Metal prosthesis of the cervical vertebra

Keiro Ono, M.D., and Koichi Tada, M.D.

Department of Orthopedic Surgery, Osaka University Medical School, Osaka, Japan

The authors successfully used a newly-devised metal prosthesis anchored by acrylic cement in four patients with cervical spinal tumor. Two of these patients suffered incomplete quadriplegia due to epidural infiltration of the tumor and required laminectomy. Severe neck pain was relieved in all cases, and neurological improvement was maintained until death.

Key Words: cervical vertebra prosthesis • acrylic cement • prosthesis, metal

Acrylic plastic was first used for vertebral replacement in cases of metastatic disease of the spine by Scoville, et al., as a palliative technique. A more simple and durable fixation, however, is still being sought. We are reporting four cases in which a metal prosthesis was inserted in the spine and anchored in place by acrylic cement. No serious tissue reaction to the acrylic cement was noted, in accordance with reports on previous studies.

Materials and Methods

The prosthesis* has a quadrilateral cylindrical form with a window in the front (Fig. 1). The size of the prosthesis (height, width, and depth) corresponds to that of the Japanese cervical vertebra. At present, only two sizes of prosthesis are available. The prosthesis is made of SMO (iron, nickel, chromium, manganese, and molybdenum alloy), which is strong and durable, and is widely used for surgical implants.

Removal of the affected vertebra and insertion of this prosthesis was usually performed through the anterior approach, as in Cloward's anterior body fusion. The collapsed vertebral body was removed with rongeurs and curettes, exposing the anterior surface of the dura. Annulus and discs were also removed from the upper and lower surfaces of the affected vertebra. A small hole was made in the upper and lower surface of the adjacent vertebrae, in order to anchor the prosthesis by acrylic cement (Fig. 2). The prosthesis was inserted carefully, under skull traction if necessary. Methyl methacrylate powder and Isomar† were mixed and poured or squirted into the prosthesis through its window. The prosthesis was firmly anchored by the cement, which filled the inside of the prosthesis and the holes in the two adjacent vertebrae. The spinal cord was protected by cold saline irrigation during the brief heat of polymerization of the cement. It was not necessary to insert Gelfoam between the spinal cord and the prosthesis, since the

*Prosthesis made by Mizuho Ikakogyo Company, Ltd., 29-10, 3-chome, Hongo, Bunkyo-Ku, Tokyo, Japan.

Metal prosthesis of the cervical vertebra

posterior wall of the prosthesis prevents the hot cement from coming into direct contact with the spinal cord. Good thermoconductivity of this metal prosthesis also helps to prevent nerve and vessel damage.

This procedure was performed on four patients; two of these who were paralytic also underwent a laminectomy. The patients were allowed to change their position in bed on the first postoperative day and to walk without a brace within 3 weeks if there were no neurological complications.

Results

The results of the procedure are summarized in Table 1. Two patients (Cases 2 and 4) died 7 and 8 months after surgery. They could walk and were without neck pain or paralysis for several months after surgery (Fig. 3); they then were readmitted because of their generally poor condition, recurrence of symptoms and spread of the tumor.

In Case 1, the patient showed marked improvement with relief of neck pain, and could live an active life for the ensuing 7 months. His symptoms recurred 13 months after surgery and thereafter he was bedridden until his death 29 months after surgery from a renal complication.

In Case 3, the patient was relieved of neck and arm pain and returned to work. Eleven months after surgery he noticed weakness and numbness of his extremities and then suddenly could not walk. After laminectomy and excision of an epidural tumor mass, the patient showed considerable improvement of the paralysis and was discharged (Fig. 4). At present, almost 3 years after surgery, he is able to care for himself.

