

Radiographic study of cervical spine changes and their clinical correlation in patients with rheumatoid arthritis

CESAR P. SOUZA¹, HELTON L.A. DEFINO²

SUMMARY

The radiographic changes on cervical spines of 81 outpatients with rheumatoid arthritis have been studied and correlated with cervical pain and neurological signs due to pressures over nervous structures within the vertebral duct. The correlation of the radiographic changes and the disease categorization by degrees and phases, as recommended by ARA (American Rheumatism Association) and the Steinbroker's classification of functional capacity was also been established.

AP, profile, and dynamic radiographs of the cervical spines were taken for radiographic evaluation. Radiographic changes

(upward migration of the odontoid process, atlantoaxial instability, sub-axial instability, or odontoid process erosion) were observed in 65 (80.2%) patients. A statistically significant correlation was noticed between patients' functional status (Steinbroker's classification) and disease phase (ARA) with the radiographic changes on patients' cervical spines. The presence of radiographic changes on cervical spines of patients with rheumatoid arthritis did not show a statistically significant correlation with nervous pressure-related pain or signs.

Keywords: Spine; Arthritis; Rheumatoid

INTRODUCTION

In patients with rheumatoid arthritis, the cervical spine stabilizing elements (joints, ligaments, and bone tissue) can be affected by abnormal synovial tissue, resulting in instability of the vertebral segment and modifying their functions related to load bearing, movements, and protection of nervous structures within the vertebral canal. Although pathological changes in the cervical spine can be mild in many patients, a pattern of progressive instability develops in a percentage of patients (17 to 87%) that can affect contiguous nervous and vascular structures^(3, 6, 8, 10, 17, 18).

Early diagnosis and treatment of cervical spine instability in patients with rheumatoid arthritis have better clinical results, as compared to late diagnosis and therapy, a finding that emphasizes how important is early diagnosis of this type of change in these patients^(5, 12, 13, 19, 21).

In contrast with international literature reports addressing changes in the cervical spine in patients with rheumatoid arthritis, such studies are lacking in our country. Only studies carried out by Barros Filho et al.^(2, 3, 4) are available. Therefore, we decided to evaluate the occurrence of cervical spine changes in outpatients with rheumatoid arthritis.

MATERIAL AND METHOD

Eighty-one outpatients assisted at the outpatient unit of Immunology of the Clinics Hospital of the Medicine School of Ribeirão Preto were selected by chance and included in the present study. All patients had confirmed diagnosis of rheumatoid

arthritis according to ARA criteria (American Rheumatism Association)⁽¹⁾. Twenty-five (31%) male and 56 (69%) female patients aged 25 to 77 years (mean age: 53 ± 13 years) were studied.

The functional capacity classification according to Steinbroker et al.⁽²⁴⁾ and the classification of rheumatoid arthritis according to ARA (American Rheumatism Association)⁽¹⁾ criteria were used so as to determine the severity of rheumatoid arthritis in our patients (Tables 1 and 2).

Cervical pain and neurological signs related to compression of nervous structures within the vertebral canal (paresthesia, paresis, hyperreflexia, clonus, and spasticity) were evaluated and correlated with radiological changes.

Radiological studies of cervical spine included anteroposterior, lateral, and dynamic (lateral in hyperflexion - hyperextension) projections were carried out according to the conventional technique.

The methods described by Ranawat et al.⁽²²⁾ and Redlund-Johnell e Peterson⁽²³⁾ were used to evaluate odontoid upward migration (Figures 1 and 2). The increase in the distance between the anterior arch of atlas and the odontoid process greater than 3 mm characterizes atlantoaxial instability and angling higher than 11 degrees or sliding greater than 3 mm characterizes subaxial instability⁽³⁾. Erosion of odontoid process was radiographically evaluated as well.

The correlation between radiological changes and pain or neurological signs related to compression of spinal nerves or spinal cord was tested by the χ^2 method with a value lower than 0.05 for statistical significance.

