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Occipitocervical fixation with a single occipital clamp using inverted hooks

Received: 2 August 1996
Accepted: 16 September 1996

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Abstract A simple occipitocervical osteosynthesis technique using cervical CCD (compact Cotrel-Dubousset) material is described in a clinical case. The originality of this technique consists in the occipital fastening used, involving the simultaneous insertion of two hooks into a single burr-hole. This greatly facilitated the positioning of the osteosynthesis rods, reduced surgical time, and pro-

vided immediate stability. These criteria are of considerable importance since this difficult surgical procedure is often performed in patients in a frail condition.

Key words Occipital cervical fusion · Occipital cervical fixation · Pathologic dens fracture · Spinal fusion · Fracture fixation, internal

Introduction

Two problems are encountered when internal fixation is performed on the occipitocervical junction. First, the poor quality of the occipital or cervical grip on the osteoporotic (rheumatoid arthritis) [1, 11] or osteolytic (metastasis) spines can induce dislodgement of the implant. Secondly, there can be technical difficulties in positioning the implant, which should be well adapted to the anatomy of the patient.

Various procedures can be used for internal fixation from the occiput to the cervical spine, and each has its advantages and disadvantages. The techniques described include simple onlay cancellous grafts, wire fixation of grafts, use of cement reinforcement, plates screwed to the skull and cervical vertebrae, and rods wired to the spine and through burr-holes to the skull. Problems can occur with these techniques, such as graft resorption, pseudoarthrosis, broken wires, and pulling out of skull or cervical screws.

Since the development of new instrumentation systems, including rods and hooks [2, 6, 8, 9, 10], the problem of providing a resistant cervical interlaminar clamp has been solved. Our practice has been to use a double occipito-occipital clamp under compression through two

burr-holes to obtain a very strong occipital grip. However, this is a lengthy procedure involving delicate handling of a cumbersome material.

The case report presented here describes a simple technique of occipitocervical osteosynthesis, in which the use of a single occipital clamp with inverted hooks allowed us to position with ease a bent CCD (compact Cotrel-Dubousset, Sofamor-Danek) cervical rod without dangerous mobilization.

Material and methods

A 50-year-old woman in good general condition had suffered for 2 years (since August 1993) from a left breast cancer that was resistant to radiotherapy and chemotherapy. An initial examination showed node and bone metastases.

Since March 1995, she had complained of acute cervical pain, and physiotherapy had been performed without an initial radiologic study. As cervicodynia worsened after the beginning of physiotherapy, X-rays of the cervical spine were performed. Lateral views showed a type II pathologic fracture of the odontoid process.

The patient was then referred to us. Neurological examination revealed no abnormalities. In addition to very severe cervical pain resistant to major analgesics, she had pain in the thoracolumbar junction related to a spine metastasis on T12. The cervical CT scan (Fig. 1) revealed a slight posterior displacement of the odontoid process and a modification of the bone stroma of the C2 and

C3 bodies. MRI showed a double metastatic localization on C2 and C3 (Fig. 2), but no spinal cord compression was visualized.

The patient underwent a 3-h operation on April 6, 1995. She was ambulant without immobilization at day 1, and drainage was removed at day 3. No transfusion was required. She suffered no apparent complications and was discharged at day 6. Radiotherapy was performed on the cervical and thoracic metastases at day 33 (30 Gy over 2 weeks). After 13 months of follow-up, she has no cervical pain and the stability of the implant has been radiographically confirmed (Figs. 3, 4).

Operating technique

The surgical procedure was performed under general anesthesia with the patient in prone position. Her head was fixed in a skull clamp and pulled with a Gardner headrest, and her arms were pulled along her body. Effective internal fixation requires that the

head be in a neutral position relative to the spinal axis. An intraoperative lateral radiograph was obtained to check the maintenance of fracture reduction.