In each case, the metal prosthesis coupled with two vertebrae were found radiologically to be entirely stable without motion on neck movement (Fig. 5).
TABLE 1
Results in four patients treated with metal prosthesis of the cervical vertebra

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs), Sex</th>
<th>Vertebral Lesion</th>
<th>Origin and Pathology</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75 M</td>
<td>C-4 body, pedicle, lamina, spinous process</td>
<td>solitary plasmocytoma</td>
<td>severe neck pain, stiffness; incom. quadriplegia below C-5</td>
</tr>
<tr>
<td>2</td>
<td>48 M</td>
<td>C-3 body</td>
<td>adenocarcinoma, maxillary sinus</td>
<td>severe neck pain; stiffness; no neurological complication</td>
</tr>
<tr>
<td>3</td>
<td>64 M</td>
<td>C-5 body</td>
<td>adenocarcinoma, thyroid gland</td>
<td>severe neck pain, stiffness; arm pain; 11 mos after initial operation, incomplete quadriplegia below C-6</td>
</tr>
<tr>
<td>4</td>
<td>65 F</td>
<td>C-4 body</td>
<td>adenocarcinoma, lung</td>
<td>neck, arm pain for 2 mos, then inc. quadriplegia</td>
</tr>
</tbody>
</table>

Fig. 3. Case 4. Preoperative (left) and postoperative (right) x-ray films of a 65-year-old woman with lung cancer metastasis onto C-4.
Metal prosthesis of the cervical vertebra

TABLE 1 (continued)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>radiotherapy; excision C-4 body, replacement, fixation between C3-5;</td>
<td>relief of neck and arm pain, fully ambulatory for 7 mos after surgery; death 29 mos after surgery, due to recurrence, spread of tumor, renal complication</td>
</tr>
<tr>
<td>laminectomy; Endoxan administered</td>
<td></td>
</tr>
<tr>
<td>radiotherapy; excision C-3 body, replacement, fixation between C2-4</td>
<td>relief of neck pain; death 7 mos after surgery due to intracranial invasion of tumor</td>
</tr>
<tr>
<td>Bleomycin administered;</td>
<td>relief of neck pain, considerable improvement of paralysis;</td>
</tr>
<tr>
<td>excision C-5 body, replacement</td>
<td>36 mos after surgery, able to care for self</td>
</tr>
<tr>
<td>fixation between C4-6; laminectomy</td>
<td></td>
</tr>
<tr>
<td>radiotherapy; excision C-4 body</td>
<td>moderate improvement of paralysis; death 8 mos after surgery due to recurrence, spread of tumor, debilitation</td>
</tr>
<tr>
<td>replacement, fixation between C3-5</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Scoville, et al.,\textsuperscript{5} were the first to use acrylic plastic for replacement or fixation of diseased vertebrae in metastatic disease of the spine, in an attempt to relieve patients from spending their last months immobilized in bed, in casts, or in traction. Their method of encasing wires or screws in acrylic plastic was simple but not durable, since acrylic plastic is not a glue but a filling material. They used Gelfoam or tantalum foil to protect nervous tissues or vessels from the heated cement during the polymerization.\textsuperscript{4,6}

We have also attempted stabilization of the spine on four patients with metastases by using bone graft. In these cases, a delay of fusion and a risk of spreading the tumor led us

![Fig. 4. Case 3. X-ray films of a 64-year-old man with thyroid cancer metastasis onto C-5, taken before (left) and immediately after (center) operation, and again 9 months after surgery (right). The acrylic cement is radiolucent and does not show on the films.](image-url)
to conclude that bone graft is less desirable than metal prosthesis for stabilization of the spine in metastatic cases.

In our four cases of malignant tumor of the cervical spine the metal prosthesis anchored with acrylic cement was substituted for the affected vertebra and rendered the spine stable and painless. Neither infection nor foreign body reaction was noted. The metal prosthesis was easy to handle and effective in protecting the spinal cord, nerve, and vertebral artery from the heated cement.

From this preliminary follow-up study, the metal prosthesis seems to be reliable, stable, and durable, although its use should be restricted to those patients with relatively long life expectancy, such as those with myeloma, thyroid cancer, and hormone-dependent cancer.

Acknowledgments

We express our thanks to Professor Mori and Dr. Shibata of the Kansai Medical College for the loan of clinical records and x-ray films of Case 4.

References


Address reprint requests to: Keiro Ono, M.D., Department of Orthopedic Surgery, Osaka University Medical School, Osaka, Japan.