Stabilization of the cervical spine with the Halifax interlaminar clamp

M. de la Torre; J.V. Martínez-Quiñones y J. Casado.

Neurosurgery Department. Hospital Militar Central Universitario «Gómez Ulla». Madrid.

Summary

The Halifax interlaminar clamp is designed for posterior fixation of the cervical column. This technique has the advantages of being fast, safe, light and RM compatible. However the procedure is not useful when the laminae are fractured, not preventing either hyperextension or cervical rotation.

We present our experience with the use of this technique in twelve patients who underwent posterior cervical fixation.

KEY WORDS: Halifax Clamp Fixation. Cervical Spine.

Introduction

Various techniques have been used for stabilization by internal posterior cervical fixation. One of the most used in recent years consists of the implantation of sublaminar wires, whether or not associated with various frameworks, such as the Randsford, with occipito-cervical anchorage. In order to avoid the technical and neurological complications described with the use of stainless steel sublaminar wire6,10,17 (Table 1), other alternatives instrumentations have been developed for posterior approach, such as the Tucker clamp14, the Knodt system1, Mitsui’s Memorial Hospital system16, the Halifax clamp7 or the Magerl’s device, the Cotrell-Dubouset or Spine-System models of occipito-cervical frameworks15.

The Halifax interlaminar clamp, which allows fixation of adjacent laminae up to a maximum of 3 or 4 vertebral segments has been shown to be, in principle, effective for stabilization of both upper [C1-C2] and lower [C3-C7] cervical segments17. Also, the use of titanium clamps enables the practice of postoperative magnetic resonance (MR) studies1.

This study shows the results obtained in a group of twelve patients consecutively treated in our Department with posterior cervical fusion by Halifax interlaminar clamp.

Material and method

Between March ‘93 and February ‘94, the technique of posterior cervical fusion with Halifax interlaminar clamp was practiced on twelve patients suffering from cervical instability.

Candidates for this technique were all patients with cervical instability due to traumatic, degenerative/inflammatory or congenital pathology, the diagnosis of which was clinically suspected and confirmed by neuro-radiological studies: a simple radiological study of the cervical column, a CT axial scan and a MR image when it was thought necessary.

In all cases the aim was to obtain an adequate stabilization of the cervical column which was considered to have been achieved on meeting the following criteria: fusion of the segments; absence of flexo-extension movements in the lateral radiograph and evidence of continuity of trabecular bone between the graft and the adjacent bone.

83.3% of cases were males, with an average age of 22 years (the environment being military) all showing a traumatic origin. Two cases were women, both over 50, whose origin was inflammatory.

Clinically speaking, a cervico-vertebral syndrome was seen in 91.6% of the patients, being associated with a radicular syndrome in two cases (16.6%) and with myelopathy in a further three (25%).
Stabilization of the cervical spine with the Halifax interlaminar clamp

Fig. 1.- Post-traumatic cervical luxation at C5-C6.

Posterior cervical fusion was indicated by traumatic or degenerative cervical pathology affecting segments C1-C2 in 6 patients (post-traumatic atlanto-axial instability in four cases, three of these having fracture of the odontoid apophysis; and atlanto-axial instability secondary to rheumatoid disease in another two) and the lower cervical segments (C3-C7) in the other six (post-traumatic internal cervical spine instability). Photographs 1 and 2. Table 2.

All patients were operated on in prone decubitus, in a neutral position with or without traction, exposing the posterior cervical arches and using resonance compatible sublaminar clamps joined by screws. An homologous spongy cortical graft was placed over the laminae. In the immediate post-operative period, all patients wore a Philadelphia-type cervical collar for at least two months.

Post-operative clinical follow-up examinations of patients took place at one month, two months, six months and one year after the operation.

Results

Distribution of the patients according to the level operated on was the following: level C1-C2, 6 cases (50%); at the level of the lower cervical segments in another 6, 3 cases (25%) in the C5-C6 space and another case at C2-C4, C3-C4 and C4-C5 levels.

---

TABLE 1

Complications arising from the use of sublaminar wiring.

