Application of syringosubarachnoid shunt through key-hole laminectomy

Technical note

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The authors describe the key-hole laminectomy technique (KHLT) for application of syringosubarachnoid shunts. This technique was used in 29 patients with noncommunicating syringomyelia. In all cases the shunts were inserted successfully without any peri- or late postoperative complications. The late follow-up magnetic resonance examinations revealed the clear collapse of syrinx in all cases. The authors advocate use of the KHLT because it is associated with less surgery-related trauma, epidural fibrosis, infection, and spinal instability.

KEY WORDS • key-hole laminectomy • syringomyelia • syringosubarachnoid shunt

Despite the fact that multilevel hemilaminectomies or total laminectomies provide a wide exposure of the spinal cord for the surgical treatment of syringomyelia, spinal tumors, and other pathological lesions, many complications such as extensive epidural fibrosis, spinal instability and deformity, nerve root compression and infection have been frequently observed.^{1-8,11-13} With the use of an operating microscope, limited removal of bone structures and ligamentum flavum enables preservation of as much of the normal anatomical structures as possible, with fewer peri- and late postoperative complications. Accordingly, the KHLT was used to place a syringosubarachnoid shunt for the surgical treatment of syringomyelia. We present our experience and summarize the treatment results.

CLINICAL MATERIAL AND METHODS

During a 6-year period, 29 patients with noncommunicating syringomyelia were treated using the KHLT for the application of a syringosubarachnoid shunt. Eighteen pa-

tients were men and 11 were women. The mean age was 37 years (range 19–62 years). All patients were evaluated using MR imaging scans and SSEP monitoring. Fourteen patients had pure cervical noncommunicating syringomyelia, nine patients had cervicodorsal syringomyelia, four patients had syringomyelia dorsal, and two patients had holocord syringomyelia. The criteria for application of the shunt was the presence of symptomatic and noncommunicating syringomyelia with a large isolated syrinx. Those patients in whom MR imaging demonstrated marked transverse diameter of the syringomyelia cavity and signs of an incomplete cord lesion were primarily advised to undergo a syringosubarachnoid shunt placement procedure.

Operative Technique:

The patient is operated on in Concorde position (prone, thorax elevated, neck flexed and tilted away from the surgeon) after endotracheal induction of anesthesia. We make a 1-cm incision lateral from the midline and a 2-cm paramedian skin incision on the symptomatic side according to the largest level of the syringomyelia cavity (Fig. 1A). Using a microscope, the appropriate lamina is exposed. The spinous processes and interspinous ligament are left

Abbreviations used in this paper: DREZ = dorsal root entry zone; KHLT = key-hole laminectomy technique; MR = magnetic resonance; SSEP = somatosensory evoked potential.

Fig. 1. Schematic drawings depicting the skin incision in KHLT for insertion of a syringosubarachnoid shunt (A), key-hole laminectomy at the C5–6 level (B), DREZ myelotomy (C), insertion of the catheter into the syrinx (D), and dural closure (E). lig = ligament; SSS = syringosubarachnoid shunt.

intact. The hemilaminae of adjacent vertebrae above and below are stripped from the paravertebral muscles subperiostally and reflected laterally as far as the facet joints are exposed (Fig. 1B). An adequate amount of bone is removed for the exposure of DREZ. The dura is opened with a half moon-shaped incision and reflected laterally (Fig. 1C). In all cases, the proximal shunt tube is inserted into the syrinx after DREZ myelotomy is performed (Fig. 1D). The closure is performed in the usual manner (Fig. 1E).

RESULTS

In all cases the shunts were successfully inserted (Fig. 2). In the peri- and early postoperative period, no complication was observed. All patients underwent neurological examinations, MR imaging, and SSEP monitoring for a mean follow-up period of 26 months (ranging from 18–36 months). In 14 cases (48%) neurological status improved. No neurological change was observed in the other cases, and spinal instability was shown to be absent. In all cases, MR imaging revealed the collapse of syrinx. There were no cases of moderate or severe epidural fibrosis. Marked improvement in 53% of all cases and no impairments in the other cases were found after SSEP examinations. Additional neurological deficits, central nervous system dysfunction, spinal deformity and instability, symptomatic epidural fibrosis, and infection were not observed in any patient during follow-up period.

DISCUSSION

Rhoton⁹ and Tator and associates¹⁰ first conducted the two-level hemilaminectomies for the treatment of sy-

ringomyelia. However, following multilevel, standard, total and hemilaminectomies, postoperative complications such as extensive epidural fibrosis, spinal deformity and instability, and nerve root compression have been frequently observed.^{1–4,6,7,11,12} We used the KHLT for insertion of a syringosubarachnoid shunt to minimize the risk of surgery-related trauma, infection, scar formation, spinal instability, and spinal deformity. The posterior approach described by Kempe⁵ for the treatment of radiculopathy has inspired us to perform our technique. The main advantages of KHLT are that it requires only a small skin incision; limited and unilateral dissections of paravertebral

Fig. 2. Intraoperative photograph (left) schematic drawing (right) illustrating the application of a syringosubarachnoid shunt through key-hole laminectomy. SSS = syringosubarachnoid shunt.

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muscles, ligaments, and laminae; and limited removal of ligamentum flavum with preservation of epidural fat tissues and venous plexi. The preservation of these components provides a better healing of soft tissues and bone structures, as well as a smaller degree of epidural scar formation, deformity, and instability. Opening of the dura and insertion of the shunt into the syrinx after DREZ myelotomy was performed with ease by using the microscope in all cases. We never encountered any difficulties during this last step, which may be related to small exposure site.

In conclusion, the KHLT for the insertion of a syringo-subarachnoid shunt in the treatment of syringomyelia is a safe, practical, and preferable technique associated with less risk and fewer complications, as compared with standard techniques in multilevel hemilaminectomy or total laminectomy.

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