Posterior cervical approach for intrathecal baclofen pump insertion in children with previous spinal fusions

Technical note

JAMES K. LIU, M.D., AND MARION L. WALKER, M.D.

Department of Neurosurgery, Primary Children’s Medical Center, University of Utah School of Medicine, Salt Lake City, Utah

Intrathecal baclofen pumps for the management of severe spasticity are being used more often in children with cerebral palsy. The intrathecal catheter is traditionally introduced dorsally in the lumbar region. In some children with previous thoracolumbar fusions for scoliosis, the fusion mass obviates the introduction of the intrathecal catheter.

The authors describe their experience with a posterior cervical approach for intrathecal baclofen pump insertion in three patients with spastic quadriplegic cerebral palsy who had previously undergone thoracolumbar fusions for scoliosis. Insertion was successful in all three patients; no complications of catheter disconnection, catheter dislodgment, or cerebrospinal fluid leakage occurred. Follow-up review ranged from 10 to 28 months postoperatively (mean 17 months). The posterior cervical approach for intrathecal baclofen pump insertion is a safe and effective alternative for patients who have previously undergone thoracolumbar spine fusions and in whom the traditional lumbar approach is not feasible.

KEY WORDS • intrathecal baclofen pump • spasticity • cerebral palsy • posterior cervical approach • pediatric neurosurgery

Clinical Material and Methods

Patient Histories

Three patients with spastic quadriplegic cerebral palsy and a history of previous thoracolumbar fusions for scoliosis underwent a posterior cervical approach for intrathecal baclofen pump insertion (Table 1). Two patients underwent revision surgery and one patient underwent a first-time baclofen pump insertion. The pumps implanted were all Medtronic synchromed pumps (Minneapolis, MN). All patients responded to previous trial injections of intrathecal baclofen with a significant reduction in muscle tone prior to pump implantation.

In Case 1 the patient had undergone placement of an initial baclofen pump in 1998 followed by an instrumented thoracolumbar fusion for scoliosis in 1999. The baclofen pump hardware became infected and was subsequently removed. After treatment of the cerebrospinal fluid infection, the patient presented in 2001 for reimplantation of the intrathecal baclofen pump.

In Case 2 the patient had undergone placement of an initial baclofen pump in 1997 followed by an instrumented thoracolumbar fusion for scoliosis in 1998. She presented in 2002 with a pump malfunction that required replacement of the intrathecal catheter tubing.
In Case 3 the patient had undergone a trial of intrathecal baclofen in 1997 and dropped one point in her Ashworth Scale score throughout both the upper and lower extremities. At that time the patient’s response to treatment was not thought to be significant and a baclofen pump was not considered. In 2002, it was thought that her response was actually significant for patients with dystonia and the patient was reconsidered for intrathecal baclofen pump placement. She had undergone thoracolumbar fusion for scoliosis 3 years before pump placement.

Surgical Procedure

Following the administration of general anesthesia, the patient was placed in the lateral decubitus position. In each case, the posterior cervical region was prepared and draped in addition to the regions traditionally prepared for the standard lumbar and abdominal incisions. A linear horizontal incision was made lateral to the umbilicus and brought down through the subcutaneous fat to expose the abdominal fascia. A subcutaneous pocket was created and the pump was implanted in the subcutaneous layer just above the abdominal fascia. In thin patients who do not have an abundance of fatty tissue, the pump can be placed beneath the rectus and external oblique fascia. This subfascial placement reduces the profile of the pump and minimizes the possibility of wound breakdown by reducing the tension on the abdominal wound. A horizontal incision over the abdominal fascia is made and a subfascial pocket is created to accommodate the pump.

In two cases (2 and 3), an initial lumbar incision was made and several attempts to access the thecal sac with fluoroscopic guidance were unsuccessful because of obstruction by the osseous fusion mass. A high-speed drill

<table>
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<tr>
<th>Case No.</th>
<th>Age (yrs)</th>
<th>Sex</th>
<th>Diagnosis</th>
<th>Operation</th>
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<td>SQCP</td>
<td>baclofen pump</td>
<td>cervical–abdominal</td>
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<tr>
<td>2</td>
<td>17, F</td>
<td>SQCP</td>
<td>baclofen pump</td>
<td>cervical–lumbar-abdominal</td>
<td>13</td>
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<tr>
<td>3</td>
<td>26, F</td>
<td>SQCP, dystonia</td>
<td>1st baclofen pump insertion, T-1 laminectomy</td>
<td>cervical–lumbar-abdominal</td>
<td>10</td>
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* Rev = revision; SQCP = spastic quadriplegic cerebral palsy.
was used to remove the fusion mass; however, the thecal sac could not be identified because of the distorted anatomy. A cervical incision was subsequently made and a T-1 laminectomy was performed in both cases. A small dural incision was made with a No. 11 blade. The arachnoid was opened and the intrathecal catheter was carefully inserted into the subarachnoid space toward the midthoracic region (T3–6) because significant spasticity of both upper and lower extremities was present. The dura mater was closed around the catheter with 4-0 sutures.

