Congress of Neurological Surgeons Systematic Review and Evidence-Based Guidelines on the Evaluation and Treatment of Patients With Thoracolumbar Spine Trauma: Timing of Surgical Intervention

**QUESTION:** Does early surgical intervention improve outcomes for patients with thoracic and lumbar fractures?

**RECOMMENDATIONS:** There is insufficient and conflicting evidence regarding the effect of timing of surgical intervention on neurological outcomes in patients with thoracic and lumbar fractures.

Strength of Recommendation: Grade Insufficient

It is suggested that “early” surgery be considered as an option in patients with thoracic and lumbar fractures to reduce length of stay and complications. The available literature has defined “early” surgery inconsistently, ranging from <8 h to <72 h after injury.

Strength of Recommendation: Grade B

The full version of the guideline can be reviewed at: https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter_10.

**KEY WORDS:** Thoracic and lumbar fractures, Thoracic and lumbar fusion, Timing of surgery, Treatment of thoracic and lumbar fractures

Treatment methodology for thoracolumbar fractures has evolved over time. Adverse consequences of prolonged bed rest and the evolution of surgical technique have led to effective operative approaches for stabilization of thoracolumbar fractures. In many circumstances, surgery is now considered the optimal treatment for patients presenting with unstable thoracolumbar spine fractures.

However, the timing of surgical intervention in the setting of thoracolumbar fractures has been debated over the years, and the relationship of timing of surgical intervention to clinical outcome has not been well defined.

The goal of this guideline is to evaluate the available literature to determine if the timing of surgical intervention has an effect of the clinical outcome for patients suffering thoracic and lumbar fractures.

**METHODS**

Details of the systematic literature review are provided in the full text of this guideline (https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter_10) and in the methodology (https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter_1) article of this guideline series. The authors collaborated with a medical librarian to search articles published between January 1, 1946, and March 31, 2015, using the National Library of Medicine PubMed database and the Cochrane Database of Systemic Reviews, the Database of Abstracts of Reviews of Effect, the Cochrane Central Register of Controlled Trials, the Health Technology Assessment Database, and the NHS Economic Evaluation Database. See search strategies provided in Appendix I.
A total of 1172 citations were manually reviewed by the task force. The authors supplemented searches of electronic databases with manual screening of the bibliographies of all retrieved publications.

RESULTS

Of the 1172 citations, the task force selected 69 articles for full text review. Of these, 58 articles were rejected for not meeting inclusion criteria or for being off-topic. Eleven studies were selected for inclusion in this systemic review. Using these studies, the task force sought to determine the whether the literature supported a recommendation regarding the timing of surgical intervention in patients with thoracolumbar fractures. Please see the full text articles (Appendix II) for detailed analysis of each individual article (https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter_10).

DISCUSSION

Timing of Surgery

The literature was highly variable with regards to what the definition of “early” and “late” surgery was. Two papers defined early surgery as <8 h after injury,3,2 while 4 papers defined it as <24 h.5–7 One paper defined it as <48 h,7 and 4 defined it as <72 h.8–11 Because of the high degree of variability regarding the time to surgery, there is insufficient evidence to determine which cut-off would be an appropriate definition of early vs late surgery.

Neurological Recovery

Six studies evaluated neurological improvement in relation to timing of surgery.1–3,5–7 One study7 showed no difference in neurological recovery between early surgery and late surgery at 48 h, while 4 studies showed that early surgery may improve neurological recovery.1,2,5,6 Two studies5,6 showed that there is no indication for early surgery in complete spinal cord injury, and Schlegel et al12 showed that the presence of neurological deficit increased the risk of morbidity compared to patients who are neurologically intact, although this study included cervical patients. Rahimi-Movaghar et al13 also showed that neurological recovery can occur in both early and late surgery (before and after 24 h). The inconsistency of the data regarding neurological outcome in relation to timing of surgery in these 7 studies led to the recommendation of insufficient evidence regarding the effect of timing of surgical intervention on neurological outcome.

Length of Stay

Hospital length of stay and intensive care unit stay were reviewed in several studies, as well as the number of days of mechanical ventilation. Five studies showed that early surgery may decrease the hospital length of stay.1,4,8,10,11 However, none of the above-mentioned studies compared postoperative length of stay. Therefore, one can make the assertion that the longer length of stay in patients undergoing late surgery was directly related to the time of delay between admission and surgical intervention. In other words, for any given patient, a delay of several days between admission and surgery would increase that patient’s hospitalization by that amount of time. The more time that the patient is recumbent prior to surgery, the greater the patient’s length of stay, and therefore, increase the risk of complications related to recumbency.

Complications

Complications related to recumbency were reviewed in 6 studies.1,4,8–11 These studies also showed a correlation between longer length of stay and late surgery. Therefore, one would expect that the increased rate of complications is due to the prolonged recumbency for patients undergoing late surgery, and the increased time of recumbency between admission and surgical intervention for patients undergoing late surgery.

Mortality

There is insufficient evidence to conclude that morbidity is higher with early surgery compared to late surgery for those with thoracolumbar fractures. Overall, 2 Level III articles and 7 Level IV articles were positive for “early surgery”, while 1 Level III articles and 2 Level IV articles were negative for “early surgery”. However, the definition of early surgery was inconsistent among these articles.

