Research Article


Markus A. Bendel, 1  Susan M. Moeschler, 1  Wenchun Qu, 1  Eugerie Hanley, 2  Stephanie A. Neuman, 3  Jason S. Eldrige, 1  and Bryan C. Hoelzer 1

1 Mayo Clinic, Rochester, MN 55905, USA
2 Ozark Orthopaedics, Fayetteville, AR 72703, USA
3 Gundersen-Lutheran Health System, La Crosse, WI 54601, USA

Correspondence should be addressed to Markus A. Bendel; bendel.markus@mayo.edu

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A recent publication reported the incidence of postdural puncture headache (PDPH) in conjunction with intrathecal drug delivery system (IDDS) implantation to be nearly 23 percent. Many patients responded to conservative measures but a percentage needed invasive treatment with an epidural blood patch (EBP). There is limited data to describe the technical details, success rates, and complications associated with EBP in this population. This study aims to provide a retrospective report of EBP for patients suffering from PDPH related to IDDS implantation. A chart review established a cohort of patients that required EBP in relation to a PDPH after IDDS implantation. This cohort was evaluated for demographic data as well as details of the EBP including technical procedural data, success rates, and complications. All patients received a trial of conservative therapy. Standard sterile technique and skin preparation were utilized with no infectious complications. The EBP was placed below the level of the IDDS catheter in 94% of procedures. Fluoroscopy was utilized in each case. The mean EBP volume was 18.6 cc and median time of EBP was day 7 after implant. There were no complications associated with EBP. EBP appears to be an effective intervention in this subset of PDPH patients.

1 Introduction

Intrathecal drug delivery system (IDDS) implantation can be an efficacious tool in managing patients with spasticity, chronic malignant or nonmalignant pain [1–9]. Many advances in our understanding of intrathecal medication administration and steady improvements in technology have helped to shape the best practices associated with device implantation and management [10]. However, this intervention is not without complication. Hematoma formation, neurologic injury, system failure, infection, catheter-associated granuloma formation, opioid induced hyperalgesia, continuous cerebrospinal fluid leak, seroma formation, and postdural puncture headache (PDPH) are known complications of IDDS placement [11–17].

A recently published retrospective review examining the incidence of PDPH in conjunction with IDDS implantation found symptoms in nearly 23 percent of patients [11]. The majority of these patients were managed conservatively with standard of care noninvasive measures including bedrest, intravenous hydration, caffeine supplementation, and analgesic medication administration [18, 19]. However, some patients continued to suffer severe symptoms of PDPH warranting an interventional management approach.

Epidural blood patch (EBP) is a well-described technique used to provide relief to patients suffering from resistant or severe PDPH. There is evidence to support its efficacy in relieving postdural puncture headache [20–23]. However, debate still remains regarding the necessity, effectiveness, timing, and exact technique of EBP [24, 25]. EBP
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carries a small risk of complications including unintended
dural puncture, subarachnoid spread, hematoma formation, increased intracranial pressure, and neurologic injury [26–
29]. However, the combination of the known risks of EBP and patients who have long-term intrathecal catheters in situ
prompts new consideration. There are case reports describing the application of EBP or fibrin glue patch in patients with
IDDS implants in the setting of continuous cerebrospinal fluid leak [30–33]. There is a scarcity of published material
describing the outcomes, technical details, and complications associated with epidural blood patch in the PDPH population
with IDDS in place. This provides a difficult landscape from which to ascertain the best practice in managing this small
but important subset of patients with PDPH.

2. Objective
The objective of the current study was to provide a detailed
review of management of refractory postdural puncture
headache in patients with implanted IDDS who required epidural blood patch procedures over a 20-year time frame at
a single academic tertiary care medical center (Mayo Clinic,
Rochester, MN).

