MAGNETIC RESONANCE IMAGING EVALUATION OF THE CERVICAL SPINE IN PATIENS WITH RHEUMATOID ARTHRITIS. Report of 30 cases.

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L'ÉVALUATION DE L'ATTEINTE DU RACHIS CERVICAL AU COURS DE LA POLYARTHRITE RHUMATOIDE PAR L'IMAGERIE PAR RÉSONANCE MAGNÉTIQUE. A propos de 30 cas.

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RÉSUMÉ

But : Le but de ce travail est d'évaluer l'atteinte du rachis cervical au cours de la polyarthrite rhmatoide (PR) grace à l'imagerie par résonance magnétique.

Méthodes : Il sagit d'une étude prospective ayant inclus 30 patients souffrant de polyarthrite rhumatoide, répondant aux critères de l'ACR.Tous les patients ont bénéficié d'un examen clinique et biologique complet. L'activité de la maladie a été évaluée par le score DAS28. Une exploration radiologique incluant des radiographies standard des mains, des poignets, des pieds et du rachis cervical de face, de profil en position neutre et en hyperflexion a été effectuée chez tous les patients. Le score de Sharp, évaluant la sévérité de l'atteinte ossuese et articulaire a été calculé chez tous les patients. Tous les patients ont bénéficié d'une imagerie par résonance magnétique du rachis cervical, permettant d'évaluer l'atteinte cervicale au cours de la polyarthrite rhumatoide.

Résultats : Les 25 femmes et 5 hommes étaient agée en moyenne de 46.6 ans (23-67ans). La PR évolue en moyenne depuis 9ans (1-22ans). Le facteur rhumatoide est positif dans 76.6%. Cinq patients présentent des douleurs cervicales associées à une raideur.Parmi lesquels quatre présentent des anomalies radiologqies sur l'IRM cervicale. Une atteinte cervicale est objectivée sur les radiographies standard cervicales dynamiques en hyperflexion dans 7 cas (23%), alors que l'IRM n'a objectivé d'anomalies cervicales que dans 5 cas à type de luxation atloidoaxoidienne antérieure dans les 5 cas suscités, d'impression basilaire dans 1 cas, de pannus rhumatoide dans 4 cas, d'érosions de l'odontoide dans 2 cas et de compression médullaire dans 1 cas. L'atteinte cervicale est corrélée à un score DAS28 élevé, au nombre d'articulations tuméfiées, au taux de CRP, et à l'importance des érosions osseuses (Score de Sharp élevé).

Conclusion : L'atteinte du rachis cervical est fréquente au cours de la PR. Cette atteinte est corrélée à la sévérité de la maladie. L'imagerie par résonance magnétique permet une étude fine des structures osseuses et surtout de l'atteinte neurologique du rachis cervical.

MOTS-CLÉS

Polyarthrite rhumatoide, imagerie par résonance magnétique, rachis cervical

SUMMARY

Aim : To investigate by magnetic resonance (MR) imaging the occurence of cervical spine (CS) involvement in rheumatoid arthritis (RA) patients.

Methods: Thirty consecutive unselected patients, who fulfilled the revised American College of rheumatology criteria for RA, Were investigated. All patients had a complete physical and laboratory evaluation. Radiological evaluation included hand and wrist x-rays, as well as CS radiographs in anteroposterior, lateral and lateral in full flexion views. In addition, MR (Spin Echo T2-weighted saggital scans, palin and contrast enhanced T1-weighted sagittal and axial scans) was performed in all patients. Hand x-rays were evaluated according to the Sharp score. Disease activity was assessed by disease activity score for 28 joint indices (DAS-28).

Results: There were 25 females and 5 males with a mean age of 46.6 years (23-67) and mean disease duration 9years (1-22). Twenty three patients (76.6%) had positive IgM rheumatoid factor (RF). five patients presented clinical findings, mainly cervical pain and stiffness of CS (four with positive and one with negative MR), while radiological findings of CS involvement were found in seven patients (23%). Five patients (16.6%) presented MR findings of CS involvement (anterior atlantoaxial subluxation 100%; vertical subluxation 20%; peridental pannus 80%; dens erosion 40%; brainstem compression 20%). Atlantoaxial subluxation correlated with high DAS-28, high level of swellen joint, high level of C-réacitve protéin and advanced erosive changes of the wrist and hand (high level of Sharp score) in the univariate analysis.

Conclusion: We conclude that the frequency of CS involvement in RA patients is high. In pateints with active erosive peripheral disease it is very probable to also have some changes in CS. These may be clinically important and in such cases, MR offer valuable information.

KEY-WORDS

Arthritis rheumatoid, magnetic resonance imaging, cervical spine.

تقييم إصابة الفقار العنقي أثناء الإصابة بآلتهاب المفاصل المتعدد الروماتزمي بواسطة التصوير بالرنين المغناطيسي.

