

Subluxation of the upper thoracic spine in rheumatoid arthritis

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Abstract. Only single cases with rheumatoid arthritis of the thoracic spine with vertebral subluxation have been reported to date. In a review of 100 patients with severe rheumatoid arthritis who had undergone occipitocervical fusion, arthritis of the upper thoracic spine with subluxation was discovered on conventional radiographs in four patients. Two additional patients were found elsewhere. Magnetic resonance imaging (MRI) was performed in three of the patients, confirming the diagnosis of subluxation of the upper thoracic vertebrae. In addition, MRI revealed encroachment on the anterior subarachnoid space and compression of the spinal cord.

Key words: Rheumatoid arthritis – Thoracic spine – Radiography – Magnetic resonance imaging

Rheumatoid arthritis (RA) of the cervical spine was first described by Garrod in 1890 [6], and many studies have followed [3, 10, 13]. In 1961 the first reports were published of single cases with arthritic affection of thoracic discs [11, 15]. Based upon autopsy findings, Bywaters [4] found arthritic changes of the thoracic spine in 8 of 14 subjects with RA. Recently a case was described

using magnetic resonance (MR) images [12]. In the present study, six cases are reported, one of which one has been discussed in a previous paper [12].

Materials and methods

A follow-up study was performed in 1986 of 100 consecutive patients with RA and atlantoaxial subluxation who had been surgically treated with posterior occipitocervical fusion between 1972 and 1984 [17]. Conventional cervical radiographs including lateral, posteroanterior, and oblique views were reviewed to detect involvement by RA and subluxation of the upper thoracic vertebrae. A review of cervical examinations from 450 patients with RA [13] was also performed. Ten patients from these two groups were subsequently examined with MR imaging. The MR images of 23 other patients with cervical RA from a later series [12] were also reviewed to detect cases with upper thoracic subluxation.

Thirty-three of the patients were examined with sagittal MR imaging of the cervical spine at 0.3 T (Fonar β -3000 M). Spin-echo images with short TR/TE (500/28) and long TR/TE (2000/56) were obtained.

Results

In 56% of the patients it was not possible to evaluate the cervicothoracic junction on conventional radiographs. In one patient with suspected upper thoracic subluxation from each of the first two reviews, MR examination confirmed the diagnosis. Rheumatoid

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Table 1. Data on patients with subluxation

Patient no.	Age ^a	Sex	Thoracic level	Subluxation size (mm)	Spontaneous fusion levels	MR performed
1	61	F	T1–T2	5	C3–C7	Yes
2	72	F	T1–T2	4	C2–T1	No
3	65	F	T1–T2	8	C4–C7	No
4	65	F	T3–T4	6	C4–C5	No
5	64	F	T1–T4	3–6	C3–C4, C5–C7	Yes
6	64	M	T2–T3	10	C5–C7	Yes

^a The age of the patient at discovery of thoracic subluxation



Fig. 1. MR image of the cervical spine of a 61-year-old woman (patient no. 1) with a 5-mm subluxation at T1-T2 (*arrow*). High signal over upper cord represents artifact from metal fixation

Fig. 2. Conventional lateral cervical tomography of a 65-year-old woman (patient no. 3) with an 8-mm subluxation at the T1-T2 level (*arrows*). Note the diminished space (6 mm) between the spinous process of T1 and the vertebral body of T2 (*arrowheads*)

Fig. 3. **A** Anterior view of the cervicothoracic junction of a 65-year-old woman (patient no. 4) with reduced discal interspace of the

upper thoracic spine and arthritic changes in the costovertebral joints (*arrows*, destroyed medial parts of the ribs). **B** Lateral view with a 6-mm subluxation at the T3-T4 level (*arrow*). **C** Anterior view 7 years later reveals increased scoliosis due to partial destruction of the T4 vertebra. An increase in the costovertebral joint changes is obvious

Fig. 4. MR image of the cervicothoracic junction of a 64-year-old woman (patient no. 5). There is arthritic involvement with subluxations at the T1-T4 levels as well as at several cervical levels

changes with subluxation of the upper thoracic spine were found in four of the 100 operated patients (Table 1, cases 1-4), in one of the second group (case 5), and in one of the third group (case 6). These six patients had classical RA with typical lesions of the hands, feet, and

cervical spine. All the upper thoracic subluxations had been missed at the primary routine evaluation of the conventional radiographs.

Patient number 1 had undergone occipitocervical fusion in 1971. She had no symptoms from her neck until

1984 when motion of the head became painful. Conventional radiographs obtained in 1984 showed a T1–T2 subluxation and spontaneous fusion from C3 to C7. MR imaging in 1986 confirmed the T1–T2 subluxation with compression of the anterior subarachnoid space, but the spinal cord was not compressed (Fig. 1).

Patient number 2 had no cervical symptoms after an occipitocervical fusion performed in 1972, but conventional radiographs from 1980–1986 revealed a T1–T2 subluxation.

