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Surgical Management of the Atlantoaxial Instability in Rheumatoid Arthritis: A Series of 28 Patients with 10 Years of Follow Up

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Abstract

It is known that cervical spine involvement occurs in over half of patients with rheumatoid arthritis (RA). This involvement is over 70% in Tunisia. The majority of our patients are seen at Ranawat's stage III with spinal cord injury. We report a series of 28 patients treated in our institution for RA with atlantoaxial dislocation with several degrees of spinal cord injury (Ranawat's stage II and III). Even though overshadowed by major impairments related to severe peripheral joint disease, 60% of our patients presented a good functional result at the average of 10 years follow up.

Keywords: Rheumatoid arthritis; Spinal injury; Atlantoaxial instability

Introduction

Rheumatoid arthritis (RA) is a progressive inflammatory condition resulting from an autoimmune process that attacks joint synovium and causes joint destruction and periarticular erosions. The same processes that affect the peripheral joints in patients with rheumatoid arthritis also affect the neck, specially the cervical spine. This inflammatory process can damage ligaments, bones and synovial joints in the cervical spine, potentially resulting in subluxation, instability and brainstem or cord compression [1].

Management of the occipito atlantoaxial region is a challenging task that aims to establish spinal stability, prevent neurologic deterioration and injury to the spinal cord, and improve neurologic function. Many studies [2] have shown that once myelopathy and injury of the spinal cord develop, the prognosis is poor and affirmed that functional prognosis depend on early surgical management. In this study we present our experience in the management of severe myelopathy in 28 patients with atlantoaxial subluxation (AAS) and we show that satisfying result can be obtained even with delayed surgery.

Materials and Methods

Study design

It is a retrospective study, including 28 patients with RA diagnosis followed at our institution and suffering from atlantoaxial instability, we didn't include patients with a history of cervical surgery or suffering from other spine injury than rheumatoid myelopathy.

Clinical presentation

From 1994 to 2007, twenty women and eight men with RA were treated in our institution for atlantoaxial instability. For clinical evaluation we used the grading system in the Ranawat classification (Table 1).

Stage I	Stage II	Stage IIIa	Stage IIIb
Pain, no neurological deficit	Subjective weakness, long-tract signs	Objective weakness, long-tract signs Ambulatory	Objective weakness, long tract signs Non-ambulatory

Table 1: Ranawat classification

Radiographic evaluation

All patients had plain radiographs, which included anteroposterior and lateral views to evaluate the Redlund-Johnell and Ranawat criteria for superior migration of the odontoid (Figure 1), with dynamic lateral views in flexion and extension.

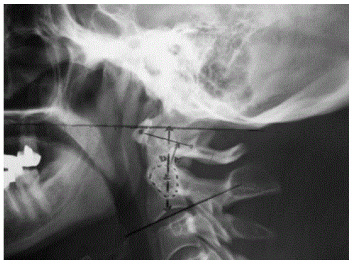

Figure 1: -Redlund-Johnell criterion Distance from inferior C2 body to McGregor line<34 mm in men or <29 mm in women is abnormal-Ranawat criterion Distance from center of pedicle of C2 to transverse axis of C1<15 mm in men or <13 mm in women is abnormal

Flexion and extension radiographs reveal instability and allow evaluation of the anterior atlantodens interval (ADI) (by convention, AAS has been defined as an ADI=9mm) (Figure 2).

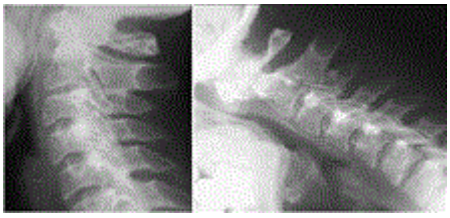

Figure 2: Dynamic radiographs

A dynamic MRI was performed in 16 patients to evaluate the posterior ADI (PADI), to calculate the cervicomedullary angle (CMA) (the angle between the anterior line of the cord and the brainstem; a CMA less than 135° suggests anterior instability) and to demonstrate the soft tissue pannus posterior to the odontoid that may accompany vertical and rotatory instability (Figures 3 and 4).