A shunt passer was used to tunnel the pump catheter subcutaneously from the cervical incision to the lumbar incision and finally to the abdominal incision. The pump catheter and the intrathecal catheter were cut to the appropriate lengths and attached with a straight connector that was anchored down to the dorsal fascia with a nonabsorbable suture to prevent catheter migration.

In Case 1, a C-1 laminectomy was performed in the patient and the catheter was then tunneled from the cervical incision directly to the abdominal incision and attached to the remainder of the baclofen pump system (Figs. 1 and 2).

Results

In all three patients insertion of an intrathecal baclofen pump through the posterior cervical approach was successful. All experienced significant reduction of spasticity and one patient experienced a reduction of dystonia. No complications of catheter disconnection, catheter dislodgment, or cerebrospinal fluid leakage occurred. Follow-up review
ranged from 10 to 28 months postoperatively (mean 17 months).

Discussion
Baclofen is a synthetic \gamma-aminobutyric acid agonist that acts selectively on both pre- and postsynaptic \gamma-aminobutyric acid B receptors within the central nervous system to reduce excitatory synaptic transmission.\textsuperscript{6,9-11} Baclofen relieves spasticity by its action on the spinal cord receptors, whereas dystonia is thought to be relieved by the drug's supraspinal action. Direct administration of baclofen into the spinal subarachnoid space provides a much higher concentration at the site of action while minimizing the systemic side effects.

In children with moderate to severe quadriparetic spasticity and/or dystonia from cerebral palsy, the reduction of muscle tone resulting from intrathecal baclofen provides pain relief, halts the progression of deformities, and renders the care of these children easier.\textsuperscript{1,4-8}

Some children with cerebral palsy have undergone previous instrumented thoracolumbar fusions for scoliosis.\textsuperscript{6} The presence of the fusion mass and, in some cases, the rod instrumentation may prevent access to the thecal sac with a Tuohy needle. To expose and access the thecal sac, the fusion mass must be removed with a high-speed drill; however, the anatomy of the spine is often distorted by severe spinal deformities. The presence of rod instrumentation also narrows the surgical corridor for drilling out the osseous mass. Access to the thecal sac may be facilitated by the use of intraoperative fluoroscopy and neuronavigational devices, such as fluoroscope-guided or computerized tomography-guided frameless stereotactic systems. This approach, however, would be technically more challenging and increase operation time and costs.

We describe a safe and effective alternative approach in which the thecal sac is accessed through a posterior cervical incision. The anatomy in this region is generally not deformed and osseous fusions are usually not present. No scar tissue is generally apparent in the field of dissection, and the laminae can be easily identified and readily removed with rongeurs to expose the thecal sac. The posterior cervical approach is less complicated, easier to perform, and decreases operation time and costs.

We performed a C-1 laminectomy in our first experience with this approach. In our later experiences we converted to a T-1 laminectomy instead because it provided a larger dural exposure and facilitated threading of the intrathecal catheter. In no patient did we encounter resistance when passing the intrathecal catheter caudally from the cervical subarachnoid space. This maneuver should be performed under fluoroscopic visualization. If resistance is encountered, the catheter should be pulled back and redirected. It is important to confirm that the catheter is in the subarachnoid space and not in the subdural space. Forceful advancement of the catheter may risk injury to the spinal cord.

In the posterior cervical approach as planned as the initial operation, only two incisions (at the neck and the abdomen) are required. If, however, a lumbar approach is first attempted and the thecal sac cannot be accessed, a posterior cervical approach can be used. We recommend that both the cervical and lumbar incisions are prepared and draped to facilitate the conversion from one approach to the other.

In patients who have undergone thoracolumbar fusions prior to an evaluation for a baclofen pump, performing a percutaneous trial injection of baclofen may be difficult. Because baclofen is lipophilic, a test injection via a high cervical puncture may be unsafe and is not recommended. Instead, a percutaneous lumbar puncture should be initially attempted under fluoroscopic guidance. If this is unsuccessful, we may consider implanting the baclofen pump without a trial injection in cases in which the patient is thought to be an excellent candidate by our multidisciplinary team. Another alternative is to place an externalized intrathecal catheter down to the midthoracic region via a posterior cervical approach, as described earlier. A test dose of baclofen can be injected into the catheter at the patient's bedside. If there is an adequate response to the baclofen, the patient is taken back to the operating room for a baclofen pump insertion.

Conclusions
The posterior cervical approach for intrathecal baclofen pump insertion is a safe and effective alternative for patients who have previously undergone thoracolumbar spine fusions that make the traditional approach unfeasible.

References