Complete Summary

GUIDELINE TITLE

Practice parameter: prediction of outcome in comatose survivors after cardiopulmonary resuscitation (an evidence-based review). Report of the Quality Standards Subcommittee of the American Academy of Neurology.

BIBLIOGRAPHIC SOURCE(S)

Wijdicks EF, Hijdra A, Young GB, Bassetti CL, Wiebe S, Quality Standards Subcommittee of the American Academy of Neurology. Practice parameter: prediction of outcome in comatose survivors after cardiopulmonary resuscitation (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology. Neurology 2006 Jul 25;67(2):203-10. [71 references] PubMed

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Cardiac arrest

GUIDELINE CATEGORY

Evaluation
Risk Assessment

CLINICAL SPECIALTY

Neurology

INTENDED USERS

Physicians

GUIDELINE OBJECTIVE(S)

To systematically review outcomes in comatose survivors after cardiac arrest and cardiopulmonary resuscitation (CPR)

TARGET POPULATION

Comatose survivors after cardiac arrest and cardiopulmonary resuscitation (CPR)

INTERVENTIONS AND PRACTICES CONSIDERED

1. Consideration of circumstances surrounding cardiopulmonary resuscitation (CPR), including anoxia time, duration of CPR, cause of cardiac arrest, and type of cardiac arrhythmia
2. Measurement of body temperature
3. Consideration of clinical findings of neurologic examination
4. Electrophysiologic tests, including electroencephalogram (EEG) and evoked/event-related potential (EP) studies
5. Biochemical markers, including neuron-specific enolase (NSE) and serum S100
6. Monitoring of intracranial pressure and brain oxygenation
7. Neuroimaging studies, including computed tomography (CT) and magnetic resonance imaging (MRI)

MAJOR OUTCOMES CONSIDERED

Rate of death or unconsciousness after 1 month or unconsciousness or severe disability after 6 months

METHODOLOGY

METHODS USED TO COLLECT/SELECT 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

Literature Search

The Mayo Clinic Library and the Biomedical Library Information Service of the University of Minnesota searched MEDLINE from January 1966 to January 2006. Review articles and monographs were additionally consulted. Search entries

included the following text words and Medical Subject Heading (MeSH) terms associated with cardiorespiratory resuscitation: "coma," "anoxic encephalopathy," "prognosis," "electrophysiological studies," and "biochemical markers."

Selection of Studies

The guideline developers excluded studies in which coma was not adequately described, single case reports, papers dealing with selected subgroups of patients, and papers written in a language other than English, German, French, or Italian or when an English translation was not available. Selected articles fulfilled the following inclusion criteria: documented cardiac arrest, age $\geq$17 years, and accepted the following definitions of coma: Glasgow Coma Scale score sum score $\leq$8, "persistent unresponsiveness," and "not regaining consciousness." Poor outcome was defined as 1) death or persisting unconsciousness after 1 month or 2) death, persisting unconsciousness, or severe disability requiring full nursing care after 6 months. These outcome measures were chosen because the chance of survival without severe motor or cognitive disability is virtually nil in patients who are vegetative $\geq$1 month or more after cardiopulmonary resuscitation (CPR) or in patients who are severely disabled after $\geq$6 months.

The authors obtained 391 potentially eligible literature citations that were reviewed in full by members of the practice parameter group. They additionally reviewed authoritative position papers on permanent vegetative state, withdrawal of care in the intensive care unit, and communication with the family.

NUMBER OF SOURCE DOCUMENTS

Four class I studies, three class II studies, and five class III studies were reviewed on circumstances surrounding cardiopulmonary resuscitation (CPR) and clinical features. One class I study, one class II study, and nine class III studies were reviewed on electrophysiologic studies. One class I study, 11 class III studies, and three class IV studies were reviewed on biochemical markers. Ten class IV studies were reviewed on monitoring brain function and neuroimaging.

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

Classification of Evidence for Prognostic Article

Class I: Evidence provided by a prospective study of a broad spectrum of persons who may be at risk for developing the outcome (e.g., target disease, work status). The study measures the predictive ability using an independent gold standard for case definition. The predictor is measured in an evaluation that is masked to clinical presentation, and the outcome is measured in an evaluation that is masked to the presence of the predictor. All patients have the predictor and outcome variables measured.