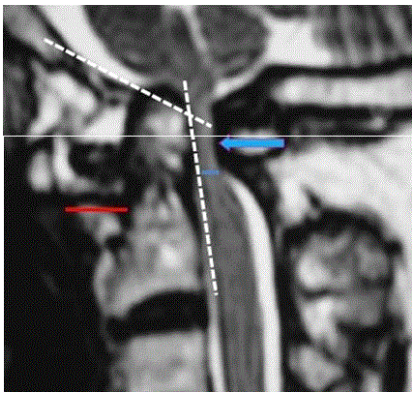

Figure 3: cervicomedullary angle (CMA) with PADI evaluation (blue arrow)

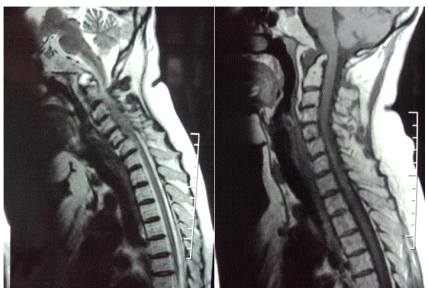

Figure 4: dynamic MRI

Operative management

Two of our patients presented a rapid worsening of the neurological status and underwent an urgent posterior decompression from C1 to C3 with occipito cervical fusion; this clinical presentation was due to a large compressive pannus (Figure 5).

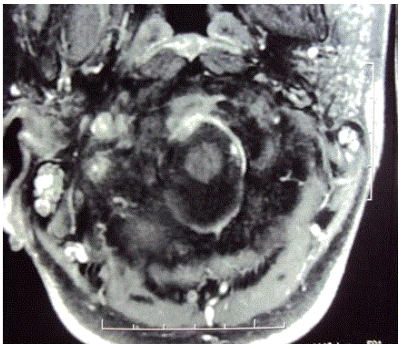

Figure 5: large compressive pannus

24 patients had traction with cranial halo for 2 weeks to evaluate the reducibility of the AAS. After the traction, a final evaluation was performed and the surgery to be performed decided as following:

Patients Class 1:

RANAWAT II +AADI > 9 mm + PADI < 12mm+ CMA 125°-135°+ Reducible AAS:

C1-C2 fusion

Patients Class 2:

RANAWAT III +/- Vertical instability +/- Irreducible AAS +/- CMA< 125°:

Posterior Occipitocervical fusion (OCF)

Eventually 14 patients were treated by OCF and 12 had C1-C2 fusions.

Surgical techniques

At the start of our series, the C1-C2 fusion was performed by lacing wires and OCF by posterior bone graft with cranio-thoracic immobilization by a cast for 6 weeks to 3 months (Figure 6).

Figure 6: OCF by posterior bone graft and cast

In later cases we used titanium lamina hooks for C1-C2 fusion and transarticular poliaxial titanium screws with occipital titanium plate and titanium connecting rods from C0 to C3 or to C4 for OCF with posterior bone graft (Figure 7).

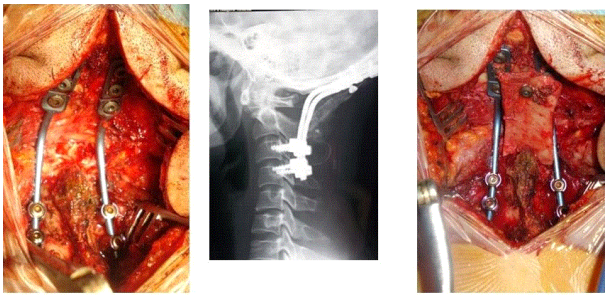

Figure 7: occipital titanium plate and titanium connecting rods from C0 to C3 for OCF with posterior bone graft.

Results

The mean age of our patients was 42 years (range 32 to 54 years).

