A STIFF COLLAR FOR THE TREATMENT OF RHEUMATOID ATLANTOAXIAL SUBLUXATION

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SUMMARY

Conservative treatment of atlantoaxial subluxation (AAS) has tended to be rather passive, since there has been a lack of effective tools. The stabilizing effect of a stiff collar in the treatment of AAS was evaluated. Fifty successive rheumatoid patients with unstable AAS were interviewed and examined clinically. Lateral view radiographs of the cervical spine were taken in neutral position, during flexion and extension without a collar, and during flexion with a stiff collar. Seventeen patients did not have cervical symptoms. A stiff collar was able to significantly stabilize AAS in more than half of the cases, the effect being predictable from neutral-position radiographs. The improvement in bearing enhanced the effect of the collar. The means and strategy of conservative treatment of AAS are discussed.

KEY WORDS: Atlantoaxial subluxation, Atlantoaxial joints, Cervical spine, Orthosis, Rheumatoid arthritis.

ATLANTOAXIAL subluxation (AAS) is a common and significant abnormality in rheumatoid arthritis (RA) [1–4], with a reported prevalence of between 19 and 70% in RA patients [3]. It was found in 33% of a population-based series of RA patients [4]. The rheumatoid inflammatory process often injures the stabilizing structures of the atlantoaxial area in the cervical spine. Since the weight of the head pulls the atlas forward during cervical spine flexion, the atlas may separate abnormally from the side of the axis, if the ligaments are damaged, and AAS will occur. AAS is often unstable and the atlas may return to its correct place during cervical extension. AAS may be symptomless, but it may cause severe pain and/or neurological symptoms, and it can even lead to myelopathy and premature death [1–3].

Most AAS patients are treated conservatively, but selected patients need to be operated on [1–5]. Conservative treatment has tended to be rather passive, however, since there has been a lack of effective tools. Cervical collars have been known to relieve the symptoms, but they have been thought to be ineffective in restricting the subluxation itself [1, 3, 6]. We have recently reported, on the basis of a small group of patients, that a stiff collar is effective in selected cases [7]. Our experiences regarding the effect of a stiff collar used in the conservative treatment of AAS are reported here.

PATIENTS AND METHODS

The series group consists of 50 successive RA patients (40 women and 10 men) with unstable AAS treated at the Rheumatism Foundation Hospital, Heinola, Finland (demographic data are given in Table I). They were interviewed and examined clinically. A custom-made stiff collar was produced for each patient. These were made of closed-cell foamed polyethylene sheeting and the anterior part was strengthened with pieces of plastic to prevent flexion [6].

Lateral view cervical spine radiographs in neutral position and during flexion and extension were taken without the collar. The distance between the posterior aspect of the anterior atlas arch and the anterior aspect of the axis (AA distance) was measured, and the patient was included in the series if this distance was > 5 mm during flexion and < 3 mm during extension, so that the difference between the flexion and extension values (= the instability) was >3 mm. In addition, a lateral-view radiograph was taken of each patient during full flexion while wearing the custom-made stiff collar, and the AA distance was compared with the extension value and the result taken to represent the instability with the collar. The effect of the collar was assessed in terms of the decrease in instability upon using the collar relative to the value without a collar. The radiographs were studied by both authors.

RESULTS

The stabilizing effect of the collar was excellent and the instability disappeared entirely in 12 cases and was reduced by at least two-thirds in 23 cases and by at least 40% in 27 cases (54%). The collar was thus assessed to be useful in these 27 cases, who will be referred to below as group A. The remaining 23 cases in which the stabilizing effect of the collar was <40% form group B (Table I).

The AA distance in the neural-position radiograph was abnormal (>3 mm) in five of the 27 cases in group A, but the same as during flexion (without a collar) in only two cases. The AAS was viewed in neutral position in 21 out of the 23 cases in group B, and was about the same as in flexion without a collar in 15 of these, and smaller but still abnormal in six cases. The AA distance in the neutral position was normal in only two cases in group B (Table II). The mean AA distance
TABLE I

