Inclusion Criteria:
- Patients 21 years old and under
- Patients with thoracic or lumbar epidurals

Exclusion Criteria:
- Patients with cervical epidurals
- Uncooperative patients
- Patients with developmental or cognitive delays unable to follow verbal instructions

Background

Epidural analgesia is recognized as an effective and adequate form of regional anesthesia for controlling acute perioperative pain in the pediatric population. (1) Epidural analgesia provides effective postoperative pain relief which facilitates early recovery, rapid weaning from ventilators, a decrease in postoperative analgesia requirements, and improves the postoperative course. However, epidural analgesia is also associated with serious, potentially life-threatening complications. Lower leg motor weakness is one of the significant complications which requires early recognition and intervention to minimize the effect of this complications. (2) Lower leg motor weakness may signify the development of an epidural hematoma or abscess, spinal cord infarction, excessive drug administration, or direct spinal cord injury. Motor block assessment is fundamental to monitoring of patients with lumbar or thoracic epidural analgesia and assists with clinical identification of serious complications. The Bromage Scale is an accepted tool for the measurement of motor block. (3) This scale assesses the intensity of motor block by the patient’s ability to move their lower extremities. For children, it should be age appropriate, performed regularly, and in conjunction with an assessment of the patient’s status, temperature, and an examination of the epidural site.

Critically Analyze the Evidence

The GRADE criteria were used to evaluate the quality of evidence presented in research articles reviewed during the development of this guideline. The table below defines how the quality of evidence is rated and how a strong versus a weak recommendation is established.

<table>
<thead>
<tr>
<th>Quality</th>
<th>Type of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies</td>
</tr>
<tr>
<td>Moderate</td>
<td>Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies</td>
</tr>
<tr>
<td>Low</td>
<td>Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence</td>
</tr>
<tr>
<td>Very Low</td>
<td>Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence</td>
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</tbody>
</table>

PICO Question 1: In patients 21 years old and younger receiving lumbar and thoracic epidurals, is the Bromage scale suitable for accessing motor block levels?

Recommendation(s): Strong recommendation with very low quality evidence to utilize the Bromage scale for assessment of motor block levels in patients 21 years old and younger with lumbar or thoracic epidurals. (6-8)

Remarks: All studies involved adult patients.

A review of literature revealed 1 systematic review, 1 randomized controlled trial and 2 observational studies regarding the use of the Bromage score or modified Bromage score in the adult population. A 2014 systematic review demonstrated that there is a lack of a standard for the assessment of motor block prior to a cesarean section. (6) The study was unable to find a clear and consistent tool in either textbooks or published literature. The lack of “gold standard” for assessment of motor block means it is very difficult for anesthetists to decide what constitutes best practice, and adjust their own practice accordingly. Lanz 1983 determined that dynamometry was a time consuming and costly method for accurate quantification of motor blockade for orthopedic patients during...
epidural anesthesia. (7) The article concluded that the Bromage score is a more practical tool under clinical considerations and provides useful information. Ahmed 2016, an observational study, determined that lower limb motor weakness occurred in 36.5% patients and was more common with a lumbar epidural. (8) Leg weakness for all study participants was successfully managed using the modified Bromage scale to assess for leg weakness. In the final observational study, Graham 2001, the study concluded that further research was needed to develop a quantitative measurement methods to assess motor block in laboring women, in addition to the modified Bromage Scale. (9)

Critical Points of Evidence

Evidence Supports

- The Bromage score is a practical tool for the assessment of motor block in the clinical setting. Several studies discuss quantifying motor block scores by use of devices to measure the force of isometric muscle contraction or by using average rectified electromyography. However, most of these devices are not easily performed in the clinical setting and are expensive. (7,8) – Strong recommendation, very low quality evidence
- Inclusion of the Bromage score in the assessment of patients with lumbar epidurals allows for successful management of leg weakness. (8) – Strong recommendation, low quality evidence

Evidence Lacking/Inconclusive

- Validation of the Bromage scale or the modified Bromage scale for the management of leg weakness following epidural analgesia
- The efficacy of utilizing the Bromage scale in the pediatric population.
- Age-appropriate or developmentally appropriate modifications of the Bromage scale.
- The use of the Bromage or modified Bromage scale for epidural management in patients with epidural analgesia for orthopedic procedures on the lower extremities.
Appendix A

Bromage Scale Legend

Stop infusion and contact Pain Services

Stop Infusion and contact Pain Services

Contact Pain Services for patient assessment and order review

Observe hourly for first 4 hours, then every 4 hours
Appendix B

**TEXAS CHILDREN’S HOSPITAL EVIDENCE-BASED OUTCOMES CENTER**
Management of leg weakness after epidural analgesia Algorithm

Patient with lumbar or thoracic epidural infusion in progress

Increasing leg weakness? Bromage score 2 or 3?