Study carried out at the the Department of Biomechanics, Rehabilitation, and Medicine of the Locomotor Apparatus

1 - Postgraduate Student at the Department of Biomechanics, Rehabilitation, and Medicine of the Locomotor Apparatus

2 - Associate Professor at the Department of Biomechanics, Rehabilitation, and Medicine of the Locomotor Apparatus of the Medicine School of Ribeirão Preto - USP

Mail address:
Helton L A Defino
Avenida Bandeirantes 3900
ZIP Code 14049-900.
Ribeirão Preto - SP - Brasil

Received on May 20, 2003 and approved on December 20, 2004

RESULTS

Cervical spine pain was reported by 44 patients (54.3%). It was mild in 22 (26%), moderate in 14 (17%), and severe in 8 (10%) patients.

Neurological signs related to compression of spinal cord or nervous roots were observed in 44 patients (54.3%) and are shown in Table 3. Isolated or combined neurological signs were found with the following results: isolated signs of neurological compression in 27 (33.3%) patients; two signs in 10 (12.3%) patients; three signs in 5 (6.17%) patients, and four signs in 2 (2.2%) patients. Isolated paresthesia was found in six patients; isolated objective weakness was seen in 6 patients; and changes in reflexes were present in 15 patients. Clonus and spasticity always occurred in association with other signs of nervous involvement. The association of paresthesia and muscular weakness was seen in 4 patients; combined paresthesia and changes in reflexes were found in 2 patients; combined changes in reflexes and objective muscular weakness were found in 2 patients; and combined changes in reflexes and muscular clonus were seen in 2 patients. Combined objective muscular weakness, paresthesia, and changes in reflexes were seen in 1 patient; the association of paresthesia, changes in reflexes, and clonus was found in 1 patient. Despite the fact that the numbers of patients presenting pain and neurological abnormalities were similar, differences were evidenced among patient subgroups: both patients with pain and no neurological abnormality and patients with neurological abnormalities and no pain were observed.

Nine patients (11.1%) had cervical or occipital pain, signs of nervous compression, and radiographic signs of cervical spine instability.

Radiographic changes (odontoid upward migration, atlantoaxial instability, subaxial subluxation, and odontoid process erosion) were seen in 68 (83.92%) of patients and are shown in Table 4 and Figures 3, 4, 5, and 6).

Grade	# of patients	%
I	17	21
II	24	29.6
III	34	42
IV	6	7.4
Total	81	100

Table 1 - Number and frequency of patients according to the ARA criteria for classification of rheumatoid arthritis

Grade	# of patients	%
I	38	46.9
II	30	37.1
III	11	13.6
IV	2	2.4
Total	81	100

Table 2 - Number and frequency of patients according to the functional capacity classification according Steinbrocker (grades)

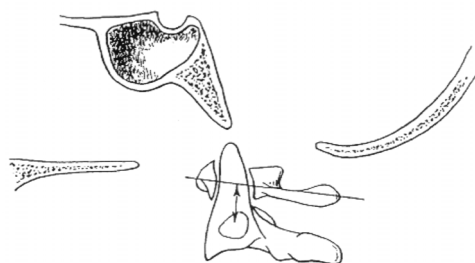


Figure 1 - Drawing showing how to measure according to Ranawat's method

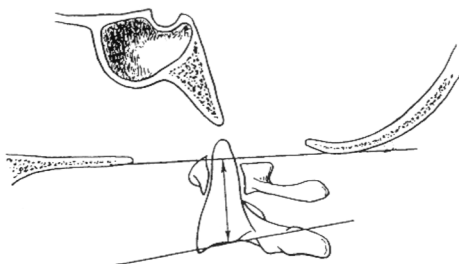


Figure 2 - Drawing showing how to measure according to Redlund-Johnell's method

Neurological evaluation	# of patients	%
Objective muscular weakness	18	22.2
Paresthesia	18	22.2
Decreased reflexes	15	18.5
Increased reflexes	13	16
Clonus	5	6
Spasticity	1	1.2

