Subfascial Implantation of Intrathecal Baclofen Pumps in Children: Technical Note

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OBJECTIVE: Indwelling intrathecal drug delivery systems are becoming increasingly important as a method of neuromodulation within the nervous system. In particular, intrathecal baclofen therapy has shown efficacy and safety in the management of spasticity and dystonia in children. The most common complications leading to explantation of the pumps are skin breakdown and infection at the pump implantation site. The pediatric population poses particular challenges with regard to these complications because appropriate candidates for intrathecal baclofen therapy are often undernourished and thus have a dearth of soft tissue mass to cover a subcutaneously implanted baclofen pump. We report a technique of subfascial implantation that provides greater soft tissue coverage of the pump, thereby reducing the potential for skin breakdown and improving the cosmetic appearance of the implantation site.

METHODS: Eighteen consecutively treated children (average age, 8 yr, 7 mo) with spasticity and/or dystonia underwent subfascial implantation of a baclofen pump. These children’s mean weight of 42.9 lb is less than the expected weight for a group of children in this age group, ranging from 4 years, 8 months, to 15 years, 7 months. In all patients, the pump was inserted into a pocket surgically constructed between the rectus abdominus and the external oblique muscles and the respective anterior fascial layers.

RESULTS: At an average follow-up of 13.7 months, no infection or skin breakdown had occurred at the pump surgical site in any of the 18 patients.

CONCLUSION: At this early follow-up, the subfascial implantation technique was associated with a reduced rate of local wound and pump infections and provided optimal cosmetic results as compared with that observed in retrospective cases. (Neurosurgery 49:753–757, 2001)

Key words: Baclofen, Cerebral palsy, Intrathecal baclofen, Spasticity

The continuous infusion of intrathecal baclofen has been shown to decrease spasticity and control dystonia in children and adults with central nervous system dysfunction (1–3, 7). The most widespread drug delivery system used is the SynchroMed Infusion System (Medtronic Neurological, Minneapolis, MN), which includes a 10-ml pump measuring 7.5 cm in diameter and 2.8 cm in height. The standard surgical procedure involves implanting the pump in the lateral abdominal wall in the subcutaneous plane. The most common reason leading to explantation of this system is wound/pump infection (1–3, 7).

Grabb and Pittman (8) originally described a new technique of inserting the drug delivery system subfascially. This technique offers the advantages of providing more substantial soft tissue coverage at the implantation site, reducing the potential for skin breakdown, and improving the cosmetic appearance of the abdomen in pediatric patients who are significantly underweight and lack sufficient soft tissue mass to adequately cover the pump, in contrast to control pediatric populations. In this report, we describe the implementation of the subfascial technique and demonstrate its potential in reducing complication rates.

PATIENTS AND METHODS

Eighteen consecutive children with an average age of 8 years, 7 months (range, 4 yr, 8 mo–15 yr, 7 mo) had a 10-ml pump implanted subfascially. Indications for continuous infusion of intrathecal baclofen were determined by a multidisciplinary protocol at the Center for Children at the Hospital for Joint Diseases/New York University Medical Center (Table 1).

Surgical technique

The patient is positioned in a lateral decubitus position on the operative table, with the right or left side down, depending on a particular patient’s body habitus and coexisting hardware.
devices (i.e., gastrostomy tubes) (Fig. 1). Initial antibiotic prophylaxis, administered just before the incision, includes both gram-positive and gram-negative coverage. With the use of a template of the pump, the implantation site is assessed to determine whether the implantation pocket will be directed cranially.

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Diagnosis*</th>
<th>Age</th>
<th>Weight (lb)</th>
<th>Percentile of Expected Weight</th>
<th>Length of Follow-up (mo)</th>
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<tr>
<td>1</td>
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<td>58</td>
<td>&lt;5th</td>
<td>9</td>
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<td>&lt;5th</td>
<td>7</td>
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<td>3</td>
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<td>75th</td>
<td>18</td>
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<tr>
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<td>9 yr, 8 mo</td>
<td>41</td>
<td>&lt;5th</td>
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<tr>
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<td>6 yr, 8 mo</td>
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<td>&lt;5th</td>
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<td>6</td>
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<tr>
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<tr>
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<td>4 yr, 8 mo</td>
<td>44</td>
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</table>

* CP, cerebral palsy.

FIGURE 1. Photograph showing the typical body habitus of a pediatric patient with spastic quadriplegic cerebral palsy indicated for intrathecal baclofen therapy and the position of the patient on the operating table before the start of the procedure.

FIGURE 2. Schematic of the location of the skin incision relative to a putative position of the intrathecal baclofen pump. The incision can be made above or below the pump, depending on the patient’s body habitus. Note the relative position of the incision versus that of the access port.
ally or caudally. The skin incision is either above or below the pump itself but never across the device (Fig. 2). A subcutaneous plane is dissected by using sharp technique until the anterior rectus abdominus and the external oblique fascia are identified (Fig. 3). An incision is made in the anterior rectus and external oblique sheaths by using a No. 15 blade knife, and a plane is developed between the fascial and muscle layers by using a combination of blunt and sharp dissection techniques (Fig. 4). Hemostasis is achieved with the use of bipolar cautery. The linea semilunaris, the tendinous raphe between the rectus abdominus and external oblique muscles, is divided to allow enough space for the pump.

FIGURE 3. Intraoperative photograph showing dissection of the subcutaneous plane. Note the relative paucity of the subcutaneous layer. The anterior rectus sheath and external oblique fascial layers are identified.

FIGURE 4. Intraoperative photograph showing the initial fascial incision through the external oblique and abdominal rectus fascial layers.

