Complete Summary

GUIDELINE TITLE

Evidence-based care guideline for anesthesia, analgesia and sedation following arterial switch operation.

BIBLIOGRAPHIC SOURCE(S)

Cincinnati Children's Hospital Medical Center. Evidence based care guideline for anesthesia, analgesia and sedation following arterial switch operation. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2006 Jan 10. 8 p. [16 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Cincinnati Children's Hospital Medical Center. Evidence based clinical practice guideline for anesthesia, analgesia and sedation following arterial switch operation. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2001 Jan 22. 8 p.

Once the guideline has been in place for four years, the development team reconvenes to explore the continued validity of the guideline. This phase can be initiated at any point that evidence indicates a critical change is needed.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Physiologic stress, pain, agitation, and discomfort following arterial switch operation

GUIDELINE CATEGORY

Evaluation
Treatment

CLINICAL SPECIALTY

Anesthesiology
Cardiology
Critical Care
Pediatrics
Surgery

INTENDED USERS

Advanced Practice Nurses
Nurses
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

To provide a clinical guideline for anesthesia, analgesia, and sedation following arterial switch operation

TARGET POPULATION

These guidelines are intended primarily for use in neonates (age ≤30 days) who have undergone an arterial switch operation (with or without ventricular septal defect closure).

The guidelines do not address all considerations needed to manage those with the following:

- Adverse/allergic reaction to morphine, fentanyl, lorazepam, or midazolam

INTERVENTIONS AND PRACTICES CONSIDERED

Assessment

1. Assessment of hemodynamic stability as indicated by electrocardiographic monitoring, the mean arterial pressure (via arterial line), left atrial pressure (via transthoracic catheter), and urine output
2. Assessment of pain relief, patient comfort, and level of sedation, as indicated by behavioral assessment and absence of tachycardia or hypertension

Treatment

1. Fentanyl infusion

2. Concurrent use of midazolam or lorazepam with the fentanyl infusion to ensure adequate sedation
3. Provision of adequate analgesia and sedation using as needed doses of morphine and midazolam once the fentanyl infusion has been discontinued

MAJOR OUTCOMES CONSIDERED

- Physiologic stress response to cardiac surgery
- Pain control
- Sedation
- Risk for adverse hemodynamic events
- Adverse effects of narcotics, such as respiratory depression
- Time to extubation
- Hemodynamic stability
- Length of stay in the Cardiac Intensive Care Unit (CICU)

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

To select evidence for critical appraisal by the group for the update of this guideline, the Medline, EmBase and the Cochrane databases were searched. Evidence from 2000 and before was verified for inclusion in the guidelines. Evidence from 2001 to January, 2006 was reviewed for relevance to the clinical topics/questions to generate an unrefined, "combined evidence" database using a search strategy focused on answering clinical questions relevant to anesthesia, analgesia, or sedation following arterial switch operations and employing a combination of Boolean searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on words in the title, abstract, and indexing terms. The citations were reduced by: eliminating duplicates, review articles, non-English articles, and adult articles. The resulting abstracts were reviewed by a methodologist to eliminate low quality and irrelevant citations. During the course of the guideline development, additional clinical questions were generated and subjected to the search process, and some relevant review articles were identified. April, 2000 was the last date for which literature was reviewed for the previous version of this guideline. The details of that review strategy are not documented. However, all previous citations were reviewed for appropriateness to this revision.

A search using the above criteria was conducted for dates of January, 2006 through July, 2006. No relevant articles were found that would require changes to the January, 2006 version of the recommendations.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The recommendations contained in this guideline were formulated by an interdisciplinary working group which performed systematic and critical literature reviews, using a grading scale, and examined current local clinical practices.

Recommendations have been formulated by a consensus process directed by best evidence, patient and family preference and clinical expertise. During formulation of these guidelines, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

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

Experience with the implementation of earlier publications of this guideline has provided information which has been incorporated into this revision.

The guidelines have been reviewed by clinical experts not involved in the development process, senior management, and other individuals as appropriate to their intended purposes. The guideline is based in part on three independent reviews performed by members of Evidence-Based Care Group of Health Policy & Clinical Effectiveness at Cincinnati Children's Hospital and Medical Center (CCHMC) using AGREE criteria (Appraisal of Guidelines for Research and Evaluation).

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Each recommendation is followed by evidence grades identifying the type of supporting evidence. Definitions of the evidence grades are presented at the end of the "Major Recommendations" field.

Clinical Assessments

1. It is recommended that hemodynamic stability be maintained as indicated by mean arterial pressure >45, left atrial pressure <15, and urine output >1cc/kg/hr. Physical exam should indicate adequate perfusion.

   Note 1: Continuous monitoring of electrocardiogram (ECG) and arterial blood pressure via an arterial line is recommended (Local Expert Consensus [E]).

   Note 2: Continuous monitoring of left atrial pressure with a transthoracic catheter is recommended (Local Expert Consensus [E]).

2. It is recommended that adequate pain relief is provided as indicated by behavioral assessment and the absence of otherwise unexplained tachycardia or hypertension.
3. It is recommended that patient comfort and sedation be maintained as indicated by behavioral assessment. The patient should not be at risk for inadvertent self-removal of lines and/or tubes.