Table 3 - Neurological signs related to compression of spinal cord or nervous roots seen in the patients included in the present study

The association ($c^2 - p < 0.05$) of radiographic changes adopted as study variables (upward odontoid migration, atlantoaxial subluxation, subaxial subluxation, and odontoid process erosion) with functional capacity (Steinbrocker's method), rheumatoid arthritis stages (ARA-American Rheumatism Association), pain, and changes in reflexes is shown in Table 5. The correlation was significant for functional classification and disease stages, indicating the association of radiographic changes and the severity of the disease. Association with pain was not found in the present study, thus showing that radiographic changes in cervical spine can develop in painless patients.

No association among the symptoms related to compression of nervous elements of the cervical spine and radiographic abnormalities was found in the present study, except for that of changes in reflexes and upward odontoid migration, as evaluated by Ranawat's method.

Odontoid process erosion was positively correlated with the stage of the disease and atlantoaxial instability was positively correlated only with the stages of the disease.

DISCUSSION

Abnormalities in cervical spine in patients with rheumatoid arthritis have less often drawn the attention than the prosthetic replacement of great joints, including the hip and the knee. The great majority of patients presenting abnormalities in the cervical spine have been referred to physicians in late stages of the disease when surgery is not associated with good results and high rates of complications are found^(12,25). The association of late diagnosis and poor results of surgical therapy for changes in the cervical spine in patients with rheumatoid arthritis has had a negative effect upon physician's attitude toward the disease. Our grasp of this issue mainly based upon the advanced stages of the disease when patients are first seen, searching for treatment of cervical spine abnormalities, has led us to carry out the present study in the target population of outpatients with rheumatoid arthritis.

The high rates of changes in cervical spine found in the present study (68 patients [83.9%]) confirmed our hypothesis

Radiographic parameters	# of patients	%
UPM* (Ranawat)	9	11
UPM* (Redlund-Johnell)	11	13.5
Atlantoaxial Subluxation (C ₁ -C ₂)	10	12.5
Subaxial subluxation (C ₂ to C ₇)	5	6
Odontoid erosion	29	35.8
Multiple subluxation (C2-C7)	4	4.9

*UOM Upward Odontoid Migration

Table 4 - Radiographic changes in cervical spine seen in the study group of patients

	Upward Odontoid Migration - Ranawat Method	Upward Odontoid Migration - Redlund-Johnell Method	Atlantoaxial Instability	Subaxial Instability	Odontoid process erosion
Functional Classification (Steinbroker)	+ 0.001	+ 0.0132	- 0.197	+ 0.028	- 0.205
ARA Stages (ARA)	+ 0.014	+ 0.025	+ 0.007	+ 0.025	+ 0.0005
Pain	- 0.731	- 0.262	- 0.302	- 0.673	- 0.640
Changes in reflexes	+ 0.0006	+ 0.041	- 0.086	- 0.222	- 0.349

Table 5 - Correlations and correlation values (p) for radiographic changes in cervical spine and the functional classification, the stage of the disease, pain, and changes in reflexes. The values marked by (+) indicate values of p < 0.05.

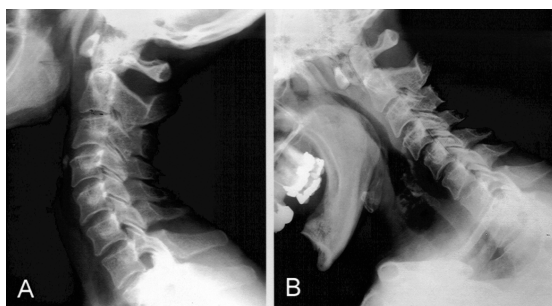


Figure 3 - Dynamic lateral radiographs of the cervical spine (A- hiperextension; B- hiperflexion), showing atlantoaxial instability



