



## Complete Summary

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### GUIDELINE TITLE

Respiratory management following spinal cord injury: a clinical practice guideline for health-care professionals.

### BIBLIOGRAPHIC SOURCE(S)

Consortium for Spinal Cord Medicine. Respiratory management following spinal cord injury: a clinical practice guideline for health-care professionals. Washington (DC): Paralyzed Veterans of America; 2005 Jan. 49 p. [123 references]

### GUIDELINE STATUS

This is the current release of the guideline.

## COMPLETE SUMMARY CONTENT

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## SCOPE

### DISEASE/CONDITION(S)

Respiratory complications of spinal cord injury (SCI), including:

- Atelectasis
- Pneumonia
- Respiratory failure
- Pulmonary embolism
- Pleural effusion
- Sleep-disordered breathing

### GUIDELINE CATEGORY

Evaluation  
Management  
Prevention

### **CLINICAL SPECIALTY**

Critical Care  
Emergency Medicine  
Family Practice  
Internal Medicine  
Neurological Surgery  
Orthopedic Surgery  
Physical Medicine and Rehabilitation  
Pulmonary Medicine

### **INTENDED USERS**

Advanced Practice Nurses  
Health Care Providers  
Nurses  
Occupational Therapists  
Physical Therapists  
Physician Assistants  
Physicians  
Psychologists/Non-physician Behavioral Health Clinicians

### **GUIDELINE OBJECTIVE(S)**

- To develop guidelines that would meet the needs of a person with recent onset spinal cord injury (SCI) who is in respiratory distress
- To gather and disseminate the best available knowledge and information about managing the respiratory needs of patients with ventilation problems

### **TARGET POPULATION**

Individuals with spinal cord injury (SCI)

### **INTERVENTIONS AND PRACTICES CONSIDERED**

#### **Assessment**

1. History (lung disease, current medications, substance abuse)
2. Physical examination (respiratory system, neurologic impairment, coexisting injuries)
3. Laboratory assessment, including arterial blood gases, routine laboratory studies, chest x-ray, and electrocardiogram (EKG)
4. Assessment of respiratory function (continuous pulse oximetry, vital capacity [VC], maximal negative inspiratory pressure, forced expiratory volume in 1 second [FEV<sub>1</sub>])
5. Monitoring of oxygen saturation and end tidal CO<sub>2</sub>

## **Management**

1. Prevention and treatment of atelectasis and pneumonia
  - Monitoring indicators
  - Intubation (for intractable respiratory failure, demonstrable aspiration, or high risk for aspiration plus respiratory compromise)
  - Specific tests of pulmonary mechanics and ventilation
  - Clearing the airway of secretions
  - Diaphragm fluoroscopy
  - Reexpansion of the affected lung tissue following successful treatment (required for atelectasis or pneumonia)
2. Mechanical ventilation
  - Recognizing role of surfactant production
  - Positive-end expiratory pressure (PEEP)
  - Monitoring for pulmonary embolism and pulmonary effusion
  - Treatment of complications of short and long-term ventilation
  - Evaluation of the need for long-term ventilation
3. Weaning from the ventilator
  - Progressive ventilator-free breathing (PVFB)
  - Synchronized intermittent mandatory ventilation (SIMV)
  - Partial weaning
4. Evaluation for electrophrenic respiration
5. Polysomnographic evaluation
6. Positive airway pressure therapy (if sleep disordered breathing is diagnosed)
7. Evaluation for and prevention of dysphagia and aspiration
8. Tracheostomy (for patients who are aspirating)
9. Psychosocial assessment and treatment
  - Monitoring of patient's post-injury feeling states
  - Assessment of substance abuse
  - Assessment of pain
  - Establishment of advance directives
  - Assistance and support of family caregivers
  - Addressing of intimacy and sexuality issues (with the patient and other appropriate parties)
  - Establishment of an effective communication system

## **Discharge and Follow-Up**

1. Education of patient and caregivers
2. Evaluation and modification of patient's home
3. Provision of appropriate medical equipment and personnel resources
4. Transportation assistance
5. Evaluation of financial resources and available benefits
6. Determining the availability of transition and leisure resources
7. Vocational evaluation

## **MAJOR OUTCOMES CONSIDERED**

- Incidence of pulmonary complications
- Symptom relief
- Incidence of adverse events following therapy
- Morbidity and mortality rate

