General

Guideline Title

Management of acute traumatic central cord syndrome (ATCCS). In: Guidelines for the management of acute cervical spine and spinal cord injuries.

Bibliographic Source(s)


Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendations (Level I-III) are defined at the end of the "Major Recommendations" field.

Recommendations

Level III

- Intensive care unit (ICU) management of patients with acute traumatic central cord syndrome (ATCCS), particularly patients with severe neurological deficits, is recommended.
- Medical management, including cardiac, hemodynamic, and respiratory monitoring, and maintenance of mean arterial blood pressure at 85 to 90 mmHg for the first week after injury to improve spinal cord perfusion is recommended.
- Early reduction of fracture-dislocation injuries is recommended.
- Surgical decompression of the compressed spinal cord, particularly if the compression is focal and anterior, is recommended.

Summary

Class III medical evidence supports the aggressive medical management including ICU care of all patients with a spinal cord injury, including those with ATCCS. Class III medical evidence suggests that surgery for ATCCS is safe and appears to be efficacious (in conjunction with medical management) for patients with focal cord compression, or to provide operative reduction and internal fixation and fusion of cervical spinal fracture dislocation injuries. The role of surgery for patients with ATCCS with long segment cord compression/injury or with spinal stenosis without bony injury remains a subject of debate in the literature. Patient age and comorbidities are important factors when considering surgical treatment for
patients with ATCCS.

Definitions:

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question⁴

<table>
<thead>
<tr>
<th>Class</th>
<th>Therapeutic Studies: Investigating the Results of Treatment</th>
<th>Diagnostic Studies: Investigating a Diagnostic Test</th>
<th>Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals</td>
<td>Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference &quot;gold&quot; standard)</td>
<td>Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\hat{A}$ statistic ≥0.60 or an intraclass correlation coefficient of ≥0.70</td>
</tr>
<tr>
<td></td>
<td>Systematic review of Class I randomized controlled trials (and study results were homogeneous⁵)</td>
<td>Systematic review of Class I studies</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Lesser-quality randomized controlled trial (e.g., &lt;80% follow-up, no blinding, or improper randomization)</td>
<td>Development of diagnostic criteria on consecutive patients (with universally applied reference &quot;gold&quot; standard)</td>
<td>Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\hat{A}$ statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70</td>
</tr>
<tr>
<td></td>
<td>Prospective comparative study⁶</td>
<td>Systematic review of Class II studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systematic review of Class II studies or Class I studies with inconsistent results</td>
<td>Study of nonconsecutive patients; without consistently applied reference &quot;gold&quot; standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case-control study⁷</td>
<td>Systematic review of Class III studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retrospective comparative study⁶</td>
<td>Case-control study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systematic review of Class II studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Case series⁸</td>
<td>Poor reference standard</td>
<td>Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\hat{A}$ statistic of &lt;0.40 or an intraclass correlation coefficient of &lt;0.50</td>
</tr>
<tr>
<td></td>
<td>Expert opinion</td>
<td>Expert opinion</td>
<td></td>
</tr>
</tbody>
</table>

⁴A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

⁵A combination of results from 2 or more prior studies.

⁶Studies provided consistent results.

⁷Study was started before the first patient enrolled.

⁸Patients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

⁹The study was started after the first patient was enrolled.

ⁱPatients treated 1 way (e.g., failed fusion) are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

Levels of Recommendation
<table>
<thead>
<tr>
<th>Level</th>
<th>Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level  II</td>
<td>Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)</td>
</tr>
<tr>
<td>Level III</td>
<td>Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)</td>
</tr>
</tbody>
</table>

Clinical Algorithm(s)
None provided

Scope

Disease/Condition(s)
Acute traumatic central cord syndrome (ATCCS), including:
- Hyperextension injuries superimposed on spinal stenosis
- Fracture subluxations
- Acute disc herniation
- Spinal cord injury without any radiographic abnormality

Guideline Category
Management
Treatment

Clinical Specialty
Critical Care
Neurological Surgery
Orthopedic Surgery

Intended Users
Advanced Practice Nurses
Hospitals
Nurses
Physician Assistants
Physicians

Guideline Objective(s)
To update the medical evidence on acute traumatic cervical central cord syndrome (ATCCS) focused on the specific issues of the natural history, medical management, and the potential surgical treatment of ATCCS
Target Population