Treatment Recommendations

4. It is recommended that a fentanyl infusion at 10 micrograms/kg/hr be started on all post-operative arterial switch patients and maintained for at least 6 hours. The infusion should be discontinued if the patient has had no signs or symptoms of low cardiac output (mean arterial pressure <45, urine output <1 cc/kg/hr, persistent base deficit >-4 despite correction with sodium bicarbonate [$NaHCO_3$] or increase in lactate level >0.5 mg/dl/hr) and is therefore considered a good candidate for extubation in the next 24 hours.

Note 1: A continuous infusion of high-dose fentanyl is maintained to blunt the physiologic stress response that occurs as a consequence of cardiac surgery (Anand, Hansen, & Hickey, 1990 [D]; Anand & Hickey, 1992 [B]). Because cardiac output decreases for at least the first 6 hours following cardiopulmonary bypass, it is recommended that the infusion be continued for at least this length of time (Wernovsky et al., 1995 [A]).

Note 2: Because of the redistribution of fentanyl into lipid tissue, long-term infusion may result in prolongation of side effects such as apnea well beyond termination of the infusion (Cincinnati Children's Hospital Medical Center Formulary, 2006)[X]. Therefore, once pain management, rather than hemodynamic stability, becomes the primary reason for narcotic use, it is desirable to use bolus dosing of a less lipophilic agent such as morphine and to discontinue the fentanyl infusion (Local Expert Consensus [E]).

Note 3: Ongoing metabolic acidosis caused by the continued production of lactic acid has been associated with a poor outcome following cardiac surgery in infants and children. (Charpie et al., 2000 [C]; Munoz et al., 2000 [C]).

5. It is recommended that midazolam (0.1 mg/kg/dose every 1 to 2 hours) or lorazepam (0.1 mg/kg/dose every 6 to 8 hours) be given concurrently with the fentanyl infusion to ensure adequate sedation in addition to anesthesia/analgesia.

   Note: Because of the variability in neonatal response to fentanyl and because of rapid development of tolerance to its sedative effects (in contrast to respiratory depressant effects), additional use of benzodiazepines is often necessary to maintain adequate sedation (Arnold et al., 1991 [C]).

6. It is recommended that adequate analgesia and sedation be provided using as needed doses of morphine (0.1 mg/kg/dose) and midazolam (0.1 mg/kg/dose) once the fentanyl infusion has been discontinued.

   Note: The longer half-life of morphine makes it a better choice for intermittent dosing than fentanyl. The histamine release associated with morphine should be well tolerated hemodynamically by patients who are otherwise stable 6 hours after cardiopulmonary bypass (Saarenmaa et al., 1999 [A]; Saarenmaa, Neuvonen, & Fellman, 2000 [C]; Santeiro et al., 1997 [C]; Hamon et al., 1996 [C]; Katz & Kelly, 1993 [C]; Arnold et al., 1991 [C]; Murat et al., 1988 [C]).

Definitions:

Evidence Based Grading Scale

M: Meta-analysis or systematic review
A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample
C: Prospective trial or large case series
D: Retrospective analysis
S: Review article

O: Other evidence
E: Expert opinion or consensus
F: Basic laboratory research
L: Legal requirement
Q: Decision analysis
X: No evidence

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence is identified and classified for each recommendation (see "Major Recommendations") using the following scheme:

M: Meta-analysis or systematic review
A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample
C: Prospective trial or large case series
D: Retrospective analysis
S: Review article
O: Other evidence
E: Expert opinion or consensus
F: Basic laboratory research
L: Legal requirement
Q: Decision analysis
X: No evidence

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Blunting of physiologic stress response to cardiac surgery
- Pain control
- Sedation that provides comfort and safety
- Decreased risk for adverse hemodynamic events

POTENTIAL HARMS

- Respiratory depression associated with high-dose narcotic use
- Because of the redistribution of fentanyl into lipid tissue, long-term infusion may result in prolongation of side effects such as apnea well beyond termination of the infusion.

QUALIFYING STATEMENTS

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- In developing this guideline, the working group recognizes the paucity of large-scale studies with direct bearing on this particular focus population. The specific recommendations in this guideline are drawn from directly applicable studies where possible, but are largely extrapolated from smaller studies and from studies more indirectly related to the present issues.
- These recommendations result from review of literature and practices current at the time of their formulations. This protocol does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the guidelines to meet the specific and unique requirements of individual patients. Adherence to this pathway is voluntary. The physician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

Appropriate companion documents have been developed to assist in the effective dissemination and implementation of the guideline.

IMPLEMENTATION TOOLS

Foreign Language Translations
Patient 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

Getting Better

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

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ADAPTATION

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

DATE RELEASED

2001 Jan 22 (revised 2006 Jan 1)

GUIDELINE DEVELOPER(S)

Cincinnati Children's Hospital Medical Center - Hospital/Medical Center

SOURCE(S) OF FUNDING

Cincinnati Children's Hospital Medical Center

GUIDELINE COMMITTEE

Cardiac Guideline Development Team 2006

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

This guideline was developed without external funding.

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GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the Cincinnati Children's Hospital Medical Center Web site.

For information regarding the full-text guideline, print copies, or evidence based practice support services contact the Children's Hospital Medical Center Health Policy and Clinical Effectiveness Department at HPCEInfo@chmcc.org.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

The following is available:

- Going home after heart surgery. Home care. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2004 Dec. 1 p. Available in English and Spanish from the Cincinnati Children's Hospital Medical Center Web site.

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NGC STATUS

This NGC summary was completed by ECRI on March 11, 2004. This NGC summary was updated by ECRI on November 29, 2006. The updated information was verified by the guideline developer on December 19, 2006.

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Date Modified: 9/22/2008