## METHODOLOGY

### **METHODS USED TO COLLECT/SELECT EVIDENCE**

Searches of Electronic Databases

### **DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE**

A literature search was designed to identify empirical evidence on patients with acute traumatic cervical spinal cord injury (SCI), regardless of the degree of completeness of injury. The period of days to months following acute injury as well as on the long-term follow-up over years was focused on. Excluded from consideration were nonpulmonary complications of SCI and venous thromboembolism/pulmonary embolus. The evidence does not cover patients with SCI occurring below the cervical level or respiratory muscle weakness caused by neuromuscular or other spinal cord diseases, such as Guillain-Barré syndrome and polio. The databases searched for literature were MEDLINE (1966-Dec 2000), HealthSTAR (1975-Dec 2000), Cumulative Index to Nursing & Allied Health Literature (CINAHL) (1983-Jan 2001), and EMBASE (1980-Feb 2000). The search strategies combined an SCI concept (implemented using Medical Subject Heading [MeSH] terms spinal cord injuries, paraplegia, and quadriplegia [exploded] and text words for tetraplegia, quadriplegia, and paraplegia) with a pulmonary disease concept. The search was limited to articles pertaining to humans and published in the English language.

Empirical studies or review articles were included after screening by the following criteria:

1. The study population includes traumatic cervical SCI.
2. The study question relates to the research questions described above.
3. The study includes data on health outcomes, health services utilization, economic outcomes, or physiological measures related to respiratory status.
4. The study design is controlled trial, prospective trial with historical controls, prospective or retrospective cohort study, or case series with 10 or more subjects.

Articles were excluded when the study population was children (all subjects or mean age <18 years) or when the study design included a case series with fewer than 10 subjects or a case report. Each article was independently reviewed by at least two investigators.

### **NUMBER OF SOURCE DOCUMENTS**

Not stated

### **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**

## **Hierarchy of the Levels of Scientific Evidence**

- I. Large randomized trials with clear-cut results (and low risk of error)
- II. Small randomized trials with uncertain results (and moderate to high risk of error)
- III. Nonrandomized trials with concurrent or contemporaneous controls
- IV. Nonrandomized trials with historical controls
- V. Case series with no controls

## **METHODS USED TO ANALYZE THE EVIDENCE**

Systematic Review

### **DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

For grading internal validity, the investigators employed the hierarchy outlined in "Rating Scheme for the Strength of the Evidence."

Each study was also evaluated for factors affecting external validity using the following criteria:

- Were the criteria for selection of patients described?
- Were patients included in the study adequately characterized with regard to level and completeness of spinal cord injury (SCI)?
- Were criteria for outcomes clearly defined (e.g., timing, measurement, reliability)?
- Was the clinical care of patients adequately described to be able to be reproduced?
- Were the results reported according to level of injury (minimum high cervical [C4 or above] versus low cervical [below C4]) or ventilation status (independently breathing versus ventilator dependent)?

These items were not aggregated into an overall quality score, but were considered individually. Studies meeting the above criteria were summarized in the Agency for Healthcare Research and Quality (AHRQ) evidence report or in update reports, which included additional topics searched expressly for this guideline, prepared for the expert guideline panel. Additional studies that do not meet the above criteria are cited in some sections of the report when sufficient high-quality evidence on the target population was not available. These studies are not graded according to the quality criteria.

## **METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Expert Consensus

### **DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS**

The guideline development process adopted by the Consortium for Spinal Cord Medicine consists of twelve steps, leading to panel consensus and organizational endorsement. After the steering committee chooses a topic, a panel of experts is

selected. Panel members must have demonstrated leadership in the topic area through independent scientific investigation and publication. Following a detailed explication and specification of the topic by select steering committee and panel members, consultant methodologists review the international literature; prepare evidence tables that grade and rank the quality of the research, and conduct statistical meta-analyses and other specialized studies as needed. The panel chair then assigns specific sections of the topic to the panel members based on their area of expertise. Writing begins on each component using the references and other materials furnished by the methodology support group.

After the panel members complete their sections, a draft document is generated during the first full meeting of the panel. The panel incorporates new literature citations and other evidence-based information not previously available. At this point, charts, graphs, algorithms, and other visual aids, as well as a complete bibliography, are added, and the full document is sent to legal counsel for review.

### **Grading the Guideline Recommendations**

After panel members had drafted their sections of the guideline, each recommendation was graded according to the level of scientific evidence supporting it. The framework used by the methodology team is outlined in "Rating Scheme for the Strength of the Recommendations." It should be emphasized that these ratings, like the evidence table ratings, represent the strength of the supporting evidence, not the strength of the recommendation itself. The strength of the recommendation is indicated by the language describing the rationale.