الباحثون : ل.داود ـ س.كوشباة

الهدف من هذه الدراسة هو تقييم إصابة الفقار العنقي أثناء الإصابة بآلتهاب المفاصل المتعدد الروماتزمي بواسطة التصوير بالرنين المغناطيسي . آشتملت دراستنا على 30 حالة وخضع كل المرضى إلى تصوير عنقي بالرنين المغناطيسي . نستنتج من خلال هذه الدراسة أن إصابة الفقار العنقي متواترة بكثرة خلال الإصابة بآلتهاب المفاصل المتعدد الروماتزمي وفحص الفقار العنقي سريريا و بالتصوير بالرنين المغناطيسي واجبه لكي نقييم الإصابة العصبية للفقار العنقي.

الكلمات الأساسية : آلتهاب المفاصل المتعدد الروماتزمي - التصوير بالرنين المغناطيسي

Cervical spine (CS) involvement is a common phenomenon in advanced rheumatoid arthritis (RA) (1,2). Anterior atlantoaxial subluxation (aAAS) and atlantoaxial impaction (AAI) are the most characteristic cervical spine disorders in RA, being detected in 13-70% and 4-35% of the patients, respectively (2,3).The atlantoaxial articulation is typically involved leading to non-traumatic dislocations with sometimes severe neurologic deficits or even death due to brainsten compression (4,5).Therefore early diagnosis and treatment is necessary to avoid irreversible neurologic sequelae. Since the clinical evaluation for potential neurologic complications of RA is frequently hampered by the presence of arthritis and deformations, objective diagnostic techniques are needed (6).Our purpose was to evaluate by Magnetic resonance (MR) imaging the frequency of CS involvement in patients with RA and the relationship between MR findings, x-rays and clinical findings.

MATERIALS AND METHODS

This cross-sectional study included 30 consecutive RA patients attending the outpatient clinic of our rheumatology department. Patients with neck trauma, neck infection or congenital abnormalities were excluded from the study. All patients fulfilled the revised American College of Rheumatology criteria (7).The patients had a physical examination which included: (i) symptoms and signs of peripheral joints involvement such as (a) morning stiffness (minutes), (b) grip strangth (mmHg), (c) number of swollen and tender joints and disease activity score for 28 joint indices (DAS-28) (8). (ii) symptoms and signs of CS involvement, such as neck and occipital pain, stiffness and neurological symptoms and signs; (iii) symptoms and signs of extraarticular manifestations (EAM) like rheumatoid nodules, pleurisy, sicca syndrome, scleritis, episcleritis, etc. In addition, the following laboratory parameters were investigated in all patients:(i)C-reactive protein (CRP), (ii) erythrocyte sedimentation rate (ESR) and (iii) IgM rheumatoid factor (RF). The radiological evaluation consisted of x-rays (anteroposterior, lateral in neutral and flexion position) and wrist and hand x-rays in postero-anterior position. CS x-rays were evaluated according to the Winfield classification (atlantoaxial subluxation (AAS) of 3 mm or more, atlantoaxial impaction, disc space narrowing affecting upper cervical discs without osteophytosis, multiple subluxation of 1 mm or more, vertebral plate erosions and sclerosis, apophyseal joint erosions and sclerosis, osteoporosis) (9). Pairs of hand, wrist and foot x-rays were evaluated using Sharp score (10). The x-rays were interpreted by one experienced radiologist who was unaware of the patient's name, clinical status and MR findings.

MR imaging was performed on a 1.5-tesla unit (Gryoscan ACS NT; Philips Medical Systems, Best) using a phased array neck coil. The study protocol consisted of : (i)sagittal turbo spin echo T2-weighted scans (TR/TE, 3000/120 msec); (ii) axial and sagittal gradient echo-T2 weighted scans (TR/TE, 500/12 msec; flip angle 25°), in neutral position and flexion; and(iii) sagittal and fat supressed axial plain and contrast enhanced (immediately after bolus intravenous injection of 0.1mmol/kg gadopentetate dimeglumine Gd-DTPA- Magnevist, Schering, Germany TM) spin Echo T1-weighted scans (TR/TE, 525/13 msec). Flexion scans were performed with the neck kept flexed by sponge supports. The flexion angle varied from 10° to 40°. For all sequences, the slice thickness was 3 mm, the intersection gap 0.3 mm, the acquisition matrix 250*256 matrix and the field of view 270mm. The scan duration for T1-weighted sequences was 2.5 min and therfore fibrotic pannus was not as intensively enhanced as active pannus (11). The MR images were interpreted in consensus by two experienced radiologists who were blinded to the patients name, the clinical status and the plain film findings. The parametres used were (6):

-dens erosion classified as normal, less than 50% erosion, or 50% or more erosion (three-point scale).

