluxación cervical se vió estrechamente asociada a cambios destructivos periféricos y a la instabilidad articular y, a un grado menor, con la presencia de nódulos subcutáneous y una reacción de latex positiva.