If the literature supporting a recommendation comes from two or more levels, the number and level of the studies are reported (e.g., in the case of a recommendation that is supported by two studies, one a level III, the other a level V, the "Scientific evidence" is indicated as "III/V"). In situations in which no published literature exists, consensus of the panel members and outside expert reviewers was used to develop the recommendation and is indicated as "Expert consensus."

### **Grading of Panel Consensus**

The level of agreement with the recommendation among panel members was assessed as either low, moderate, or strong. Each panel member was asked to indicate his or her level of agreement on a 5-point scale, with 1 corresponding to neutrality and 5 representing maximum agreement. Scores were aggregated across the panel members and an arithmetic mean was calculated. This mean score was then translated into low, moderate, or strong. A panel member could abstain from the voting process for a variety of reasons, including, but not limited to, lack of expertise associated with the particular recommendation.

## **RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

### **Categories of the Strength of Evidence Associated with the Recommendation (Grade of Recommendation)**

- A. The recommendation is supported by one or more level I studies.

- B. The recommendation is supported by one or more level II studies.
- C. The recommendation is supported by expert opinion one or more level III, IV, or V studies.

### **Levels of Panel Agreement with the Recommendations (Strength of Panel Opinion)**

Low - Mean agreement score 1.0 to less than 2.33

Moderate - Mean agreement score 2.33 to less than 3.67

Strong - Mean agreement score 3.67 to 5.0

### **COST ANALYSIS**

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

### **METHOD OF GUIDELINE VALIDATION**

External Peer Review  
Internal Peer Review

### **DESCRIPTION OF METHOD OF GUIDELINE VALIDATION**

After legal analysis to consider antitrust, restraint-of-trade, and health policy matters, the draft document is reviewed by clinical experts from each of the consortium organizations plus other select clinical experts and consumers. The review comments are assembled, analyzed, and entered into a database, and the document is revised to reflect the reviewers' comments. Following a second legal review, the draft document is distributed to all consortium organization governing boards. Final technical details are negotiated among the panel chair, members of the organizations' boards, and expert panelists. If substantive changes are required, the draft receives a final legal review. The document is then ready for editing, formatting, and preparation for publication.

## **RECOMMENDATIONS**

### **MAJOR RECOMMENDATIONS**

Rating schemes for the levels of scientific evidence (I, II, III, IV, V), grade of recommendation (A, B, C) and the strength of panel opinion (Low, Moderate, Strong) are defined at the end of the "Major Recommendations" field.

### **Initial Assessment of Acute Spinal Cord Injury (SCI)**

1. Guide the initial management of people presenting with suspected or possible spinal cord injury in the field and in the emergency department using the American Heart Association and the American College of Surgeons' principles

of basic life support, advanced cardiac life support, and advanced trauma life support.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

2. Perform an initial history and physical exam to include the following:
  - Relevant past medical history
  - Prior history of lung disease
  - Current medications
  - Substance abuse
  - Neurologic impairment
  - Coexisting injuries

*(Scientific evidence-- NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

3. The initial laboratory assessment should include:
  - Arterial blood gases
  - Routine laboratory studies (complete blood count, chemistry panel, coagulation profile, cardiac enzyme profile, urinalysis, toxicology screen)
  - Chest x-ray
  - Electrocardiograph (EKG)

Conduct periodic assessments of respiratory function to include:

- Respiratory complaints
- Physical examination of the respiratory system
- Chest imaging as indicated
- Continuous pulse oximetry
- Performance of the respiratory muscles: vital capacity (VC) and maximal negative inspiratory pressure
- Forced expiratory volume in 1 second (FEV<sub>1</sub>) or peak cough flow
- Neurological level and extent of impairment

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

4. Monitor oxygen saturation and end tidal carbon dioxide (CO<sub>2</sub>) to measure the quality of gas exchange during the first several days after injury in correlation with patient expression of respiratory distress.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Prevention and Treatment of Atelectasis and Pneumonia**

5. Monitor indicators for development of atelectasis or infection, including:
  - Rising temperature
  - Change in respiratory rate

- Shortness of breath
- Increasing pulse rate
- Increasing anxiety
- Increased volume of secretions, frequency of suctioning, and tenacity of secretions
- Declining vital capacity
- Declining peak expiratory flow rate, especially during cough

Note: If atelectasis or pneumonia is present on the chest x-ray, institute additional treatment and follow serial chest radiographs. If temperature, respiratory rate, vital capacity, or peak expiratory flow rate is trending in an adverse direction, obtain a chest radiograph.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