A vertical posterior midline incision was performed, extending from the occiput to the spinous process of C7. The occipital squama must be clearly exposed 2 cm above the external occipital protuberantia and laterally as far as the occipitomastoid lines.

Sharp subperiosteal dissection was used to expose the posterior ring of C1 and the spinous processes and laminae of C2–C7. The laminae of C4 and C5 were prepared to receive the laminar hooks: the superior border of the lamina of C4 and the inferior border of the lamina of C5 were freed medially of their ligamentum flavum attachments, and a small rongeur was used to prepare the clamp site.

A high-speed drill was used on the occipital squama to roughen the bone and make two symmetrical burr-holes relative to the midline and situated under the upper nuchal line. The edges of the craniotomy were smoothed with a small Kerissong rongeur after dura mater was removed with a spatula.

Fig. 5 Diagram indicating the positioning of closed hooks (each with a large groove) through the occipital squama. *TOP*, positioning in alignment with the burr-hole; *middle*, introduction of both hooks at the same time, *bottom*, inverted clamp in position

Fig. 6 Surgical image with the occipital squama above. The right rod is already in place, and left rod is about to be positioned, and the cervical hooks are ready to receive the rod. The occipital claw is in place; the rod need only be turned and lowered toward the cervical hooks

Fig. 7 Diagram showing the rotation of the rod around the inverted occipital claw and its lowering into the cervical hooks

Fig. 8 The locking systems are in place. It is only necessary to put pressure on the cervical hooks and then consolidate the construction with a transversal linking device placed in distraction

Prior to the operation, both CCD cervical rods (5 mm diameter) were bent to take the exact shape of the occipitocervical curve and lie flat on the occipital squama and the laminae. The rods were cut to optimal length before introduction. One side was instrumented first, followed by the other.

At the occipital level, two closed hooks, each with a large groove (ref. CE1120), were inserted together (Fig. 5). The burr-hole was just large enough to allow the two hooks to enter at the same time. The hooks were thus wedged at the level of the grooves and prevented from coming out or migrating in the posterior fossa.

Open CCD cervical hooks were placed in supralaminar position on C4 and in infralaminar position on C5. The upper end of the rod was then slipped inside the inverted hooks of the occipital claw, without taking the position and orientation of the cervical hooks into account. In fact, the occipital claw provides an anchorage point around which the rod will turn before descending into the grooves of the open hooks (Figs. 6, 7). The locking systems of the cervical hooks were then put in place (Fig. 8). No hooks were blocked until the second rod had been positioned. The same procedure was used for the second rod.

Bone graft was not performed.

To ensure the solidity of the construction, compression was applied to the cervical hooks, and the occipital hooks were tightened after distraction was achieved by insertion of a spatula between them. The construction was then consolidated using a transverse linking device placed in distraction. Two drains were provided.

Figures 3 and 4 show the situation 13 months after surgery.

Discussion

The method described is an alternative fixation technique used in a single case. Follow-up is still short (13 months), and it cannot be claimed that the technique would be efficient in every case, particularly in cases in which considerable deformity or great instability is involved.

This method has two advantages over the classical techniques of occipital screwing [3–5, 7, 8, 10, 12, 13] and the use of an occipito-occipital grip in compression [2, 6, 9]. First, the occipital grip is easy to position, since only one burr-hole is required on each side. Secondly, the rods are bent beforehand to avoid the constraints of performing this procedure in situ. The rods can be easily inserted into the occipital hooks since they turn in the burr-hole and are thus perfectly adjustable. Likewise, the insertion of the rod into the cervical hooks is trouble free, since the rod turns around the fixed point provided by the occipital grip. This avoids the potentially dangerous maneuvering of the occipitocervical junction involved when rods must be pushed and slid into the hooks.

The cervical CCD material used was not cumbersome. The simple, fast construction proposed provides an alternative to occipitocervical internal fixation, but more cases and longer follow-up are required to validate this procedure.

Acknowledgements We are grateful to James Gray for his assistance with the translation.

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