Patients with acute traumatic central cord syndrome (ATCCS)

Interventions and Practices Considered

1. Intensive care unit (ICU) management of patients
2. Medical management, including cardiac, hemodynamic, and respiratory monitoring, and maintenance of mean arterial blood pressure at 85 to 90 mmHg for the first week
3. Early reduction of fracture-dislocation injuries
4. Surgical decompression of the compressed spinal cord

Major Outcomes Considered

- Improvement in American Spinal Injury Association (ASIA) motor score
- Functional outcome (ambulation, hand function, bladder function, bowel function)
- Neurological deterioration
- Length of hospital and rehabilitation stay

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Search Criteria

A computerized search of the National Library of Medicine (PubMed) database of the literature published from 1966 to 2011 was undertaken. The medical subject headings "central cord syndrome" yielded 1533 citations, "spinal cord injury combined with central cord syndrome" yielded 421 citations, and "traumatic central cord syndrome" yielded 74 citations. Non-English language citations were excluded.

These search parameters resulted in 29 articles specifically describing the management and outcome of patients with central cervical spinal cord injuries. The reference lists of these articles were searched for any additional articles germane to this topic. A comprehensive, contemporary bibliography is provided containing 101 citations.

Number of Source Documents

Twenty-nine manuscripts make up the foundation for this updated review and are summarized in Evidentiary Table format (see Table 2 in the original guideline document).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)
Rating Scheme for the Strength of the Evidence

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question

<table>
<thead>
<tr>
<th>Class</th>
<th>Therapeutic Studies: Investigating the Results of Treatment</th>
<th>Diagnostic Studies: Investigating a Diagnostic Test</th>
<th>Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals</td>
<td>Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference &quot;gold&quot; standard)</td>
<td>Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\hat{A}$ statistic $\geq 0.60$ or an intraclass correlation coefficient of $\geq 0.70$</td>
</tr>
<tr>
<td></td>
<td>Systematic review$^b$ of Class I randomized controlled trials (and study results were homogeneous$^c$)</td>
<td>Systematic review$^b$ of Class I studies</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Lesser-quality randomized controlled trial (e.g., $&lt;80%$ follow-up, no blinding, or improper randomization)</td>
<td>Development of diagnostic criteria on consecutive patients (with universally applied reference &quot;gold&quot; standard)</td>
<td>Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\hat{A}$ statistic of $0.40$–$0.60$ or an intraclass correlation coefficient of $0.50$–$0.70$</td>
</tr>
<tr>
<td></td>
<td>Prospective$^d$ comparative study$^e$</td>
<td>Systematic review$^b$ of Class II studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systematic review$^b$ of Class II studies or Class I studies with inconsistent results</td>
<td>Study of nonconsecutive patients; without consistently applied reference &quot;gold&quot; standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case-control study$^g$</td>
<td>Systematic review$^b$ of Class III studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retrospective$^f$ comparative study$^e$</td>
<td>Case-control study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systematic review$^b$ of Class II studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Case series$^h$</td>
<td>Poor reference standard</td>
<td>Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\hat{A}$ statistic of $&lt;0.40$ or an intraclass correlation coefficient of $&lt;0.50$</td>
</tr>
<tr>
<td></td>
<td>Expert opinion</td>
<td>Expert opinion</td>
<td></td>
</tr>
</tbody>
</table>

$^a$A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

$^b$A combination of results from 2 or more prior studies.

$^c$Studies provided consistent results.

$^d$Study was started before the first patient enrolled.

$^e$Patients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

$^f$The study was started after the first patient was enrolled.

$^g$Patients identified for the study on the basis of their outcome; called "cases" (e.g., failed fusion), are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

$^h$Patients treated 1 way with no comparison group of patients treated in another way.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables
Description of the Methods Used to Analyze the Evidence

Selected articles were carefully reviewed by the authors. An evidentiary table was created (refer to Table 2 in the original guideline document) that reflected the strengths and weaknesses of each article.

On occasion, the assessed quality of the study design was so contentious and the conclusions so uncertain that the guideline authors assigned a lower medical evidence classification than might have been expected without such a detailed review. In every way, adherence to the Institute of Medicine’s criteria for searching, assembling, evaluating, and weighing the available medical evidence and linking it to the strength of the recommendations presented in this document was carried out.