6. Intubate the patient for the following reasons:
  - Intractable respiratory failure, especially if continuous positive airway pressure (CPAP) and bi-level positive airway pressure (BiPAP) or noninvasive ventilation has failed
  - Demonstrable aspiration or high risk for aspiration plus respiratory compromise

*(Scientific evidence--III; Grade of recommendation--C; Strength of panel opinion--Strong)*

7. If the vital capacity shows a measurable decline, investigate pulmonary mechanics and ventilation with more specific tests.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

8. Implement the following steps to clear the airway of secretions:
  - Assisted coughing
  - Use of an in-exsufflator/exsufflator
  - Intermittent positive pressure breathing (IPPB) "stretch"
  - Glossopharyngeal breathing
  - Deep breathing and coughing
  - Incentive spirometry
  - Chest physiotherapy
  - Intrapulmonary percussive ventilation
  - CPAP and bi-level positive airway pressure BiPAP
  - Bronchoscopy
  - Positioning (Trendelenburg or supine)

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

9. Determine the status of the movement of the diaphragm (right and left side) by performing a diaphragm fluoroscopy.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

10. Successful treatment of atelectasis or pneumonia requires reexpansion of the affected lung tissue. Various methods include:

- Deep breathing and voluntary coughing
- Assisted coughing techniques
- Insufflation-exsufflation treatment
- IPPB "stretch"
- Glossopharyngeal breathing
- Incentive spirometry
- Chest physiotherapy
- Intrapulmonary percussive ventilation (IPV)
- CPAP and BiPAP
- Bronchoscopy with bronchial lavage
- Positioning the patient in the supine or Trendelenburg position
- Abdominal binder
- Medications

*(Scientific evidence--III/IV; Grade of recommendation--C; Strength of panel opinion--Strong)*

Please refer to the original guideline document for a discussion of medications used in a comprehensive medical management program.

## **Mechanical Ventilation**

### **Intractable Atelectasis**

11. If the patient needs mechanical ventilation, use a protocol that includes increasing ventilator tidal volumes to resolve or prevent atelectasis.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

12. Set the ventilator so that the patient does not override the ventilator settings.

*(Scientific evidence--III/V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Surfactant, Positive-End Expiratory Pressure (PEEP), and Atelectasis**

13. Recognize the role of surfactant in atelectasis, especially when the patient is on the ventilator.

*(Scientific evidence--None; Grade of Recommendation--NA; Strength of panel opinion--Strong)*

## **Complications of Short-Term and Long-Term Ventilation**

### **Atelectasis**

14. Use a protocol for ventilation that guards against high ventilator peak inspiratory pressures. Consider the possibility of a "trapped" or deformed lung in individuals who have trouble weaning and have had a chest tube or chest surgery.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Pneumonia**

15. Employ active efforts to prevent pneumonia, atelectasis, and aspiration.

*(Scientific evidence--IV/V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Pulmonary Embolism and Pleural Effusion**

16. Monitor ventilated patients closely for pulmonary embolism and pleural effusion.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Long-Term Ventilation**

17. Evaluate the need for long-term ventilation.
- Order equipment as soon as possible.
  - If a ventilator is needed, recommend that patients also have a backup ventilator.

*(Scientific evidence--III/V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Weaning from the Ventilator**

18. Consider using progressive ventilator-free breathing (PVFB) over synchronized intermittent mandatory ventilation (SIMV).

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Electrophrenic Respiration**

19. For apneic patients, consider evaluation for electrophrenic respiration.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

20. Consider the advantages of acute and long-term use of noninvasive ventilation over initial intubation and long-term tracheostomy if the treatment staff has the expertise and experience in the use of such devices.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Sleep-Disordered Breathing**

21. Perform a polysomnographic evaluation for those patients with excessive daytime sleepiness or other symptoms of sleep-disordered breathing.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

22. Prescribe positive airway pressure therapy if sleep disordered breathing is diagnosed.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Dysphagia and Aspiration**

23. Evaluate the patient for the following risk factors:

- Supine position
- Spinal shock
- Slowing of gastrointestinal tract
- Gastric reflux
- Inability to turn the head to spit out regurgitated material
- Medications that slow gastrointestinal activity or cause nausea and vomiting
- Recent anterior cervical spine surgery
- Presence of a tracheostomy
- Advanced age

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

24. Prevent aspiration by involving all caregivers, including respiratory therapists, speech therapists, physical therapists, pharmacists, nurses, and physicians, in the care of the patient.