The mean follow-up period was 10 years with a minimum period of 4 years (range, 48–250 months).

The diagnosis of RA was made with a mean delay of 2 years after first symptoms.

Adherence to medical treatment was considered sufficient in only 6 patients.

18 of our patients were Ranawat III and 10 Ranawat II.

Clinical outcomes and functional results

19 (67%) of our patients improved their Ranawat class and showed a subjective satisfaction with pain relief.

An improvement of muscular strength with an average of 1 point, in terms of muscle power grades, was observed in 16 patients (57 %).

For bending and rotation, patient with C1-C2 fusion (12 patients) presented an average gain of motion of 10% (Figure 8), while those with OCF had an average loss of motion of 15%.

Figure 8: cervical mobility after OCF

Radiological result

Four (14%) of our patients developed a pseudarthrosis (Figure 9), unrelated to the surgical procedure performed.

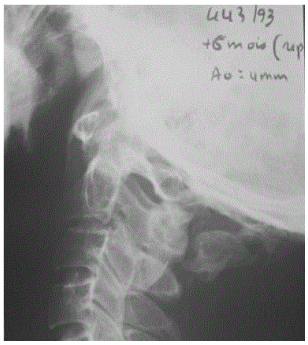

Figure 9: Pseudarthrosis

Biomecanical consequences

Subaxial cervical spine instability (SAS) occurred in 10 patients (6 with OCF and 4 with C1-C2 fusion), and the segments most often involved were C3/C4 and C4/C5.

10 patients (83%) who underwent C1-C2 fusion developed vertical instability with soft tissue pannus and significant decrease of muscle power grade.

One of the two patients who had posterior decompression and occipito-cervical fixation showed at the control MRI a pannus regression.

Vertical instability was not observed in patients treated by OCF.

Discussion

The diagnostic delay of RA in our series and the proportion of severs injuries were more significant than the others studies, this made therapeutic management (medical and surgical) challenging; in fact the evolution of RA diagnosed with a delay of 2 years is comparable to the natural course of this pathology, even with a good observance of medical treatment.

Neurological recovery of at least one Ranawat Class in patients who have undergone surgical decompression and/or stabilization has been reported in many series and this result has to be compared with our conclusions [3-5].

The 85% rate of radiographic fusion in our series compares favorably with those reported in the literature, which range from 60% to 100% [3,6,7].

Our overall cumulative rate of radiographic subaxial instability was 35% after an average of 10 years follow-up. In our study, SAS most commonly occurred at the C3-C4 and C4-5 segments probably because fusion down to C3 or C4 increases biomechanical stress at the level immediately below the fusion leading to instability.

Previous studies suggest that the rate of subaxial instability among RA patients following cervical arthrodesis ranges between 9% and 39% [8,9]. This result has to be compared to the incidence of such luxation occurring during the natural course of RA [10].

Vertical translocation of the odontoid is a common and potentially fatal occurrence in cervical RA. Immobilizing the occipito-atlantoaxial complex decreases the likelihood of vertical translocation. That is why, based on our results, we urge prophylactic OCF in the early stages of rheumatoid cervical myelopathy, especially if we know that adherence to medical treatment is poor.

OCF may also reduce progression of the retrodendal pannus, potentially decreasing the risk of compressive myelopathy.

Because of the limited number of our series, larger studies with longer follow-up periods are necessary to better define the incidence of postoperative SAS following cervical spine surgery, the outcome of including additional segments in the initial fusion and the need for dynamic interspace devices to reduce the mechanical stress on the adjacent segments.

Conclusion

If Occipitocervical arthrodesis is contemplated, the critical evaluation of the subaxial spine and vertical instability is imperative to avoid reoperations.

The results of this study suggest that early stabilization of the occipito-atlantoaxial complex rather than C1-2 fusion may potentially prevent the occurrence of superior migration of the odontoid.

Continued follow-up in patients with RA who have undergone cervical spine arthrodesis is essential.

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