FIGURE 5. Schematic cross section of the subfascial pocket for the baclofen pump. The various layers and tendinous insertions are identified. Note that the pocket is formed under the fascial layers of the rectus abdominus and external oblique muscles. The linea semilunaris, the tendinous raphe between these muscles, is divided to allow enough space for the pump.

FIGURE 6. Intraoperative photograph showing the position of the pump in the subfascial pocket.

FIGURE 7. Intraoperative photograph showing closure of the fascial layers with the implanted pump in place.

RESULTS

In this series of subfascially implanted pumps, no infection or skin breakdown at the implantation site has occurred to date, with an average follow-up of 13.7 months (range, 3–27 mo). The improved cosmetic appearance that the subfascial technique affords as compared with the subcutaneous technique can be seen. The average hospital stay of our patients is 3 days. In our previous series of 12 patients undergoing subcutaneous pump implantation, 3 experienced infection that required removal of the pump.
DISCUSSION

Children with spastic cerebral palsy may be at increased risk for perioperative infection. Stallings et al. (9, 10) demonstrated that the pediatric population affected by spastic neurological illness is both undernourished and underweight. This delay in children’s growth is characterized by a marked reduction in body weight (64% of the median) and fat stores (61–81% of the median), with general sparing of lean body mass (88% of the median). Furthermore, studies reported in the literature have directly associated malnutrition states with immune dysfunction (4–6). A recent study specifically demonstrated that children with cerebral palsy are malnourished and that “disturbances in the immune system secondary to malnutrition predispose these patients to infection” (11, p 674). In our report, most of the patients were significantly underweight and had limited soft tissue available for coverage of the pump, leading us to seek a more optimal implantation technique.

The new subfascial technique, although no more difficult than subcutaneous implantation, provided more substantial soft tissue coverage of the pump at the implantation site. Even though the subfascial pump lies deeper than a subcutaneously implanted pump, it is easily palpable, and refilling is not more difficult than a pump that is implanted subcutaneously. We have also observed fewer complications of infections and skin breakdown at the site of implantation as compared with data from previous reports using the subcutaneous technique (1–3, 7). Other investigators have reported significant complication rates with regard to skin breakdown and subsequent pump/wound infections in the pediatric population. In a recent multicenter study of both adults and children, 5 (13%) of 39 baclofen pump implantations were complicated by wound infections, with three of the five patients requiring pump explantation (7). In the most recently reported pediatric series, Armstrong et al. (7) found that 4 of 12 patients developed local pump infections. In one of these patients, the infection developed 4 years after implantation. These rates are in concordance with our own prior surgical experience with the use of subcutaneously implanted pumps.

We believe that subfascial implantation seems promising in reduced-weight pediatric patients with spasticity of cerebral origin. The rate of infectious complications as compared with subcutaneous implantation seems to be less. The underlying mechanism of this effect remains to be demonstrated. The cosmetic results seem superior with the use of the subfascial placement. It will be of interest to apply this technique to selected adult patients in whom cosmetic appearance is of particular concern.

REFERENCES


COMMENTS

This article reports the results of subfascial placement of baclofen pumps in 18 children as young as 4 years of age and weighing as little as 27 lb. Clearly, the relatively large size of the pump is a concern in these children, both for cosmetic reasons and given the serious consequences of wound breakdown. Since this technique was first described orally (P Grabb, personal communication), I believe that many pediatric neurosurgeons have been using it, at least in smaller patients. The pumps do not seem to be harder to refill in the deeper location, so the only possible downsides to their use are slightly more dissection and that the patient probably will experience more pain immediately after the operation. The authors’ patients did not experience any wound infections; but with such a small series, it is impossible to know whether this outcome is related to this particular technique.

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Kopell et al. provide a timely technical note on a subfascial implantation of intrathecal baclofen pumps. In a number of centers, this technique is being used instead of the subcutaneous implantation of pumps that had been used previously. A number of anecdotal reports have indicated that this technique is not only feasible but also might reduce the number of local complications associated with the implantation of these devices. This technical note will be helpful to others who implant the pump subcutaneously and need guidance as well as to those who might be considering this procedure.

Paul Steinbok
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I first heard of subfascial pump placements in 1996 from an orthopedist in England who used the technique in adult patients into whom he implanted pumps for spinal spasticity. Since then, I have placed pumps subfascially in approximately 180 patients and published a description of the technique in a recent pediatric neurosurgery atlas (1).

The subfascial placement is helpful in children and adults whose subcutaneous tissue is less than 2 cm, which comprises the great majority of those with cerebral spasticity who are candidates for a pump. The subfascial dissection can be performed almost bloodlessly with the needle tip on a coagulating cautery. Once the pump is implanted into the subfascial pocket, it must be affixed to the underlying muscles with sutures through at least two of the pump’s suture eyelets.

The main advantages of subfascial placements are the lower profile of the pump and the reduced tension on the skin edges. As Kopell et al. note, many candidates for pumps are undernourished and seem prone to infection. Although the subfascial placement has improved wound edge healing, it has not decreased the incidence of infection among patients at my institution. A frequent question is whether subfascial pumps are more difficult to refill; they are not. The fascia is less than 1 mm thick, and that additional thickness does not impede palpation of the septum or identification of the pump edges. Techniques of pump replacement are not significantly different, regardless of whether the pump is above or below the fascia.

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This technical note describes a useful point. Baclofen pumps are large, bulky devices, and the other children who need them are often small and debilitated, leading to skin breakdown over the pump in the abdomen. Particular problems are noted when spine braces may rub the area of the device. Placing the pump in the subfascial compartment may help eliminate some of these problems. In small children, this space is also small. Ultimately, these pumps will undoubtedly be made smaller, which will help alleviate these problems. In the meantime, one must be vigilant with these implants and consider moving the pump if skin breakdown looks imminent.

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