Future Research

In reviewing the available medical literature, it is clear that there is a lack of research that adequately compares the timing of surgery to neurological outcome. Even the definition of “early” and “late” surgery varies considerably in the currently available literature. However, the nature of traumatic injuries does not lend itself to randomized controlled trials. The fact that many patients with thoracolumbar fractures also have concurrent multisystem injuries makes it difficult to parse out confounding factors that could also have an effect on the relationship between timing of surgery and neurological outcome. Future trials or the implementation of prospective registries are needed in order to ascertain a relationship between the timing of surgical intervention and neurological outcome for patients with thoracolumbar fractures.

CONCLUSION

The available medical literature is inconsistent in determining a definitive correlation between timing of surgical intervention and its effect on neurological outcome. The data suggests that early surgery reduces the length of hospitalization, and therefore may reduce the risk of complications related to recumbency. Surgery may be performed as early after injury as medically feasible in order to reduce the length of stay and complications related to recumbency for patients with thoracolumbar fractures. The
available literature has a highly variable definition of what is considered "early" surgery, ranging from <8 h to <72 h after injury.

Disclosures

These evidence-based clinical practice guidelines were funded exclusively by the Congress of Neurological Surgeons and the Section on Disorders of the Spine and Peripheral Nerves in collaboration with the Section on Neurotrauma and Critical Care, which received no funding from outside commercial sources to support the development of this document.

Potential Conflicts of Interest

The task force members were required to report all possible conflicts of interest (COIs) prior to beginning work on the guideline, using the COI disclosure form of the AANS/CNS Joint Guidelines Committee, including potential COIs that are unrelated to the topic of the guideline. The CNS Guidelines Committee and Guideline Task Force Chairs reviewed the disclosures and either approved or disapproved the nomination. The CNS Guidelines Committee and Guideline Task Force Chairs are given latitude to approve nominations of Task Force members with possible conflicts and address this by restricting the writing and reviewing privileges of that person to topics unrelated to the possible COIs. The conflict of interest findings are provided in detail in the companion introduction and methods manuscript (https://www.cns.org/guideline-chapters/congress-neurological-surgeons-systematic-review-evidence-based-guidelines/chapter_1). The authors have the following potential conflicts of interest: Dr Anderson: Aesculap-Consultant, SI Bone-Stock shareholder, Sarteco-Stock shareholder, Expanding Orthopedics-Stock shareholder, Titan Spine-Stock shareholder, RTI-Other, Stryker-Other, Lumar Spine Research Society-Board officer position (President), Dr Arnold: Medtronic-Consultant, Sofamor Danek-Consultant, Spine Wave-Consultant, InVivo-Consultant, Stryker Spine-Consultant, Evoke Medical-Stock shareholder, Z-Plasty-Stock shareholder, AO Spine North America-Sponsored or reimbursed travel (for self only), Dr Chi: DePuy Spine-Consultant, K2M-Consultant, Dr Dailey: K2M-Grants/Research support/Consultant, Zimmer Biomet-Consultant, Medtronic-Consultant, Dr Dhall: Globus Medical-Honorarium, Depuy Spine-Honorarium, Dr Harrop: DePuy Spine-Consultant, Astellas-Other/Scientific advisor, Teijin-Other/Scientific advisor, Biowentes-Other/Scientific advisor, AO Spine-Board, trustee, or officer position, Dr O’Toole: Globus Medical-Consultant fee, RTI Surgical-Consultant, Theracell, Inc.-Stock shareholder.

Disclaimer of Liability

This clinical systematic review and evidence-based guideline was developed by a multidisciplinary physician volunteer task force and serves as an educational tool designed to provide an accurate review of the subject matter covered. These guidelines are disseminated with the understanding that the recommendations by the authors and consultants who have collaborated in their development are not meant to replace the individualized care and treatment advice from a patient’s physician(s). If medical advice or assistance is required, the services of a competent physician should be sought. The proposals contained in these guidelines may not be suitable for use in all circumstances. The choice to implement any particular recommendation contained in these guidelines must be made by a managing physician in light of the situation in each particular patient and on the basis of existing resources.

REFERENCES


Acknowledgments

The guidelines task force would like to acknowledge the CNS Guidelines Committee for their contributions throughout the development of the guideline and the AANS/CNS Joint Guidelines Review Committee for their review, comments, and suggestions throughout peer review, as well as the contributions of Trish Rehring, MPH, CHES, Senior Manager of Clinical Practice Guidelines for the CNS, and Mary Bodach, MLIS, Guidelines Specialist and Medical Librarian for assistance with the literature searches. Throughout the review process the reviewers and authors were blinded from one another. At this time, the guidelines task force would like to acknowledge the following individuals with reviews for their contributions: Maya Babu, MD, MBA, Greg Hawryluk, MD, PhD, Steven Kalkanis, MD, Yi Lu, MD, PhD, Jeffrey J. Olson, MD, Martina Steppler, MD, Cheerag Upadhyaya, MD, MSc, and Robert Whitmore, MD.