-Presence or absence of AAS was evaluated in neutral and flexion position (atlantoaxial distance >3mm) (two-point scale)

-Presence or absence of compression of the brainstem (two-point scale)

-Subarachnoid space (level C2), classified as normal space, and decreased space (two–point scale) in neutral and in flexion position.

-Fat body caudal to the clivus classified, as present or absent (two-point scale)

-Amount of hypervascular –active pannus (enhanced soft tissue

mass around the dens) classified as absent, small (<5mm), large (>5mm) (three point scale).
-Atlantoaxial impaction (normal:dens under the line of McRae (two point scale).
-Presence or absence of vertebral plate erosion.
-Presence or absence of subaxial subluxation (SAS) in neutral and in flexion position.
Radiological and MR studies were performed the same day.
All subjects included in the study signed a written informed consent form. The study was performed with the approval of the institutional Review Board.

Statistical analysis
The relationship of MR with clinical, laboratory and radiological parametres was evaluated using the chi2 test. A multivariate logistic regression analysis was conducted, using radiographic damage and MR imaging damage as dependant parametres. These parametres were dichotomized (presence vs absence of damage). Only parametres presenting a statistically significant association with pannus in the univariate analysis were included in the model.

RESULTS

The clinical and radiological findings are shown in table I. There were 25 females and 5 males with a mean age of 46 years [23-67] and disease duration of 9 years [1-22].23 patients had positive IgM RF. Five patients presented clinical findings of CS involvement, mainly cervical pain and stiffness (four with positive and one with negative MR), while radiological findings of CS involvement were found in seven patients (23%). Five out of 30 patients (16.6%) presented with MR findings of CS involvement (table I). More specifically : peridental pannus formation was found in 80% of patients (>5mm in two cases) (table II, Fig 1), dens erosion in 40%, anterior atlantoaxial subluxation in 100% of patients (4 patients in flexion position and 3 in neutral position) (fig.2), vertical subluxation 20% (one case), SAS in 40% and brainstem compression 20%). More specifically: Atlantoaxial subluxation was associated with (i) high DAS-28 (>5.3), (ii)high level of swellen joint (>5),(iii) high level of C-réacitve protéin (>43mg/l) and (iiii) advanced erosive changes of the wrist and hand (Sharp score >40) in the univariate analysis ($p<0.05$). All these parametres included in the model presents significant association with atlantoaxial subluxation. Flexion MR depicted brainstem in one case. A large AAS was observed in x-rays in this patient with brainstem compression (9mm) who had occipital pain and hyperreflexia. 7 patients had AAS according to the atlantoaxial distance measurements made on functional x-rays (flexion). In contrast, only 5 patients had AAS according to the measurements made on functional MR imaging (flexion) (table III). Using functional x-rays as gold standard for AAS evaluation, the sensitivity and specificity of functional MR imaging was 62% and 100% respectively.

Table 1 : Demographic, clinical and imaging findings of patients with established rheumatoid arthritis.

Number of patients	**30**
Women/men	25/5
Mean age (years)	46.6
Mean disease duration (years)	9
Extraarticular manifestations	8 (26%)
Clinical findings of cervical spine involvement, no. (%)	5 (16.6%)
Radiological findings of cervical spine involvement, no. (%)	7 (23%)
Magnetic resonance findings of cervical spine, no.(%)	5 (16%)
IgM rheumatoid factor, no (%)	23 (76.6%)
Disease modifying anti-rheumatic drug therapy	
-Methotrexate and prednisone, no. (%)	27 (90%)
- Methotrexate and sulfalazine, no. (%)	3 (10%)

Table 2 : Magnetic resonance findings of the cervical spine in patients with rheumatoid arthritis.

Magnetic resonance findings	**Patients (n=30)**	**%**
Peridental pannus formation	4	80
Dens erosion	2	40
Atlantoaxial subluxation	5	100
Subaxial subluxation	2	40
Narrowing of the anterior subarachnoid space (level C2)	1	20
Vertebral plate erosions	1	20
Brainstem compression	1	20
Atlantoaxial impaction	1	20

Table 3 : Atlantoaxial distance at flexion x-ray and magnetic resonance finding. Presence of atlantoaxial subluxation when atlantoaxial distance >=3mm.

Patient n°	**X-ray atlantoaxial distance flexion (mm)**	**Magnetic resonance finding atlantoaxial distance flexion (mm)**
1	4	2
2	5	3.5
3	8	5
4	5	4
5	4	2
6	5	4
7	5	4

Figure 1 : . A 52-year old patient with a six years of RA. MR findings of the CS depicted peridental pannus.