<table>
<thead>
<tr>
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<th>Group A (27 cases)</th>
<th>Group B (23 cases)</th>
<th>Significance (t-test)</th>
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<tbody>
<tr>
<td>Age (yr)</td>
<td>53.0 (12.6)</td>
<td>50.7 (12.1)</td>
<td>NS</td>
</tr>
<tr>
<td>Duration (yr)</td>
<td>21.4 (10.1)</td>
<td>19.2 (8.7)</td>
<td>NS</td>
</tr>
<tr>
<td>Flexion (mm)</td>
<td>6.8 (1.2)</td>
<td>8.2 (1.5)</td>
<td>P &lt; 0.005</td>
</tr>
<tr>
<td>Extension (mm)</td>
<td>1.1 (1.0)</td>
<td>1.3 (0.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Neutral (mm)</td>
<td>2.2 (1.9)</td>
<td>6.4 (2.4)</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>Instability (mm)</td>
<td>5.7 (1.7)</td>
<td>7.0 (1.7)</td>
<td>NS</td>
</tr>
<tr>
<td>Collar flexion (mm)</td>
<td>2.0 (1.3)</td>
<td>7.4 (1.6)</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>Collar Instability (mm)</td>
<td>1.0 (1.1)</td>
<td>6.1 (1.8)</td>
<td>P &lt; 0.0001</td>
</tr>
</tbody>
</table>

NS, non-significant.

in the neutral position was 2.2 (1.9) mm in group A and 6.4 (2.4) mm in group B. This difference is statistically highly significant (P < 0.0001, t-test).

The stabilizing effect of a collar was good in five patients whose AA distance in the neutral position was abnormal, and who thus seem to form an exception to the hypothesis. In all of them, the bearing of the cervical spine happened to be more extended in the radiograph taken during flexion with the collar than in that taken in neutral position. The slight correction in the bearing thus improved the effect of the collar.

There were four cases in group A whose first collar was not able to restrict the instability. These collars were checked after the radiographs and found to be ineffective in preventing flexion since their anterior part was too soft or too low. They were replaced with better ones, which were found to be effective by new flexion radiographs. Group B included two patients whose collar was ineffective; however, no AAS was seen in neutral position. In these cases, we failed to produce an effective collar and for individual reasons we did not have time to prepare any special collars for them.

Seventeen cases (seven in group A and 10 in group B) had no symptoms in the cervical area. Thirty-three patients had pain in the neck and this increased upon constant flexion in 15 cases. Twenty-nine patients with pain and five symptomless cases had tensile and tender neck and shoulder muscles. Nine patients suffered from crepitation upon neck movement, one had vertigo and seven had unsppecific peripheral numbness. None of the symptoms were correlated with the severity of AAS, but the pains had an association with the muscle tension of the area. A marked limitation in the rotation of the head was present in 10 cases, but the neck movements were fairly good in general. None had abnormalities in the clinical neurological examination, although weakness of the extremities was often present because of the joint damage.

DISCUSSION

In their classic work, Althoff and Goldie [6] tested four types of cervical collars and orthoses, and found them to be unable to reduce the maximal AAS during flexion. Ineflectiveness of the collars has remained the general opinion ever since [1,3]. We have earlier criticized their selection of patients, since some of their 11 cases practically had ankylosis in the atlantoaxial area [7].

Previous results of ours have suggested that the instability of AAS can be restricted by a custom-made stiff collar in cases where there is no AAS in neutral position [7]. The results obtained here with more patients confirm this finding (Table I).

TABLE II

<table>
<thead>
<tr>
<th>AA distance in neutral position (mm)</th>
<th>Group A</th>
<th>Group B</th>
</tr>
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<tbody>
<tr>
<td>0–3</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>4–6</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>≥ 7</td>
<td>1</td>
<td>13</td>
</tr>
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The difference is statistically highly significant (P < 0.001)
It was shown here that it is not sufficient to order a collar for a patient, but it is essential to check that it fits and works. Its ability to prevent flexion can be seen clinically and the restriction of instability can be confirmed by a flexion radiograph taken while wearing the collar. Even a suitable collar will soften and wear out if used daily, and it should thus be checked and replaced if necessary. The main purpose of the collar in the case of an AAS patient is to prevent flexion of the cervical spine. Thus, the anterior part should be strong and high enough, but probably the lateral and posterior parts could be lighter to make the collar more convenient to use (Fig. 1). The collar used here is scarcely any better than other collars that are able to prevent flexion, but it is probable that the structure of collars made specially for rheumatoid patients can be improved in the future.

Lateral view cervical spine radiographs in flexion and extension should be taken when a patient has symptoms, suspected to be of cervical origin, but also at some time, at least before major operations, in every case of erosive RA to find asymptomatic AAS patients (34% of our patients were symptomless). When an unstable AAS is diagnosed, we suggest that a radiograph should also be taken in neutral position to find out the prevalent AA position [7].

