One-stage lateral rhachotomy and posterior spinal fusion with compression hooks for Pott’s paralysis in the elderly

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ABSTRACT

Purpose. To evaluate the safety and effectiveness of one-stage lateral rhachotomy and posterior fusion with compression hooks, for the treatment of Pott’s paralysis in the elderly.

Methods. 11 elderly patients underwent lateral rhachotomy (costotransversectomy and pediculectomy) to debride the tuberculosis focus extending into the epidural space and to decompress the spinal cord. After debridement, the interbody cavity was packed with autologous iliac bone chips. For stabilisation, posterior fusion was performed using a compression lamina hook system. Patients were followed up for at least 2 years for complications. Neurological status was assessed using the Frankel score. The kyphotic deformity was measured on lateral radiographs taken before surgery and at follow-up.

Results. During separation of the adhesion around the abscess, a dural tear occurred in one patient and a pleural tear in another. Both tears were successfully repaired. One patient had mild pneumonia after surgery. The Frankel scores of the 11 patients improved from C or D before surgery to D or E after surgery. No relapse of spinal tuberculosis was encountered. The mean deformity angle was 25.5 degrees before surgery and 23.2 degrees at the final follow-up. Spinal fusion was achieved in all patients.

Conclusion. Without the need of thoracotomy, one-stage lateral rhachotomy with posterior spinal fusion using compression hooks was an effective option for treating Pott’s paralysis in the elderly.

Key words aged; paralysis; spinal fusion; tuberculosis

INTRODUCTION

Treatment of Pott’s disease in the elderly is a challenge because of the poor physical condition of patients who have much comorbidity (impaired pulmonary function, heart disease, diabetes mellitus), especially when their vertebrae are osteoporotic. Thoracotomy has been considered the standard procedure to treat this condition, but exerts considerable stress on lung function. In contrast, costotransversectomy and lateral rhachotomy is considered the least invasive from this perspective. Lateral rhachotomy was first described by Capener in 1954. It provides an access to the anterior and lateral aspect of the dural tube.
by excision of a pedicle after costotransversectomy, which permits evacuation of the abscesses including granulation and sequestra that compress the spinal cord.

We retrospectively evaluated the outcome of elderly patients with Pott’s paralysis treated with lateral rhachotomy and posterior spinal fusion with compression hooks.

**MATERIALS AND METHODS**

From 1994 to 2001 inclusive, 11 patients with Pott’s paralysis at the thoracic spine underwent decompression of the spinal cord by lateral rhachotomy and posterior fusion using a compression hook system at the Tohoku University Hospital. The 7 male and 4 female patients had a mean age of 69 (range, 61–77) years. Seven patients had a history of lung tuberculosis, 9 had impaired lung function and 10 had comorbidities such as coronary disease and diabetes mellitus. All patients had progressive paralysis. The preoperative Frankel scores were C in 7 patients and D in 4. Four patients were recumbent, 3 were ambulatory with crutches and the remaining 4 needed no support but had unstable gaits. The levels of the lesions were from T3-T4 to T11-T12. Figure 1 shows the enhanced T1-weighted magnetic resonance images of an interbody lesion and spinal cord compression at T10-T11. Two vertebrae were involved in 8 patients and 3 in each of the other 3. All patients received antituberculosis chemotherapy for at least one month before surgery.

The compression hook system consists of a threaded rod 4.2 mm in diameter with 2 hooks: a fixed hook on one end of the threaded rod and a swinging hook on the other end with 20° adjustability, which facilitates its anchoring onto the laminae in kyphotic spines (Fig. 2).

The lateral rhachotomy performed was as described by Capener except for a few modifications. A straight skin incision instead of the curved one was made 6 to 8 cm lateral to the midline because in this series the kyphotic deformities were milder than those in Carpener’s. One or 2 pedicles were unilaterally removed after costotransversectomy. Radicular vessels and intercostal nerves were preserved as their ligation might result in the Adamkiewicz artery injury. To prevent the metal works from having direct contact with the focus of tuberculosis, no parts of the laminae were removed. Whenever debridement or decompression through a unilateral approach was insufficient, the same procedure was carried out on the contralateral side.

Cancellous bone chips and slivers were harvested from the posterior iliac crest. The bone chips were packed into the anterior to middle part of the cavity, with special care to avoid packing them close to the dural tube. After thorough lavage, the wound was closed. A new midline incision was made. Laminae to be fixed (one or 2 laminae cranially and caudally beyond the affected vertebrae) were exposed subperiosteally. The hook system was bilaterally positioned with the upper and lower most laminae in the fusion area as purchase sites and longitudinal compression was applied gradually, by tightening the nuts. All laminae were decorticated and a sliver of bone was laid over them.

After the surgery, all patients wore a hard corset for 6 months and continued taking antituberculosis chemotherapy for 12 months. They were followed up for 24 to 54 (mean, 39) months.

Surgical complications were reviewed; each patient’s neurological status was assessed before
surgery and at the final follow-up using the Frankel score. The deformity angle was measured by 2 lines as per Upadhyay’s description: one being parallel to the superior border of the proximal vertebra and the other parallel to the inferior border of the distal vertebra of the diseased segment (Fig. 3). Bone union was assessed using sagittal reconstruction of computed tomographic (CT) images.

