Complete Summary

GUIDELINE TITLE

Care of the ventilator circuit and its relation to ventilator-associated pneumonia.

BIBLIOGRAPHIC SOURCE(S)

Hess DR, Kallstrom TJ, Mottram CD, Myers TR, Sorenson HM, Vines DL. Care of the ventilator circuit and its relation to ventilator-associated pneumonia. Respir Care 2003 Sep;48(9):869-79. [73 references] PubMed

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

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SCOPE

DISEASE/CONDITION(S)

Ventilator-associated pneumonia

GUIDELINE CATEGORY

Prevention

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Pulmonary Medicine

INTENDED USERS

Nurses
Physician Assistants
Physicians
Respiratory Care Practitioners

GUIDELINE OBJECTIVE(S)

To make appropriate recommendations for change frequency of the ventilator circuit and additional components of the circuit

TARGET POPULATION

Adult and pediatric patients receiving mechanical ventilation

INTERVENTIONS AND PRACTICES CONSIDERED

Change frequency for ventilator circuits, humidification systems (active, passive, heated, and unheated), and closed suction catheters

MAJOR OUTCOMES CONSIDERED

Cost savings

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

A PubMed (MEDLINE) search was conducted using the following search terms: pneumonia AND mechanical ventilation, humidifier, ventilator circuit, heated circuit, suction catheter, endotracheal suction, closed suction catheter, respiratory therapy equipment, endotracheal intubation, heat and moisture exchanger, tracheostomy, respiratory care, equipment contamination, equipment disinfection, artificial ventilation. The search was confined to human studies published in the English language. References and abstracts were retrieved into reference management software (EndNote, ISI, Berkeley, California). By inspection of these titles, references having no relevance to the study questions were eliminated. For the titles that remained, the abstracts were assessed for relevance, and additional references were eliminated as appropriate. This process was conducted independently by 2 individuals, after which their reference lists were merged to provide the reference base for further analysis. Throughout the process of developing these guidelines, members of the Writing Committee surveyed cross-references to identify additional references to be added to the reference base for analysis.

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

Level 1: Randomized, controlled trial with statistically significant results

Level 2: Randomized, controlled trial with significant threats to validity (e.g., small sample size, inappropriate blinding, weak methodology)

Level 3: Observational study with a concurrent control group

Level 4: Observational study with a historical control group

Level 5: Bench study, animal study, case series

METHODS USED TO ANALYZE THE EVIDENCE

Meta-Analysis
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Data were extracted from selected references using a standardized critique form. To validate this form and to establish the reliability of the review process, several references were evaluated by the entire committee during a face-to-face meeting. All references were then independently examined by at least 2 members of the Writing Committee. The critiques were compared and differences were resolved using an iterative process.

The critique forms were submitted to the principal author of the guideline, who transferred the information into evidence tables and conducted appropriate statistical analysis.

Quantitative analysis consisted of meta-analysis and petograms. Statistical analysis was conducted using RevMan software (RevMan Analyses, Version 1.0 for Windows, in Review Manager [RevMan] 4.2, Oxford, England: The Cochrane Collaboration, 2003). Relative risk was calculated using a random effect model. $P < 0.05$ was considered statistically significant.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Grade A: Scientific evidence provided by randomized, well-designed, well-conducted, controlled trials with statistically significant results that consistently support the guideline recommendation; supported by Level 1 or 2 evidence

Grade B: Scientific evidence provided by well-designed, well-conducted observational studies with statistically significant results that consistently support the guideline recommendation; supported by Level 3 or 4 evidence

Grade C: Scientific evidence from bench studies, animal studies, case studies; supported by Level 5 evidence

Grade D: Expert opinion provides the basis for the guideline recommendation, but scientific evidence either provided inconsistent results or was lacking.

COST ANALYSIS

The costs associated with ventilator circuit changes were calculated in 8 studies. Because these studies were conducted over a span of 20 years and in different countries, direct cost comparisons are difficult. Not surprisingly, each of these studies suggests considerable savings in personnel and materials costs with less frequent ventilator circuit changes.