If AAS is not seen in neutral position, the stiff collar will probably be very useful, as it will prevent flexion and thus keep the atlas in place. The stabilizing ligaments will not be strained and the progression of AAS will probably be retarded or prevented. When the abnormal ranges of AA movements are not reached continuously, a collar will perhaps also encourage stiffening or ankylosis of the area, which would reduce the risk of complications and the need for operative stabilization.

If the maximal AAS is seen also in the neutral-position radiographs, the stiff collar will be less useful, since subluxation will be present when it is worn, but it will still be needed to prevent flexion and reduce the force directed at the ligaments, as this can retard the progression of AAS.

AAS patients often do not use their collar since they feel that it is uncomfortable or ugly, especially if they are symptomless [7, 8]. They should be carefully informed of the abnormality and the stabilizing effect of the collar (probably confirmed by a radiograph taken during flexion with a collar), however, in order to encourage them to pursue this form of treatment. For the present, there is no evidence of collars preventing radiological progression in the rheumatoid cervical spine [8–10], but a favourable effect would probably be found in those patients who do not have AAS in the neutral position and are well motivated to use a collar. The pathogenesis of atlantoaxial impaction (AAI) is different and will not be prevented by a collar. Development of AAI may even stabilize the area [11].

A collar is known to offer some pain relief, partly caused by the fact that it warms the cervical muscles and thus reduces their painful tension [2, 3, 6]. A collar also has a great psychological value, and gives a feeling of stability [3, 6, 12]. These effects can be achieved with either a soft collar or a stiff one. Our results show that a stiff collar also restricts AA instability in selected cases and offers some real stability.

GUIDELINES FOR INFORMING PATIENTS

Careful patient teaching forms the basis of the effective conservative treatment of rheumatoid cervical spine. It should be started when an unstable AAS is diagnosed, preferably in early cases, before surgery is about to be indicated. A favourable effect of a collar seems to be more probable if the AAS is not very severe (Table I).

AAS is widest during flexion of the cervical spine, when the weight of the head pulls the atlas forward. The force is partly directed at the injured ligaments of the area, the impairment of which will probably progress in the long run if powerful flexion lasts for some time or is frequently repeated. Thus, an AAS patient should be advised to avoid flexion during daily activities [1–3]. The patient needs good information on the abnormality in order to be motivated to follow the advice given. The ergonomics of the movements performed at work and at home should be carefully planned so that a constant flexion position is not needed. Aids such as a book-rest when reading may be useful. If an AAS patient sleeps on his/her back, the pillow should be low so that it does not raise the head into a harmful flexion position [2]. AAS is so frequent among RA patients that this advice may be useful for them in general, even before AAS has developed or been diagnosed.

Using the collar reminds the AAS patient to avoid dangerous flexion. A patient with unstable AAS should use the collar when performing activities which easily entail the flexion position of the head. When the patient knows to avoid flexion, she/he needs the collar less. The collar should be used whenever reasonable for avoiding flexion or for relieving painful muscle tension: at work, at home, when watching television or reading, etc., but it is seldom needed continuously. It should not be used when it notably increases the hazards of falling; however, it may be useful when walking on a slippery road, etc. The collar gives the necessary support in traffic, as even a minor injury or accident may have serious consequences in the presence of unstable AAS [13–15]. In addition, the collar reminds the medical staff of cervical instability, e.g. in an operating theatre [16–18].

When using a collar, muscular fitness in the area should be maintained with a programme of exercises [12, 19]. The patient should be prepared to move his/her neck even though the flexion movement is avoided. In addition to traditional cervical muscle exercises, an AAS patient will probably benefit from isometric stabilizing exercises for the small muscles of the upper cervical spine. Attention should be paid to exercises which improve the whole bearing. Our results suggest that improvement of the bearing of the cervical spine will return the atlas to its correct place when in
neutral position and thus give better chances of success with collar treatment. The fitness of the muscles of the neck will probably relieve the muscular pain and also improve stability.

Effective symptomatic medication and physical treatment are an important part of conservative treatment for rheumatoid cervical spine (Table III). However, active disease-modifying medication is also needed to retard the destructive process in the atlantoaxial area. It is to be hoped that these results regarding the effectiveness of the collar for controlling instability will inspire a new interest in conservative treatment for rheumatoid cervical spine.

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REFERENCES