RESULTS

Bilateral rhachotomy was deemed necessary in 4 patients. During separation of the adhesion around respective abscesses, one patient sustained a 1-cm pleural tear and another a 0.5-cm dura mater tear. The tears were tied or sutured under direct vision. One patient developed a mild postoperative pneumonia, which was successfully treated. All patients began to sit up 2 to 3 weeks after surgery and ambulate after 4 weeks. In this series of patients, wound infection, deep venous thrombosis or decubitus ulcer were not encountered. Moreover, there was no deterioration in their comorbidities and no feature to suggest relapse of their spinal tuberculosis.

At the final follow-up, neurological status improved from a Frankel score of C to D in 5 patients, from C to E in 2, and from D to E in 2; in 2 others it remained at D. Seven patients could ambulate independently and the 4 required crutches (Fig. 4). CT scans showed that the spinal cord was decompressed sufficiently in all patients.

In all patients, sagittal reconstruction of CT images showed the bony continuity between the remaining vertebral bodies and the bone chips packed in the cavity and between laminae, facets and grafted sliver bones posteriorly (Fig. 5). The mean deformity angle was 25.5° before surgery, 20.7° immediately after surgery, and 23.2° at final follow-up. At final follow-up, the kyphotic deformities improved by 1° to 5° in 9 patients and worsened by 1° to 2° in 2.

DISCUSSION

The method of surgical treatment for Pott’s paralysis should be based on the patient’s physical condition including senility and lung function. In 1956, Hodgson and Stock introduced anterior radical debridement and spinal reconstruction through a transthoracic approach. This radical surgery was effective in eradicating spinal tuberculosis and therefore gained popularity. However, the transthoracic approach was liable to serious complica-
tions, especially in elderly patients. Ito et al.\textsuperscript{12} in 1934 first described a radical operation for Pott’s disease, which involved costotransversectomy. In 1954, Capener\textsuperscript{6} reported removal of the pathological tissues, such as sequestra, compressing the spinal cord through lateral rhachotomy. These extrapleural procedures are less invasive than anterior radical surgery and are therefore more suitable for patients with poor lung function.

The main goals of surgery for Pott’s paralysis are (i) the eradication of the infection and (ii) decompression of the spinal cord, which can be achieved by lateral rhachotomy, even through a limited window. The interbody focus is debrided and the spinal cord is decompressed anteriorly and laterally. Even though the debridement may not be as complete as that by anterior radical surgery, it is sufficient for the focus to heal when undertaken in combination with chemotherapy.\textsuperscript{13,14} At the final follow-up, all patients in this series became free of spinal tuberculosis without relapse, and neurological improvement was satisfactory.

To promote neurological improvement\textsuperscript{15} and facilitate early patient ambulation,\textsuperscript{16} the spine should be stabilised after debridement and decompression. The curedt interbody cavity is packed with bone grafts after decompression. Bone chips and slivers are more easily implanted into a desired position and ensure faster bony union and reconsolidation. However, they cannot correct the deformity or provide support to the spine. To correct the deformity and stabilise the spine so as to allow early ambulation, the anterior fusion needs to be supplemented by posterior instrumentation.\textsuperscript{13,17,18} This is helpful in maintaining the correction until fusion is achieved.\textsuperscript{5,19} Fortunately, in almost all cases of spinal tuberculosis, the posterior elements such as the laminae, facets, and spinous processes remain intact.

Among the options for posterior instrumentation, the Harrington and Luque systems produce long segment fixation, which is a shortcoming from the perspective of preserving mobility of the spinal segments. Both the pedicle screw system and the lamina hook system produce short segment fixation. However, the former does not suit elderly patients; screws tend to loosen because osteoporotic bone does not provide sufficient anchorage and the thoracic pedicles have thin and fragile cortices.\textsuperscript{3} The lamina hook system is the better choice for elderly patients, and provides stronger purchase sites for the implants than the pedicles.\textsuperscript{7} The lamina hook system, therefore, can apply a stronger longitudinal compression force to correct the kyphotic deformity with the facet joints as fulcra, while holding the spine until bone union is achieved. In addition, the bones packed into the cavity bear some axial load transmitted to the anterior and middle columns, as the vertebral bodies are not completely destroyed. As is usual in spinal tuberculosis, in all our patients the posterior elements such as the laminae, facet joints, and spinous processes remained intact preoperatively. No hook dislocation occurred after surgery and the goal of posterior fusion was achieved.

In order to sufficiently correct a severe kyphotic deformity, it is necessary to incise a shortened anterior longitudinal ligament and spread out the intervertebral spaces. Lateral rhachotomy does not allow such a correction, because it permits no incision in the ligament. Undamaged laminae and facets are essential to correct the deformity and stabilise the spine with the lamina hook system. Lesions extending to the laminae would therefore be a contraindication. We successfully applied our lamina hook system even where lesions involved 3 vertebrae. Because of limited length of the hook system, lesions involving 4 vertebrae or more need another hook system with a longer rod to stabilise the spine after lateral rhachotomy.

Although the mycobacterium is unlikely to produce biofilm around metal works and cause persistent infection,\textsuperscript{20} as a precaution, implants should be kept away from the tuberculosis focus. We made a new midline incision for positioning the hook system and removed no part of the laminae behind the focus of infection.

CONCLUSION

Debridement of the tuberculosis focus and decompression of the spinal cord were successfully achieved through lateral rhachotomy without serious complications. Our posterior compression hook system facilitated stabilisation of the spine and early ambulation until bone union. One-stage lateral rhachotomy and posterior fusion with compression hooks is a safe surgical treatment for elderly patients with Pott’s paralysis.

REFERENCES