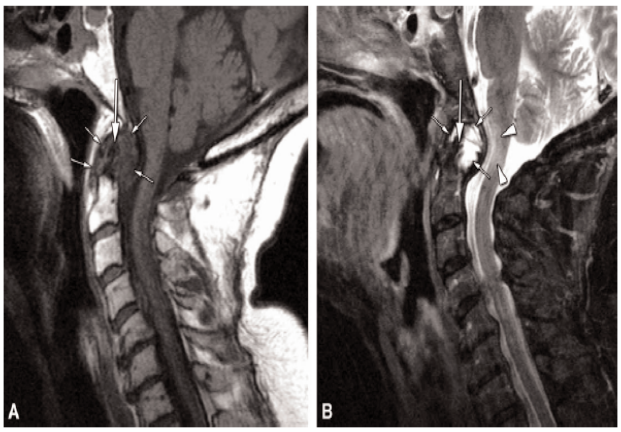
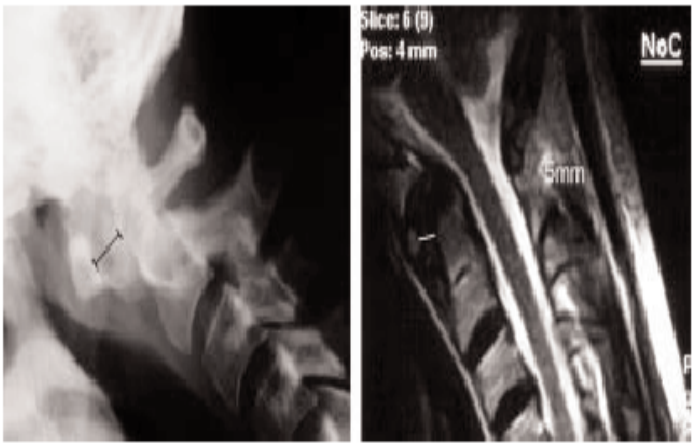


Figure 2 : A 27-year old patient with a four years of RA. MR findings of the CS depicted anterior atlantoaxial subluxation (Magnetic resonance finding atlantoaxial distance flexion =5mm) while x-ray atlantoaxial distance flexion =8mm.



DISCUSSION

Involvement of the cervical spine is a highly characteristic component in RA (1,2). The chronic inflammation may injure the stabilising ligaments of the atlantoaxial area. Early detection of CS involvement in RA patient is of great value to adapt treatment appropriately and thus to limit pain or neurologic sequelae (5). Diagnosis of rheumatoid cervical spine involvement is radiological (1,12). The most important approach in examination is lateral view plain radiography, taken during full flexion of the neck. It shows most of the subluxations and other abnormalities. About 50% of unstable aAAS cases would not be diagnosed by neutral position radiographs alone (13). However, osseous lesions detected by conventional x-ray appear latter in the course of the disease since they are secondary to mechanical instability, rather than to acute inflammatory process (14). MRI is the best means of assessing active synoovitis and possible neural structure compression in the cervical spine (6,15,16).It has been scown that functional MRI identifies unstable AAS more often than neutral position MRI (17). However dynamic examination by MRI is difficult, making it unreliable for exploring the true extent of subluxations (18). In fact, the degree of AAS evaluated in x-rays in flexion was significantly larger than those measured in MR flexion images (19).This is probably explained by the different position of the patient during these two examinations. X-rays are taken with the patient in upright position reaching a maximal flexion as the gravity pulls the head downwards. MR images are taken with the patient in supine position and flexion obtained using sponge supports, is never maximal. Other reasons for this discordance btween the x-rays and the MR finding is that the degree of AAS is overestimated in x-rays due to magnification and underestimated in gradient echo T2 weighted sequences (17,20). In this study, MR imaging revealed increased frequency of CS involvement and especially peridental pannus formation, which is in accordance with previous study (4,5). Nevertheless, severe CS changes namely dens erosion and brainstem compression were less frequent than in previous studies (5). A lack of correlation between the ence of pannus in CS and laboratory indicators of mmation was found in this study. A possible explanation iat RA is a polyarticular disease and inflammatory vium of CS depicted by MR represents only a part of the disease burden (21). CS involvement has been previously ciated with the extent of erosions in peripheral joints, the ence of RF and continuous high disease activity (20,22). ie present study atltoaxial subluxation was positively lated with high DAS-28, high level of swellen joint, high of C-réacitve protéin and advanced erosive changes of rist and hand. A lack of correlation between radiographic MR findings of CS involvement and clinical findings has found in this study and this is in agreement with other ts (22). This is probably because conventional x-rays t CS involvement only at the late stage of the disease while MR imaging by depicting inflammatory synovium reveals CS lesions earlier (23).

CONCLUSION

Our results suggest that cervical spine radiological involvement is a frequent finding in patients with RA. However, in patients with active, erosive peripheral disease it is very probable to also have some changes in CS.

Therefore, plain radiographs of the cervical spine should be obtained regularly to seek cervical spine manifestations, even in patients without cervical symptoms. MR may offer valuable information.

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