<table>
<thead>
<tr>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical hyperlordosis.</td>
</tr>
<tr>
<td>Cervicalgia.</td>
</tr>
<tr>
<td>Dural and/or spinal cord lesions. LCR fistula.</td>
</tr>
<tr>
<td>Impaction of the wire with spinal cord damage.</td>
</tr>
<tr>
<td>Laminar fracture.</td>
</tr>
<tr>
<td>Delay in or lack of union.</td>
</tr>
<tr>
<td>Material not RM compatible.</td>
</tr>
</tbody>
</table>

* Titanium Sublaminar Wire is currently available.
Stabilization of the cervical spine with the Halifax interlaminar clamp

Neurocirugía

Fig. 3.— Complication at level C1-C2 in a patient with atlanto-axial instability due to rheumatoid arthritis. One of the system screws has come undone, allowing migration of the lower clamp.

Traumatic pathologies made up 83.3% of our group.

One month after the surgical treatment, the clinical development of the patients was entirely satisfactory. At two months, we noticed poor consolidation of the graft in one patient who had been operated on for a pathology in the C1-C2 cervical segment (atlanto-axial instability due to rheumatoid disease), for which reason cervical immobilization was maintained for a further two months, achieving satisfactory consolidation. At six months, evolution was good in 91.6% of patients, while in the previously mentioned patient we observed unscrewing of one of the system with migration of the lower clamp (Fig. 3). She was subjected to another operation, in which arthrodesis was performed, with a Spine System occipito-cervical plate.

Discussion

Since Tucker\(^\text{14}\) described the effectiveness of a posterior fixation device for luxation at C1-C2 level the modified use of this technique (the Halifax clamp) has also proved to be useful for fixation and stabilization of the lower cervical segments\(^\text{11,14,16}\). However, the use of the system at the C1-C2 level is currently under discussion. Cybulski et al.\(^\text{3}\) have defined it as a safe, effective alternative method of arthrodesis, although one patient in their group needed further surgery because a clamp at C1-C2 level came free and migrated. A recent evaluation of the technique of implantation of the Halifax interlaminar clamp was carried out by Statham et al.\(^\text{16}\) in a multi-centre study in the United Kingdom. In their series, 45 patients were stabilized at the C1-C2 level, complications appearing in 14 patients: in 10 cases, one of the screws came loose and in the other four, they were the clamps which came loose. The 26 patients stabilized at levels C3-C7 had no complications. In none of these arthrodeses was interlaminar osseous graft used. Aldrich et al.\(^\text{1}\) described, as complications in 16 patients stabilized at C1-C2 level, two laminar fractures and one clamp coming loose. In two cases, a screw came loose.

Our experience suggests that the use of this system for posterior cervical fixation is highly effective for the lower cervical segments. When the system is used at the C1-C2 level, the failure rate is up to 20%. Virtually all the studies agree on this point\(^\text{2,11,13,12,16}\), failures being attributed in most cases to technical and design problems. The anatomical characteristics of the atlanto-axial segment, make it a multiaxial joint with great mobility, in contrast to the lower cervical segments, which is mainly responsible for flexo-extensor movements. In addition, the posterior arch of the atlas has a rounded configuration, contrasting with the pointed edges of the sub-atlantoidal laminae and this, together with the large volume of the spiny apophysis of C2, makes it difficult to align the clamps vertically, implying less contact surface between the clamp and the arch of C1 because of the resulting inclination. This causes the clamp to come loose with rotation, especially if screws come undone. Some authors\(^\text{14,15}\) have advised against its use for C1-C2 fixation.

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Stabilized level</th>
<th>Cases</th>
<th>C3-C7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma</td>
<td>C1-C2</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>2</td>
<td>–</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>6</td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

TABLE 2

Distribution according to the pathology.

303
Stabilization of the cervical spine with the Halifax interlaminar clamp

Conclusions

The Halifax interlaminar clamp is safe and effective and represents the technique of election in patients with lower cervical unisegmentary pathology. By contrast, the technical problems and complications are more frequent in atlanto-axial arthrodesis, failure rate being of up to 20% at this level.

The modification of the clamp (greater width of anchorage and more thread for the screw) will probably improve the results obtained with fixation of the C1-C2 cervical segment, making its use effective in odontoid fractures.

We believe that its use is not indicated in severe atlanto-axial subluxations of traumatic or degenerative/inflammatory origin.

We consider that the system should always be complemented with a laminar graft of spongy cortical bone and with cervical immobilization during at least two months.

References