3. Methods
Following appropriate institutional review board (IRB)
approval, we performed a retrospective cohort study based
upon a 20-year chart review of clinical experience at a large
academic medical center (Mayo Clinic, Rochester, MN).
Patients who underwent placement of an IDDS during the
period between June 1, 1989, and May 31, 2009, were included.
The Mayo Clinic medical data retrieval service identified all
patients who underwent implantation of an IDDS in this
time frame with the use of ICD-9 codes. As described in the
prior publication [11], a subset of patients who had symptoms
consistent with PDPH was identified by examining all inpa-
tient and outpatient clinical notes for a three-week period
following IDDS implantation. This subset was examined for
patients that proceeded to invasive intervention in the form
of epidural blood patch. This formed the cohort.

The following data points were harvested from each med-
ical record of the cohort: age at time of IDDS implantation,
gender, indication for IDDS, date of IDDS implantation,
methods of conservative PDPH management, IDDS catheter
entry level, epidural blood patch level, epidural blood patch
volume, interval between IDDS implantation and epidural
blood patch, and preepidural blood patch skin prepara-
tion method. Improvement in headache symptoms after
blood patch was recorded. Finally, each record was carefully
screened for immediate and delayed post-EBP complications.

4. Results
The medical data retrieval service returned 319 surgical
reports on 285 different patients over the specified time
frame. As previously reported, chart review uncovered post-
dural puncture headache symptoms in 73 patients (22.9%)
[11]. Of the patients with PDPH, 15 patients had symptoms
refractory to conservative treatment and required 17 epidural
blood patch procedures. The complete results are summa-
rized in Table 1.

4.1. Conservative Treatments. All patients received a trial of
at least one conservative measure. The conservative measures
and their incidence of use in this cohort are as follows:
bedrest (100%), intravenous hydration (67%), caffeine (67%),
acetaminophen (47%), and antiemetic therapy (27%). See
Table 2.

4.2. Infectious Precautions. All epidural blood patches were
performed under standard sterile technique. Three cases did
not have skin preparation explicitly documented (20%). All
others were completed with chlorhexidine (60%), betadine
(13%), or both (7%). One patient received prophylactic
intravenous antibiotics due to proceduralist preference.

4.3. Image Guidance. All of the procedures were performed
with fluoroscopic guidance to ensure proper needle position-
ing.

4.4. EBP Level. The blood patch was performed below the
level of the IDDS catheter insertion in 94% of cases. See
Table 3.

4.5. EBP Blood Volume. One procedure did not have volume
administered explicitly recorded in the medical chart. The
mean volume for the remaining procedures was 18.6 mL. The
volume administered was determined by the development
of patient reported paresthesias or a maximum volume of
20 mL.

4.6. EBP Timing. The initial blood patch was placed on
median postimplantation day number 7. The range of initial
blood patch timing ranged from 3 to 36 days after IDDS
implantation. Two patients required repeat blood patch
application—these occurred on days 15 and 28 after implant
which were 3 and 8 days after the initial EBP, respectively. See
Table 4.

4.7. PDPH Symptom Resolution. All patients reviewed
achieved relief of the PDPH symptoms. First-time blood
patch success rate was 10/15 (67%). Two patients required
repeat blood patches that were both successful (13%). Three
patients (20%) were found to have persistent cerebrospinal
fluid leak that required reoperation with purse-string suture
placement and/or surgical fibrin glue placement at the IDDS
catheter entrance site.