Patient number 3 underwent urgent occipitocervical fusion because of paraplegia, which persisted postoperatively. The preoperative radiograph revealed RA of the costovertebral joints, and a postoperative control examination showed a T1–T2 subluxation with destruction of the adjacent endplates (Fig. 2). Anterior fusion (Cloward) was performed at T1–T2, but the neurological symptoms remained unchanged. The patient died 3 years later.

Patient number 4 was operated upon with occipitocervical fusion in 1977. The preoperative lateral radiograph was not of diagnostic quality below C7, but the posteroanterior radiograph revealed narrow discs of the upper thoracic spine and arthritic changes of the medial ends of the adjacent ribs at the same levels (Fig. 3A). At a follow-up 2 years later a 6-mm subluxation was discovered at the T3–T4 level (Fig. 3B). Seven years later an increased scoliosis had appeared at that level due to destruction/compression of the ventral and right side of the T4 vertebra (Fig. 3C).

Patient number 5 had severe pain from her neck but no neurological symptoms. A routine cervical radiograph 8 years earlier had shown no changes in the upper thoracic spine, but the current radiograph revealed arthritis with subluxations at the T1–T4 levels. MR images also showed subluxation and disc involvement (Fig. 4).

Patient number 6 had his occipitocervical fusion in 1985. In 1986 he had symptoms of spinal cord compression and subluxation at the T2–T3 level was seen on conventional radiographs but was more obvious on sagittal MR images. MR imaging also revealed encroachment on the subarachnoid space and compression of the spinal cord at this level, while there was no narrowing of the spinal canal at the craniocervical junction [12]. Anterior decompression with fusion of T2–T3 was undertaken using acrylic bone cement.

Discussion

Only a few cases of RA of the thoracic spine have previously been reported; the paper by Baggenstoss et al. [1] seems to be the first. Their case, as well as that of Heywood and Meyers [7], showed granuloma of the vertebral body without involvement of the discs. In 1961 Seaman and Wells [15] reported a patient with "spondylitis" leading to a block formation of T8–T9. In the same year Martel and Duff described a patient with lateral subluxation of the upper thoracic spine [11]. Bywaters made the first serial autopsy investigation, and among 14 cases with severe RA he found 8 with discitis

and rheumatoid erosions of the costovertebral joints [4]. Costovertebral joint RA has been mentioned by a few other authors [2, 5].

In the present study there are no autopsy reports, but the changes of the upper thoracic spine are radiologically of the same destructive type as those of the cervical spine. In each of our six patients, all of whom had severe RA, sagittal subluxation was also present; this has, to our knowledge, not been reported by other authors. In our patient number 3 this subluxation, and not the cervical one, may have been the cause of the patient's paraplegia, and in patient number 6 the subluxation caused compression of the spinal cord. Five of the six patients had previously undergone occipitocervical fusion, and, in addition, all six patients had one or more cervical levels showing spontaneous fusion. Thus, the upper thoracic subluxation may have been caused by increased motion as a compensation for decreased mobility in the cervical spine. This is in analogous to the frequent finding (approximately 40%) of subaxial cervical subluxations in patients with spontaneous or surgical occipitocervical fusion [14].

The pathogenesis of discovertebral affection has been discussed especially concerning the cervical spine. The synovial school [4] regards the discovertebral disorder as an extension from the uncovertebral or costovertebral joints, the traumatic school [10] considers it a consequence of chronic discovertebral trauma secondary to apophyseal joint instability, and the enthesopathic school [15] sees it as being caused by involvement of spinal entheses. Patients number 3 and 4 in the present study had destructive RA of the costovertebral joints, and thus at least these cases support the synovial school [4].

The costovertebral joints stabilize the thoracic spine, and subluxations of the vertebrae ought not to appear without involvement of these joints. Arthritis of the costovertebral joints was discovered in only two of our patients, but it was probably present in the others. Without angulated oblique views it is difficult to exclude RA of these joints.

The cervicothoracic junction is difficult to evaluate on conventional radiographs, and our six cases of subluxation were all missed at the primary routine examination of the films. In addition, patients with RA often have stiff, high-positioned shoulders which may conceal the cervicothoracic junction. Thus, in this material there may be more cases with RA of the upper thoracic spine. MR imaging, allowing better depiction of the upper thoracic spine [8, 9], will probably further improve the detection of RA in this region. MR imaging also reveals the level of the spinal column that is most severely affected. This is important in preoperative evaluation [8].

Heywood and Meyers [7] maintained that subcervical rheumatoid spondylitis is in fact far more common than the sparse reports in the literature would indicate, and the present results support this contention. However, it may not be such a common observation, as the present material comprises selected patients from the southern half of Sweden with such severe cervical RA that in all but one patient an occipitocervical fusion had already

been performed. Thus, it is not possible to estimate the incidence of this regional involvement.

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