- Institute an alert system for patients with a high risk for aspiration.
- Position the patient properly.
- Ensure easy access to a nurse call light and alarm system.
- Have the patient sit when eating, if possible.
- Screen patients without a tracheostomy who have risk factors or signs and symptoms of dysphagia.
- If the patient is found to be aspirating and is on large ventilator tidal volumes, monitor the peak inspiratory pressure closely.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Moderate)*

25. Consider a tracheostomy for patients who are aspirating. If the patient has a tracheostomy and is aspirating, the tracheostomy cuff should only be deflated when the speech therapist--and possibly a nurse or respiratory therapist as well--is present. (All involved personnel should be expert in suctioning.) Monitor SPO<sub>2</sub> as an early indicator of an aspiration impact.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

## **Psychosocial Assessment and Treatment**

### **Adjustment to Ventilator-Dependent Tetraplegia**

26. Consider the manner in which the individual is accommodating to the spinal cord injury, including the individual's post-injury psychological state.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Enhancement of Coping Skills and Wellness**

27. Assist the patient and family in the development, enhancement, and use of coping skills and health promotion behaviors.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Affective Status**

28. Monitor the patient's post-injury feeling states, specifically for the emergence of depression and anxiety.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Substance Abuse**

29. Assess the patient for the presence of comorbid substance abuse beginning in the acute rehabilitation setting.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Pain**

30. Assess the patient's level of pain, if any, and establish the type of pain to determine the most appropriate physical and psychological treatment modalities.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Secondary Mild Brain Injury**

31. Assess for possible comorbid brain trauma as indicated by the clinical situation.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Decision-Making Capacity**

32. Determine the individual's capacity to make decisions and give informed consent on medical-related issues by examining the following:

- Organicity
- Medications
- Psychological reactions
- Pre-morbid substance abuse
- Pain

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Advance Directives**

33. Discuss advance directives, specifically the living will and durable power for medical health care, with the competent patient or the patient's proxy to determine the validity of the documents post trauma.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Family Caregiving**

34. As appropriate, assess and support family functioning.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Intimacy and Sexuality**

35. Explore issues of intimacy and sexuality with the patient and other appropriate parties.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Establishment of an Effective Communication System**

36. Assess the patient's ability to communicate, and ensure that all staff can effectively interact with the patient to determine his or her needs and concerns.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Education Program Development**

37. Plan, design, implement, and evaluate an educational program to help individuals with SCI and their families and caregivers gain the knowledge and skills that will enable the individual to maintain respiratory health, prevent pulmonary complications, return home, and resume life in the community as fully as possible.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Discharge Planning**

38. Working with the multidisciplinary rehabilitation team, the patient and his or her family develop a discharge plan to assist the individual with ventilator-dependent spinal cord injury in transitioning from the health-care facility to a less restrictive environment, preferably a home setting.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Home Modifications**

39. Evaluate and then modify the home environment to accommodate the demands of wheelchair access and respiratory equipment.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Caregivers**

40. Home health-care workers, family members, privately hired assistants, and others trained in personal care and respiratory management of the individual with spinal cord injury should provide care or be available to assist the patient 24 hours a day. Efficient care of the patient depends on careful charting by home caregivers and proper management of the home medical supply inventory.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Durable Medical Equipment**

41. Prescribe the appropriate durable medical equipment for home use based on the evaluations of therapy staff and the patient. Consider emergency provisions (e.g., backup generator and alarms) and assistive technology as part of a safe and effective environment.

*(Scientific evidence--V; Grade of recommendation--C; Strength of panel opinion--Strong)*

### **Transportation**

42. Use a van equipped with a lift and tie downs or accessible public transportation to transport the person with ventilator-dependent spinal cord injury. The patient should be accompanied by an attendant trained in personal and respiratory care.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Finances**

43. Evaluate thoroughly the patient's personal and financial resources and provide expert guidance in applying for benefits and coordinating assets to maximize all available resources.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Leisure**

44. Explore and provide information on diversionary pursuits, leisure interests, local community resources, and adaptive recreational equipment.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Vocational Pursuits**

45. Arrange a vocational evaluation to determine special aptitudes, interests, and physical abilities; factor in the need for transportation and attendant services.