4.8. Complications. We found no complications directly
related to performing an epidural blood patch in this cohort.

5. Discussion
The goal of this study was to address the relative paucity
of published technical data in placing an epidural blood
Table 1: Summary of results.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Gender</th>
<th>Indication</th>
<th>Conservative treatments</th>
<th>Catheter level</th>
<th>EBP level</th>
<th>Image guidance?</th>
<th>Volume (mL)</th>
<th>POD#</th>
<th>Skin prep</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54</td>
<td>M</td>
<td>Multiple sclerosis</td>
<td>1, 2, 3, 5</td>
<td>L1-2</td>
<td>L2-3</td>
<td>Yes</td>
<td>20</td>
<td>4</td>
<td>ChloraPrep</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>49</td>
<td>F</td>
<td>Ovarian cancer</td>
<td>1, 2, 3, 4, 5</td>
<td>L4-5</td>
<td>L5-S1</td>
<td>Yes</td>
<td>20</td>
<td>5</td>
<td>ChloraPrep</td>
<td>None</td>
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<tr>
<td>3</td>
<td>57</td>
<td>M</td>
<td>Multiple sclerosis</td>
<td>1</td>
<td>L2-3</td>
<td>L3-4</td>
<td>Yes</td>
<td>20</td>
<td>36</td>
<td>ChloraPrep</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>49</td>
<td>F</td>
<td>Spasticity; spinal cord injury</td>
<td>1, 2, 3, 4, 5, 6</td>
<td>L3-4</td>
<td>L4-5</td>
<td>Yes</td>
<td>12</td>
<td>13</td>
<td>ChloraPrep</td>
<td>None</td>
</tr>
<tr>
<td>5*</td>
<td>54</td>
<td>M</td>
<td>Prostate cancer</td>
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<td>T10-11</td>
<td>T10-11</td>
<td>Yes</td>
<td>15</td>
<td>16</td>
<td>Bacitracin</td>
<td>None</td>
</tr>
<tr>
<td>6</td>
<td>45</td>
<td>F</td>
<td>Multiple sclerosis</td>
<td>1</td>
<td>L2-3</td>
<td>L4-5</td>
<td>Yes</td>
<td>20</td>
<td>3</td>
<td>ChloraPrep</td>
<td>None</td>
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<tr>
<td>7**</td>
<td>72</td>
<td>M</td>
<td>Lung cancer</td>
<td>1, 2</td>
<td>L1-2</td>
<td>L3-4</td>
<td>Yes</td>
<td>15</td>
<td>20</td>
<td>ChloraPrep</td>
<td>None</td>
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<tr>
<td>8</td>
<td>45</td>
<td>F</td>
<td>Breast cancer</td>
<td>1, 3, 5</td>
<td>L2-3</td>
<td>L4-5</td>
<td>Yes</td>
<td>20</td>
<td>8</td>
<td>ChloraPrep</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>43</td>
<td>M</td>
<td>Spasticity; spinal cord injury</td>
<td>1, 2, 3</td>
<td>L2-3</td>
<td>L4-5</td>
<td>Yes</td>
<td>20</td>
<td>7</td>
<td>ChloraPrep</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>49</td>
<td>M</td>
<td>Pancreatic cancer</td>
<td>1, 2, 3, 4</td>
<td>L3-4</td>
<td>L5-S1</td>
<td>Yes</td>
<td>20</td>
<td>3</td>
<td>ChloraPrep</td>
<td>None</td>
</tr>
<tr>
<td>11**</td>
<td>30</td>
<td>M</td>
<td>Spasticity; spinal cord injury</td>
<td>1, 2, 3, 4, 5</td>
<td>L4-5</td>
<td>L5-S1</td>
<td>Yes</td>
<td>20</td>
<td>12</td>
<td>Betadine</td>
<td>None</td>
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<tr>
<td>12</td>
<td>34</td>
<td>F</td>
<td>Melanoma</td>
<td>1</td>
<td>L2-3</td>
<td>L3-4</td>
<td>Yes</td>
<td>18</td>
<td>14</td>
<td>Unknown</td>
<td>None</td>
</tr>
<tr>
<td>13</td>
<td>50</td>
<td>F</td>
<td>Pancreatic cancer</td>
<td>1, 2, 3, 5</td>
<td>L1-2</td>
<td>L5-S1</td>
<td>Yes</td>
<td>15</td>
<td>7</td>
<td>ChloraPrep</td>
<td>None</td>
</tr>
<tr>
<td>14</td>
<td>43</td>
<td>F</td>
<td>Multiple sclerosis</td>
<td>1, 2, 3, 5</td>
<td>L2-3</td>
<td>L3-4</td>
<td>Yes</td>
<td>20</td>
<td>6</td>
<td>Betadine</td>
<td>None</td>
</tr>
<tr>
<td>15</td>
<td>53</td>
<td>F</td>
<td>Multiple sclerosis</td>
<td>1</td>
<td>L3-4</td>
<td>L5-S1</td>
<td>Yes</td>
<td>Unknown</td>
<td>7</td>
<td>Unknown</td>
<td>None</td>
</tr>
</tbody>
</table>