Figure 4 - Lateral cervical spine radiograph showing upward odontoid migration



Figure 5 - Lateral cervical spine radiograph showing a subaxial subluxation



Figure 6 - Lateral cervical spine radiograph showing erosion of the odontoid process

that this issue has been neglected. The findings of the present study are consistent with those reported in literature^(6,7,16). The rates of cervical abnormalities vary widely with the severity and the duration of the disease, as well as the criteria employed for diagnosis. The positive association between the extent of patients' incapacity and the stages of the disease corroborate the findings reported in literature^(15,20) and should be taken into account when physicians evaluate patients with these characteristics.

The lack of correlation between pain or neurological symptoms and cervical spine abnormalities in our patients is very important finding and emphasizes that a careful workup of cervical spine is indicated even in patients without these changes. This finding has also been found by other authors^(6,20) although some authors have emphasized the usefulness of these clinical parameters (that actually are very important) to diagnose this type of abnormality^(5,14,16).

The neurological evaluation of patients with severe rheumatoid arthritis is difficult to carry out because of the destruction of peripheral joints induced by the disease that affect the motor examination of upper and lower limbs^(5,9). Rigidity and joint pain affect stretch reflexes and render their analysis inaccurate. One must remember that peripheral neuropathies can result from either compression of nervous elements by hypertrophy of synovial tissue or endarteritis⁽¹¹⁾. This mechanism of intrinsic vascular lesion has also been seen in patients with myelopathy⁽⁹⁾. Physical examination of the patients taking part in the present study revealed clonus and lack of radiographic signs of cervical spine instability, suggesting that neurological abnormalities are not exclusively due to mechanical factors of nervous compression. The positive correlations of reflex abnormalities by Ranawat's method and subaxial instability should be analyzed with caution, taking into account the pathophysiology of neurological deficits in rheumatoid arthritis.

In the present study cervical spine changes were found in outpatients and radiographically evidenced although many patients did not have cervical pain or other clinical symptoms. The correlation of these changes and the disease stage or grade should also be taken into account in the follow-up of patients because the correlation of the severity of rheumatoid arthritis and increased cervical spine changes was evident.

We hope that our study will be helpful for the treatment of patients with rheumatoid arthritis and warn physicians that relevant changes in the cervical spine can be associated with mild or no previously described clinical signs or symptoms in the early stages in many patients although they can ultimately lead to severe compression of nervous elements. Early diagnosis and appropriate treatment will result only if the attending physician actively investigates such changes before they lead to functional or neurological abnormalities.

CONCLUSIONS

The radiological examination of 81 outpatients with rheumatoid arthritis showed radiologic abnormalities of the cervical spine in 65 (80.25%) patients, including upward odontoid migration, atlantoaxial subluxation, subaxial subluxation, and odontoid process erosion.

No statistically significant correlation was found between radiographic cervical instability changes and cervical pain or signs of neurological compression.

A statistically significant correlation was found between the grade of the disease (Classification of Functional Capacity according to Steinbrocker and Classification of Rheumatoid Arthritis in Stages) and the radiological changes found in the present study.