Class II: Evidence provided by a prospective study of a narrow spectrum of persons at risk for having the condition, or by a retrospective study of a broad spectrum of persons with the condition compared to a broad spectrum of controls. The study measures the prognostic accuracy of the risk factor using an acceptable independent gold standard for case definition. The risk factor is measured in an evaluation that is masked to the outcome.

Class III: Evidence provided by a retrospective study where either the persons with the condition or the controls are of a narrow spectrum. The study measures the predictive ability using an acceptable independent gold standard for case definition. The outcome, if not objective, is determined by someone other than the person who measured the predictor.

Class IV: Any design where the predictor is not applied in an independent evaluation OR evidence provided by expert opinion or case series without controls.

METHODS USED TO ANALYZE THE EVIDENCE

Meta-Analysis of Randomized Controlled Trials
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

When data could be abstracted from the articles, the guideline developers calculated sensitivity, false-positive rate (FPR) (1 – specificity), and corresponding 95% confidence interval (CI). They chose to report our calculation of the FPR because clinicians need to be informed about the ability of the clinical examination and laboratory tests to predict poor outcome with a high level of certainty (low FPR). They calculated 95% CIs for sensitivity and FPR using Wilson's method. For meta-analyses, they assessed heterogeneity with the chi-squared test. In the absence of heterogeneity, they used the fixed-effects method to pool the data.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Other

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

An international group was formed to review the prognostic value of the clinical examination and of ancillary investigations (electrophysiologic, biochemical, and radiologic) for poor outcome in comatose survivors after cardiopulmonary resuscitation (CPR). The guideline developers specifically assessed the value of the following seven variables to predict poor outcome: Circumstances surrounding CPR, elevated body temperature, neurologic examination, electrophysiologic studies, biochemical markers, monitoring of brain function, and neuroimaging studies.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Classification of Recommendations

A = Established as effective, ineffective, or harmful for the given condition in the specified population (Level A rating requires at least two consistent Class I studies.)

B = Probably effective, ineffective, or harmful for the given condition in the specified population (Level B rating requires at least one Class I study or at least two consistent Class II studies).

C = Possibly effective, ineffective, or harmful for the given condition in the specified population (Level C rating requires at least one Class II study or two consistent Class III studies.)

U = Data inadequate or conflicting; given current knowledge, predictor is unproven.

COST ANALYSIS

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

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

This guideline was approved by the Quality Standards Subcommittee on January 28, 2006; by the Practice Committee on April 27, 2006; and by the American Academy of Neurology (AAN) Board of Directors on May 4, 2006.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Definitions of the strength of the recommendations (A, B, C, U) and classification of the evidence (Class I through Class IV) are provided at the end of the "Major Recommendations" field.

Results and Recommendations

Are the circumstances surrounding cardiopulmonary resuscitation (CPR) predictive of outcome?

Prognosis cannot be based on the circumstances of cardiopulmonary resuscitation (**recommendation level B**).

Is hyperthermia predictive of outcome?

Prognosis cannot be based on elevated body temperature alone (**recommendation level C**).

Which features of the neurologic examination of the comatose patient are predictive of outcome?

The prognosis is invariably poor in comatose patients with absent pupillary or corneal reflexes, or absent or extensor motor responses 3 days after cardiac arrest (**recommendation level A**). Patients with myoclonus status epilepticus within the first day after a primary circulatory arrest have a poor prognosis (**recommendation level B**).

Which electrophysiologic studies are helpful in determining outcome?

Burst suppression or generalized epileptiform discharges on electroencephalogram (EEG) predicted poor outcomes but with insufficient prognostic accuracy (**recommendation level C**).

The assessment of poor prognosis can be guided by the bilateral absence of cortical somatosensory evoked potentials (SSEPs) (N20 response) within 1 to 3 days (**recommendation level B**).

Do biochemical markers accurately predict outcome?

Serum neuron-specific enolase (NSE) levels >33 micrograms/L at days 1 to 3 post-CPR accurately predict poor outcome (**recommendation level B**). There are inadequate data to support or refute the prognostic value of other serum and cerebrospinal fluid (CSF) biochemical markers in comatose patients after CPR (**recommendation level U**).

Does monitoring of intracranial pressure and brain oxygenation predict outcome?