Key: conservative treatments:
1. Bedrest.
2. IV fluids.
3. Caffeine.
4. Antiemetics.
5. Acetaminophen.
6. Opioids.

* Patient found to have persistent CSF leak despite initial blood patching. Ultimately required reopening of the incision and placement of a purse-string stitch and/or fibrin glue along the catheter insertion site.

** Transient relief after initial blood patch. Blood patch was repeated and symptoms resolved.
Table 2: Incidence of conservative treatments.

<table>
<thead>
<tr>
<th>Number of conservative treatments employed</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27% (4/15)</td>
</tr>
<tr>
<td>2</td>
<td>7% (1/15)</td>
</tr>
<tr>
<td>3</td>
<td>20% (3/15)</td>
</tr>
<tr>
<td>4+</td>
<td>47% (7/15)</td>
</tr>
</tbody>
</table>

Table 3: Location of epidural blood patch.

<table>
<thead>
<tr>
<th>Location of EBP relative to IDDS catheter</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>At IDDS insertion site</td>
<td>6% (1/17)</td>
</tr>
<tr>
<td>1 level below</td>
<td>47% (8/17)</td>
</tr>
<tr>
<td>2 levels below</td>
<td>35% (6/17)</td>
</tr>
<tr>
<td>3 or more levels below</td>
<td>12% (2/17)</td>
</tr>
</tbody>
</table>

Table 4: Timing of epidural blood patch after IDDS implant.

<table>
<thead>
<tr>
<th>Time of EBP after IDDS implant</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–7 days</td>
<td>53% (8/15)</td>
</tr>
<tr>
<td>8–14 days</td>
<td>27% (4/15)</td>
</tr>
<tr>
<td>15+ days</td>
<td>20% (3/15)</td>
</tr>
</tbody>
</table>

Epidual blood patching appears to be an effective intervention for patients who are afflicted with PDPH related to IDDS implantation. A majority of the patients obtained lasting relief after application of a single blood patch, while a small subset needed a second blood patch. This is consistent with success rates of EBP in other patient populations [22, 23]. Of the patients who did not respond initially, it appears reasonable to proceed with repeat EBP or epidural fibrin glue administration. On rare occasions, patients may require operative intervention with dural repair or revision.

Limitations. This study has recognizable limitations. Although our dataset spans a time frame of 20 years, it includes only 15 patients in our cohort. It is difficult to extrapolate to an entire population based on this sample size. Secondly, a retrospective chart review study design is not sufficient to establish any cause-effect relationship, but it would be very difficult to construct a randomized, prospective trial to assess the effectiveness of this intervention. Lastly, this dataset includes a compilation of several proceduralists with varying preferences in their procedural technique. It is impossible to control for individual preference retrospectively and this makes the interpretation of the results more difficult.

6. Conclusions

In conclusion, this study has evaluated the largest known-to-date cohort of patients with PDPH after IDDS implant and provided a technical report on how these patients have been managed with EBP. EBP appears to be an effective intervention in this subset of PDPH patients and no complications were observed utilizing the techniques as outlined above. Repeat blood patches or epidural fibrin glue administration may be helpful for patients who do not respond to initial EBP.

Competing Interests

The authors have no relevant competing interests to disclose.

References