Articles that did not achieve immediate consensus among the author group were discussed extensively until a consensus was reached. Very few contributions required extensive discussion. Most articles were easily designated as containing Class I, II, or III medical evidence using the criteria set forth by the author group at the initiation of the literature evaluation process (see the "Rating Scheme for the Strength of the Evidence" field).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The current author group was selected for its expertise in spinal surgery (both neurosurgical and orthopedic), neurotrauma, clinical epidemiology, and, in several cases, prior experience with guideline development. The topics chosen for inclusion in this iteration of these guidelines are contemporary and pertinent to the assessment, evaluation, care, and treatment of patients with acute cervical spine and/or spinal cord injuries.

Rating Scheme for the Strength of the Recommendations

Levels of Recommendation

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)</td>
</tr>
<tr>
<td>II</td>
<td>Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)</td>
</tr>
<tr>
<td>III</td>
<td>Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)</td>
</tr>
</tbody>
</table>

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations
Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field). All articles provided Class III medical evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate management of acute traumatic central cord syndrome (ATCCS)

Potential Harms

Not stated

Qualifying Statements

Qualifying Statements

- Medical evidence-based guidelines are not meant to be restrictive or to limit a clinician's practice. They chronicle multiple successful treatment options (for example) and stratify the more successful and the less successful strategies based on scientific merit. They are not absolute, "must be followed" rules. This process may identify the most valid and reliable imaging strategy for a given injury, for example, but because of regional or institutional resources, or patient co-morbidity, that particular imaging strategy may not be possible for a patient with that injury. Alternative acceptable imaging options may be more practical or applicable in this hypothetical circumstance.

- Guidelines documents are not tools to be used by external agencies to measure or control the care provided by clinicians. They are not medical-legal instruments or a "set of certainties" that must be followed in the assessment or treatment of the individual pathology in the individual patients we treat. While a powerful and comprehensive resource tool, guidelines and the recommendations contained therein do not necessarily represent "the answer" for the medical and surgical dilemmas faced with many patients.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Mobile Device Resources

For information about availability, see the Availability of Companion Documents and Patient Resources fields below.

Institute of Medicine (IOM) National Healthcare Quality Report

Categories

IOM Care Need
Identifying Information and Availability

Bibliographic Source(s)


Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2013 Mar

Guideline Developer(s)

American Association of Neurological Surgeons - Medical Specialty Society
Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

Congress of Neurological Surgeons

Guideline Committee

Guidelines Author Group of the Joint Section of Disorders of the Spine andPeripheral Nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons

Composition of Group That Authored the Guideline

Authors: Bizhan Aarabi, MD, FRCSC, Department of Neurosurgery, University of Maryland, Baltimore, Maryland; Mark N. Hadley, MD (Lead Author), Division of Neurological Surgery, University of Alabama at Birmingham, Birmingham, Alabama; Sanjay S. Dhall, MD, Department of Neurosurgery, Emory University, Atlanta, Georgia; Daniel E. Gelb, MD, Department of Orthopaedics, University of Maryland, Baltimore, Maryland; R. John Hurlbert, MD, PhD, FRCSC, Department of Clinical Neurosciences, University of Calgary Spine Program, Faculty of Medicine, University of Calgary, Calgary, Alberta, Canada; Curtis J. Rozzelle, MD, Division of Neurological Surgery, Children's Hospital of Alabama, University of Alabama at Birmingham, Birmingham, Alabama; Timothy C. Ryken, MD, MS, Iowa Spine & Brain Institute, University of Iowa, Waterloo/Iowa City, Iowa; Nicholas Theodore, MD, Division of Neurological Surgery, Barrow Neurological Institute, Phoenix, Arizona; Beverly C. Walters, MD, MSc, FRCSC (Lead Author), Division of Neurological Surgery, University of Alabama at Birmingham, Birmingham,
Financial Disclosures/Conflicts of Interest

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this guideline.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Available from the Neurosurgery Web site [link].

Availability of Companion Documents

The following are available:


Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on July 9, 2013. The information was verified by the guideline developer on October 3, 2013.

Copyright Statement

This NGC summary is based on the original guideline, which is subject to the guideline developer's copyright restrictions.

Disclaimer

NGC Disclaimer

The National Guideline Clearinghouseâ“¢ (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.
Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria.

NGC, AHRQ, and its contractor ECRI Institute make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI Institute, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.