There are inadequate data to support or refute the prognostic value of intracranial pressure (ICP) monitoring (**recommendation level U**).

Are neuroimaging studies indicative of outcome?

There are inadequate data to support or refute whether neuroimaging is indicative of poor outcome (**recommendation level U**).

Definitions:

Classification of Evidence for Prognostic Article

Class I: Evidence provided by a prospective study of a broad spectrum of persons who may be at risk for developing the outcome (e.g. target disease, work status). The study measures the predictive ability using an independent gold standard for case definition. The predictor is measured in an evaluation that is masked to clinical presentation, and the outcome is measured in an evaluation that is masked to the presence of the predictor. All patients have the predictor and outcome variables measured.

Class II: Evidence provided by a prospective study of a narrow spectrum of persons at risk for having the condition, or by a retrospective study of a broad

spectrum of persons with the condition compared to a broad spectrum of controls. The study measures the prognostic accuracy of the risk factor using an acceptable independent gold standard for case definition. The risk factor is measured in an evaluation that is masked to the outcome.

Class III: Evidence provided by a retrospective study where either the persons with the condition or the controls are of a narrow spectrum. The study measures the predictive ability using an acceptable independent gold standard for case definition. The outcome, if not objective, is determined by someone other than the person who measured the predictor.

Class IV: Any design where the predictor is not applied in an independent evaluation OR evidence provided by expert opinion or case series without controls.

Classification of Recommendations

A = Established as effective, ineffective, or harmful for the given condition in the specified population. (Level A rating requires at least two consistent Class I studies.)

B = Probably effective, ineffective, or harmful for the given condition in the specified population (Level B rating requires at least one Class I study or at least two consistent Class II studies.)

C = Possibly effective, ineffective, or harmful for the given condition in the specified population (Level C rating requires at least one Class II study or two consistent Class III studies.)

U = Data inadequate or conflicting; given current knowledge, predictor is unproven.

CLINICAL ALGORITHM(S)

An algorithm is provided in the original guideline document, titled "Decision algorithm for use in prognostication of comatose survivors after cardiopulmonary resuscitation."

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").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Accurate prediction of outcomes in comatose survivors after cardiac arrest and cardiopulmonary resuscitation (CPR)

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

This statement is provided as an educational service of the American Academy of Neurology (AAN). It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure, nor is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and physician caring for the patient, based on all the circumstances involved.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Clinical Algorithm
Patient Resources
Quick Reference Guides/Physician Guides

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

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Wijdicks EF, Hijdra A, Young GB, Bassetti CL, Wiebe S, Quality Standards Subcommittee of the American Academy of Neurology. Practice parameter:

prediction of outcome in comatose survivors after cardiopulmonary resuscitation (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology. Neurology 2006 Jul 25;67(2):203-10. [71 references] PubMed

ADAPTATION

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

DATE RELEASED

2006 Jul

GUIDELINE DEVELOPER(S)

American Academy of Neurology - Medical Specialty Society

SOURCE(S) OF FUNDING

American Academy of Neurology (AAN)

GUIDELINE COMMITTEE

Quality Standards Subcommittee

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The authors report no conflicts of interest.

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: A list of American Academy of Neurology (AAN) guidelines, along with a link to a Portable Document Format (PDF) file for this guideline, is available at the AAN Web site.

Print copies: Available from the AAN Member Services Center, (800) 879-1960, or from AAN, 1080 Montreal Avenue, St. Paul, MN 55116.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- AAN guideline development process [online]. St. Paul (MN): American Academy of Neurology. Available from the American Academy of Neurology Web site.
- Prediction of outcome in comatose survivors after cardiopulmonary resuscitation. AAN summary of evidence-based guideline for clinicians. St. Paul (MN): American Academy of Neurology. 2 p. Available in Portable Document Format (PDF) from the American Academy Neurology Web site.

PATIENT RESOURCES

The following is available:

- Prediction of recovery from coma after CPR. AAN summary of evidence-based guideline for patients and their families. St. Paul (MN): American Academy of Neurology (AAN). 2 p.

Electronic copies: Available in Portable Document Format (PDF) from the AAN Web site.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

NGC STATUS

This NGC summary was completed by ECRI on October 2, 2006. The information was verified by the guideline developer on November 1, 2006.

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