**NO**
- Contact Pain Services to reassess the patient’s analgesia. Routine observations q 4 hrs. Return to unit once discharge criteria met.

**YES**
- Switch off epidural infusion. Contact Pain Services and inform them of situation

Contact Pain Services for patient assessment and review of orders

Reassess leg strength every 15 minutes

Leg strength improving?

**YES**
- Patient comfortable?
  - **YES**
    - Restart epidural infusion as necessary; consider bolusing epidural
  - **NO**
    - Contact Pain Services to reassess the patient’s analgesia

**NO**
- 2 hrs since stopping epidural infusion?
  - **YES**
    - Contact Pain Services, IMMEDIATELY. Suspect an epidural hematoma
    - Urgent MRI scan <4hrs of onset of adverse clinical signs
  - **NO**
    - Continue to reassess leg strength every 15 minutes. Contact Pain Service for patient reassessment after 3 hours

**Inclusion Criteria:**
- Patients 21 years old and under
- Patients with thoracic or lumbar epidurals

**Exclusion Criteria:**
- Patients over the age of 21 years old
- Patients with cervical epidurals
- Uncooperative patients
- Patients with developmental or cognitive delays unable to follow verbal instructions

Please refer to Procedure #1948, Communication of Clinical Concern Procedure. An epidural hematoma has to be evacuated within 8 hours of onset of symptoms for the patient to have the best chance of recovery of neurologic function. **DO NOT DELAY**.
References


2. The Royal College of Anesthetists, Faculty of Pain Medicine (2010). Best practice in the management of epidural analgesia in the hospital setting.


Clinical Standards Preparation
This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children’s Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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Kathy Carberry, MPH, RN, Director
No relevant financial or intellectual conflicts to report.

Development Process
This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:
1. Review Preparation
   - PICO questions established
   - Evidence search confirmed with content experts
2. Review of Existing Internal and External Guidelines
   - Practice guidelines for acute pain management in the perioperative setting
   - Best practice in the management of epidural analgesia in the hospital setting
   - Epidural analgesia guideline
   - Anesthesia and Pain Management epidural guideline
3. Literature Review of Relevant Evidence
   - Searched: PubMed, Cochrane
4. Critically Analyze the Evidence
   - 1 systematic review, 1 randomized controlled trial, and 2 nonrandomized studies
5. Summarize the Evidence
   - Materials used in the development of the guideline, evidence summary, and order sets are maintained in a Bromage Scale evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence
Published clinical guidelines were evaluated for this review using the AGREE II criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence in support of or against specific interventions and identifies where evidence is lacking/inconclusive. The following categories describe how research findings provide support for treatment interventions. “Evidence Supports” provides clear evidence that the benefits of the intervention exceed harm. “Evidence Against” provides clear evidence that the intervention is likely to be ineffective or that it is harmful. “Evidence Lacking/Inconclusive” indicates there is currently insufficient data or inadequate data to support or refute a specific intervention. The GRADE criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

<table>
<thead>
<tr>
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<tr>
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<td>Desirable effects clearly outweigh undesirable effects or vice versa</td>
</tr>
<tr>
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<td></td>
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- 1 systematic review, 1 randomized controlled trial, and 2 nonrandomized studies
- Evidence search confirmed with content experts
- Practice guidelines for acute pain management in the perioperative setting
- Best practice in the management of epidural analgesia in the hospital setting
- Epidural analgesia guideline
- Anesthesia and Pain Management epidural guideline
- Searched: PubMed, Cochrane
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- Materials used in the development of the guideline, evidence summary, and order sets are maintained in a Bromage Scale evidence-based review manual within EBOC.

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- Evidence from unbiased observational studies
- Evidence from RCTs with serious flaws or indirect evidence
- Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
- Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
- Evidence for at least 1 critical outcome from systematic clinical observations or very indirect evidence

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Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies in the management of leg weakness after epidural analgesia in children with lumbar or thoracic epidurals. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process
Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children’s Hospital. Content Expert Teams are involved with every review and update.

Disclaimer
Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care, and are not intended to be used to dictate a course of care. Each physician/practitioner must use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient family, to make the ultimate judgment regarding care.

Version History
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<th>Date</th>
<th>Action</th>
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<tr>
<td>Nov 2016</td>
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