METHOD OF GUIDELINE VALIDATION

Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The draft document was reviewed by experts on ventilator circuit care. Each of the reviewer´s comments was carefully assessed and the document was further revised as appropriate.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Each recommendation is rated based on the levels of the evidence and the grades of recommendation. Definitions of the grades of the recommendations (A, B, C, and D) and levels of the evidence (Level I- Level V) are presented at the end of the "Major Recommendations" field.

Recommendation #1: Ventilator circuits should not be changed routinely for infection control purposes. The available evidence suggests no patient harm and considerable cost savings associated with extended ventilator circuit change intervals. The maximum duration of time that circuits can be used safely is unknown. (**Grade A**)

Recommendation #2: Evidence is lacking related to ventilator-associated pneumonia (VAP) and issues of heated versus unheated circuits, type of heated humidifier, method for filling the humidifier, and technique for clearing condensate from the ventilator circuit. It is prudent to avoid excessive accumulation of condensate in the circuit. Care should be taken to avoid accidental drainage of condensate into the patient´s airway and to avoid contamination of caregivers during ventilator disconnection or during disposal of condensate. Care should be taken to avoid breaking the ventilator circuit, which could contaminate the interior of the circuit. (**Grade D**)

Recommendation #3: Although the available evidence suggests a lower VAP rate with passive humidification than with active humidification, other issues related to the use of passive humidifiers (resistance, dead space volume, airway occlusion risk) preclude a recommendation for the general use of these devices. The decision to use a passive humidifier should not be based solely on infection control considerations. (**Grade A**)

Recommendation #4: Passive humidifiers do not need to be changed daily for reasons of infection control or technical performance. They can be safely used for at least 48 hours, and with some patient populations some devices may be able to be used for up to 1 week. (**Grade A**)

Recommendation #5: The use of closed suction catheters should be considered part of a VAP prevention strategy. When closed suction catheters are used, they do not need to be changed daily for infection control purposes. The maximum duration of time that closed suction catheters can be used safely is unknown. (**Grade A**)

Recommendation #6: Clinicians (respiratory therapists, nurses, and physicians) caring for mechanically ventilated patients should be aware of risk factors for VAP (e.g., nebulizer therapy, manual ventilation, and patient transport). (**Grade B**)

Rating Scheme for the Strength of the Recommendation

Grade A: Scientific evidence provided by randomized, well-designed, well-conducted, controlled trials with statistically significant results that consistently support the guideline recommendation; supported by Level 1 or 2 evidence

Grade B: Scientific evidence provided by well-designed, well-conducted observational studies with statistically significant results that consistently support the guideline recommendation; supported by Level 3 or 4 evidence

Grade C: Scientific evidence from bench studies, animal studies, case studies; supported by Level 5 evidence

Grade D: Expert opinion provides the basis for the guideline recommendation, but scientific evidence either provided inconsistent results or was lacking.

Rating Scheme for the Level of Evidence

Level 1: Randomized, controlled trial with statistically significant results

Level 2: Randomized, controlled trial with significant threats to validity (e.g., small sample size, inappropriate blinding, weak methodology)

Level 3: Observational study with a concurrent control group

Level 4: Observational study with a historical control group

Level 5: Bench study, animal study, case series

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

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

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Evidence indicates that the origin of ventilator-associated pneumonia (VAP) is more likely from sites other than the ventilator circuit, and thus changing circuits less frequently will offer substantial cost savings.

POTENTIAL HARMS

When using passive humidifiers, the following issues must be considered:

- Increased work of breathing
- Higher P_{aco2} and minute ventilation
- Increased risk of airway occlusion

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Staying Healthy

IOM DOMAIN

Effectiveness
Safety

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

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ADAPTATION

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

DATE RELEASED

2003 Sep

GUIDELINE DEVELOPER(S)

American Association for Respiratory Care - Professional Association

SOURCE(S) OF FUNDING

American Association for Respiratory Care (AARC)

GUIDELINE COMMITTEE

Writing Committee

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: Available in Portable Document Format (PDF) from the American Association for Respiratory Care (AARC) Web site.

Print copies: Available from the American Association for Respiratory Care (AARC), CPG Desk, 11030 Ables Ln, Dallas, TX 75229-4593; Web site: www.aarc.org.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

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Date Modified: 9/29/2008