

**TEXAS CHILDREN'S HOSPITAL**  
**EVIDENCE-BASED OUTCOMES CENTER**  
 Management of leg weakness after epidural analgesia- Bromage Scale  
 Evidence Summary

**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. <sup>(1)</sup> 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.<sup>(2)</sup> 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. <sup>(3)</sup> 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.

Recommendation	
<b>STRONG</b>	Desirable effects clearly outweigh undesirable effects or vice versa
<b>WEAK</b>	Desirable effects closely balanced with undesirable effects
Quality	Type of Evidence
<b>High</b>	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
<b>Moderate</b>	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
<b>Low</b>	Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence
<b>Very Low</b>	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

**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 <sup>(6-8)</sup>

**Remarks:** All studies involved adult patients

A review of literature revealed one systematic review, one randomized controlled trial and two 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. <sup>(6)</sup> 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.<sup>(7)</sup> 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.<sup>(8)</sup> 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.<sup>(9)</sup>

### **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. <sup>(7,8)</sup> – 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.<sup>(8)</sup> – 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**

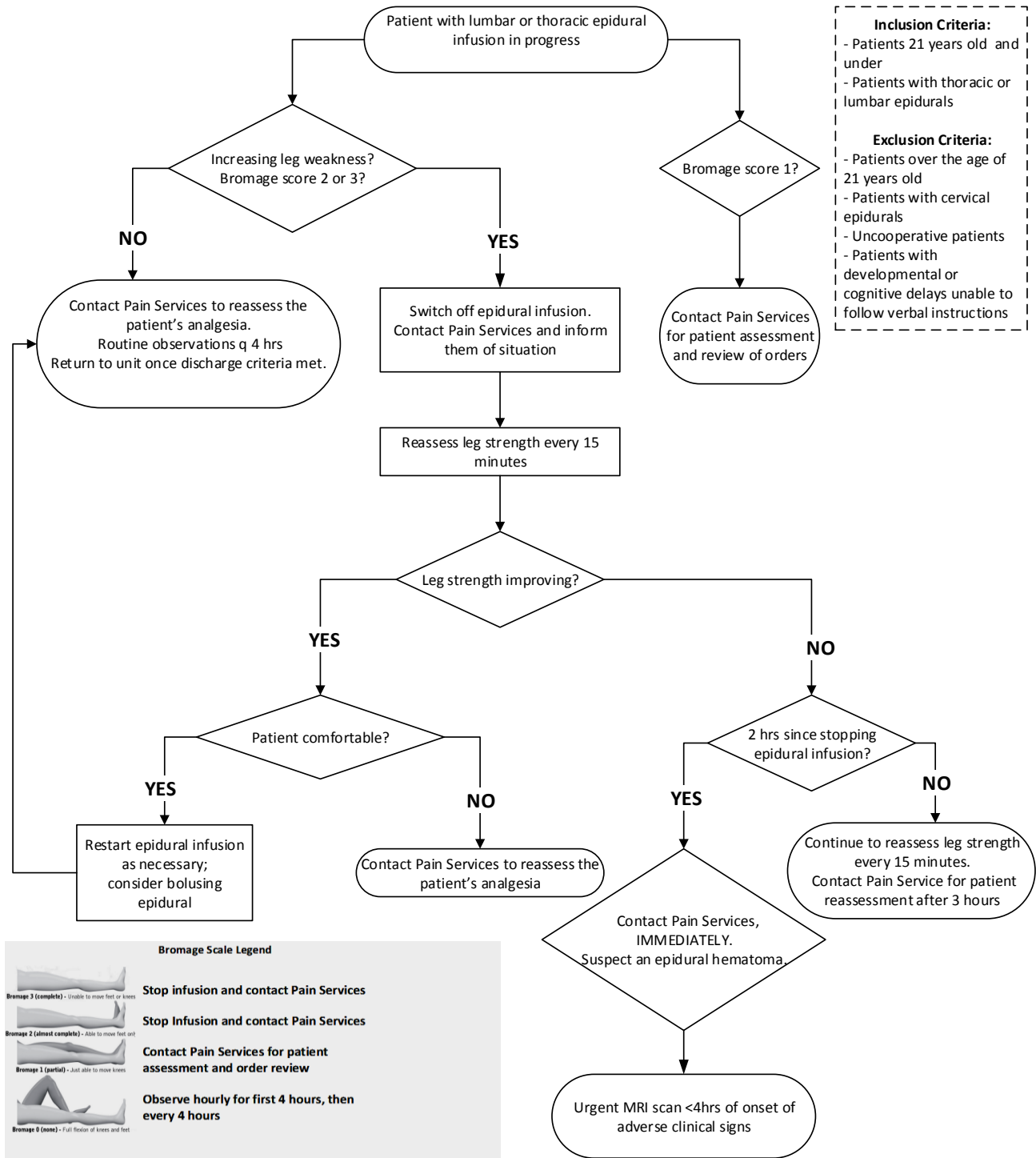


**Contact Pain Services for patient assessment and order review**



**Observe hourly for first 4 hours, then every 4 hours**

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Management of leg weakness after epidural analgesia Algorithm**



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

1. American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology* (2012). Practice guidelines for acute pain management in the perioperative setting.
2. The Royal College of Anesthetists, Faculty of Pain Medicine (2010). Best practice in the management of epidural analgesia in the hospital setting.
3. Great Ormond Street Hospital For Children (2015). Epidural analgesia guideline.
4. Royal Children's Hospital of Melbourne (2014). Anesthesia and Pain Management epidural guideline.
5. Bromage PR. Philadelphia: WB Saunders; 1978: 144.
6. Hoyle, J. & Yentis, S. M. (2014). Assessing the height of block for caesarean section over the past three decades: trends from the literature. *Anaesthesia* 2015, 70, 421-28.
7. Lanz, E., Theiss, D., Kellner, G., Zimmer, M., & Staudte, H. (1983). Assessment of Motor Blockade during Epidural Anesthesia. *Anesthesia & Analgesia* 1983; 62: 889-93.
8. Ahmed, A. & Baig, T. (2016). Incidence of lower limb motor weakness in patients receiving postoperative epidural analgesia and factors associated with it: An observational study. *Saudi Journal Anaesthesia Apr-Jun; 10(2): 149-153.*
9. Graham, A. C. & McClure, J. H. (2001). Quantitative assessment of motor block in laboring women receiving epidural analgesia. *Anaesthesia* 2001, 56, 470-76.

**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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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
  - 2 observational study
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.

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.

Recommendation	
<b>STRONG</b>	Desirable effects clearly outweigh undesirable effects or vice versa
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**Recommendations**

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 guideline 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**

Date	Comments
Nov 2016	Originally completed
Jan 2020	Reaffirmed