REFERENCES

1. Arnett FC, Edworthy SM, Bloch DA. The American Rheumatism Association 1987. Revised criteria for the classification of rheumatoid arthritis. *Arthritis Rheum* 31:315-324, 1988.
2. Barros Filho TEP, Carenirio JF, Hasegawa OH, Leivas TP. Parâmetros para avaliação das radiografias da transição occipitocervical. *Rev Bras Ortop* 25:75-78, 1990.
3. Barros Filho TEP, Oliveira RP, Rodrigues NR, Greve JMD, Laurindo IMM, Pereira RMR, Cossermelli W. Alterações radiográficas da coluna cervical na artrite reumatóide. *Rev Bras Ortop* 27:344-351, 1992.
4. Barros Filho TEP, Taricco MA. A Artrite reumatóide e a coluna cervical. *Rev Bras Ortop* 24:361-364, 1989.
5. Boden SD. Rheumatoid arthritis of the cervical spine. *Spine* 19:2275-2280, 1994.
6. Cabot A, Becker A. The cervical spine in rheumatoid arthritis. *Clin Orthop* 131:130-140, 1978.
7. Collins DN, Barnes CL, Fitz Randolph RL. Cervical spine instability in rheumatoid patients having total hip or knee arthroplasty. *Clin Orthop* 272: 127-135, 1991.
8. Conlon PW, Isdale IC, Rose BS. Rheumatoid arthritis of the cervical spine: an analysis of 333 cases. *Ann Rheum Dis*. 25:120-125, 1966.
9. Delamarter RB, Bohman HH. Postmortem osseous and neuropathology analysis of the rheumatoid cervical spine. *Spine* 19:2267-2274, 1994.
10. Eulerink F, Meijers KA. Pathology of the cervical spine in rheumatoid arthritis: a controlled study of 44 spines. *J Pathol* 120:91-180, 1976.
11. Floyd AS, Learmonth ID, Mody G, Meyers DL. Atlanto-axial instability and neurologic indicators in rheumatoid arthritis. *Clin Orthop* 241:177-182, 1989.
12. Grob D. Principles of surgical treatment of the cervical spine in rheumatoid arthritis. *Eur Spine J* 2:180-190, 1993.
13. Grob MD, Wusch R, Grauer W, Sturzenegger J, Dvorak J. Atlantoaxial fusion and retrodental pannus in rheumatoid arthritis. *Spine* 22:1580-1583, 1997.
14. Kawaida H, Sakou T, Morizono Y, Yoshikuni N. Magnetic resonance imaging of upper cervical disorders in rheumatoid arthritis. *Spine* 14:1144-1148, 1989.
15. Kramer J, Jolesz F, Kleefield J. Rheumatoid arthritis of the cervical spine. *Rheum Dis Clin North Am* 17:757-773, 1991.
16. Lipson SJ. Rheumatoid arthritis of the cervical spine. *Clin Orthop* 239:121-127, 1989.
17. Meikle J, Wilson M. Rheumatoid involvement of the cervical spine. *Ann Rheum Dis* 30:154-161, 1971.
18. Morizono Y, Sakou T, Kawaida, H. Upper cervical involvement in rheumatoid arthritis. *Spine* 12:72-76, 1987.
19. O'hara R, Silvaggio V, Donaldson WF, Kraus DR. Surgery for rheumatoid arthritis of the cervical spine. In: Bridwell KH, Wald RL ed. *The textbook of spinal surgery*. Philadelphia: Lippincott, 1991. p.1439.
20. Pellici PM, Ranawat CS, Tsairis P, Bryan WJ. A prospective study of the progression of rheumatoid arthritis of the cervical spine. *J Bone Joint Surg Am* 63:342-350, 1981.
21. Peppelman WC, Kraus DR, Donaldson WF, Agarwal A. Cervical spine surgery in rheumatoid arthritis: improvement of neurologic deficit after cervical spine fusion. *Spine* 18:2375-2379, 1993.
22. Ranawat CS, O'Leary P, Pellici P, Tsairis P, Marchisello P, Dorr L. Cervical spine fusion in rheumatoid arthritis. *J Bone Joint Surg Am* 61: 1003-1010, 1979.
23. Redlund-Johnell I, Peterson H. Radiographic measurements of the craniocervical region. *Acta Radiol Diagn* 25:23-28, 1984.
24. Steinbrocker O, Traeger CH, Batterman RC. Therapeutic criteria in rheumatoid arthritis. *JAMA* 140:659-662, 1949.
25. Zoma A, Strurrock RD, Fischer WD, Freeman PA, Hamblen DL. Surgical stabilization of the rheumatoid cervical spine. A review of indications and results. *J Bone Joint Surg Br* 69:8-12, 1987.