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Transition Resources**

46. Identify medical and other transition resources in the home community, including:

- Local specialists
- Respiratory services
- Home supply and durable medical equipment
- Vendors
- Pharmacies
- Home health-care services
- Advocacy groups

*(Scientific evidence--NA; Grade of recommendation--NA; Strength of panel opinion--Strong)*

### **Definitions:**

### **Hierarchy of the Levels of Scientific Evidence**

- I. Large randomized trials with clear-cut results (and low risk of error)
- II. Small randomized trials with uncertain results (and moderate to high risk of error)
- III. Nonrandomized trials with concurrent or contemporaneous controls
- IV. Nonrandomized trials with historical controls
- V. Case series with no controls

### **Categories of the Strength of Evidence Associated with the Recommendation (Grade of Recommendation)**

- A. The recommendation is supported by one or more level I studies.
- B. The recommendation is supported by one or more level II studies.
- C. The recommendation is supported by expert opinion one or more level III, IV, or V studies.

### **Levels of Panel Agreement with the Recommendations (Strength of Panel Opinion)**

Low - Mean agreement score 1.0 to less than 2.33

Moderate - Mean agreement score 2.33 to less than 3.67

Strong - Mean agreement score 3.67 to 5.0

### **CLINICAL ALGORITHM(S)**

None provided

## **EVIDENCE SUPPORTING THE RECOMMENDATIONS**

### **TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS**

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

A list of references is provided in the original guideline document, which includes all sources used by the guideline development panel to support their recommendations. It provides the level of scientific evidence (I-V or NA) for each graded article.

## **BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS**

### **POTENTIAL BENEFITS**

Improved outcomes and decreased incidence of pulmonary complications in patients with spinal cord injury

### **POTENTIAL HARMS**

- Side effects or complications of therapy
- Mechanical ventilation may result in pneumothorax, barotrauma.

## **QUALIFYING STATEMENTS**

### **QUALIFYING STATEMENTS**

This guideline has been prepared based on scientific and professional information available in 2004. Users of this guide should periodically review this material to ensure that the advice herein is consistent with current reasonable clinical practice.

## **IMPLEMENTATION OF THE GUIDELINE**

### **DESCRIPTION OF IMPLEMENTATION STRATEGY**

An implementation strategy was not provided.

### **IMPLEMENTATION TOOLS**

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**

Living with Illness  
Staying Healthy

## **IOM DOMAIN**

Effectiveness  
Patient-centeredness

## **IDENTIFYING INFORMATION AND AVAILABILITY**

### **BIBLIOGRAPHIC SOURCE(S)**

Consortium for Spinal Cord Medicine. Respiratory management following spinal cord injury: a clinical practice guideline for health-care professionals. Washington (DC): Paralyzed Veterans of America; 2005 Jan. 49 p. [123 references]

### **ADAPTATION**

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

### **DATE RELEASED**

2005 Jan

### **GUIDELINE DEVELOPER(S)**

Consortium for Spinal Cord Medicine - Private Nonprofit Organization

### **GUIDELINE DEVELOPER COMMENT**

Consortium Member Organizations include: American Academy of Orthopedic Surgeons, American Academy of Physical Medicine and Rehabilitation, American Association of Neurological Surgeons, American Association of Spinal Cord Injury Nurses, American Association of Spinal Cord Injury Psychologists and Social Workers, American College of Emergency Physicians, American Congress of Rehabilitation Medicine, American Occupational Therapy Association, American Paraplegia Society, American Physical Therapy Association, American Psychological Association, American Spinal Injury Association, Association of Academic Physiatrists, Association of Rehabilitation Nurses, Christopher Reeve Paralysis Foundation, Congress of Neurological Surgeons, Insurance Rehabilitation Study Group, International Spinal Cord Society, Paralyzed Veterans of America, U.S. Department of Veterans Affairs, United Spinal Association

### **SOURCE(S) OF FUNDING**

Paralyzed Veterans of America

### **GUIDELINE COMMITTEE**

Guideline Development Panel

### **COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE**

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## **FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST**

Not stated

## **GUIDELINE STATUS**

This is the current release of the guideline.

## **GUIDELINE AVAILABILITY**

Electronic copies: May be downloaded from the [Paralyzed Veterans of America \(PVA\) Web site](#) for a nominal fee.

Print copies: Single copies available from the Consortium for Spinal Cord Medicine, Clinical Practice Guidelines, 801 18th Street, NW, Washington, DC 20006.

## **AVAILABILITY OF COMPANION DOCUMENTS**

A number of care protocols are available in the appendices to the original guideline document.

## **PATIENT RESOURCES**

None available

## **NGC STATUS**

This NGC summary was completed by ECRI on August 8, 2005. The information was verified by the guideline developer on August 18, 2005.

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