日本集中治療医学会
The Japanese Society of Intensive Care Medicine
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Ventilator-Associated Pneumonia Prevention Bundle

2010 Revised Edition

(JSICM-VAP Bundle)

Committee on ICU Evaluation

Japanese Society of Intensive Care Medicine

I. Ensuring hand hygiene

Background

Hand washing and hygiene are the basic steps for protecting healthcare providers and patients from nosocomial infections. Horizontal transmission of pathogens via human hands can serve as one factor responsible for nosocomial infections including ventilator-associated pneumonia (VAP). This risk should be avoided by strictly ensuring hand washing and hygiene.

Practices

(1) All healthcare providers and patient's family members should wash their hands at the following occasions:

1) Before entering the patient care zone
2) Before contacting the patient
3) After touching the patient's body fluids or secretions
4) After moving away from the patient
5) After departing from the patient care zone

(2) Healthcare workers should wash hands before and after touching the respiratory circuit.
(3) If the hands are not visibly soiled, the hands could be cleaned with an alcohol-based antiseptics preparation instead of tap water and soap.
(4) If the hands are visibly soiled, the hands should be washed with water and soap.
(5) A hand disinfector should be set at an easily accessible location on the patient's bedside.

References

1. Boyce JM, Pittet D: Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Infect Control Hosp Epidemiol 2002; 23:S3–40.
2. Garner JS: Guideline for isolation precautions in hospitals. The Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol 1996; 17:53–80.

II. Avoid frequent ventilator circuit exchanges

Background

Opening the ventilator circuit increases the risk of lower airway infections due to the contamination of the ventilator circuit. Periodical exchange of the circuit elevates the incidence of VAP.

Practices

(1) The circuit should be exchanged between every patient.
(2) Visibly dirty or damaged circuits should be exchanged.
(3) Although periodical exchange of the circuit is not prohibited, it is not advisable to exchange it in less than 7 days.
(4) Water droplets pooled in the circuit should be removed in an aseptic manner upon detection or before postural change of the patient.

References

1. Branson RD. The ventilator circuit and ventilator-associated pneumonia. Respir Care 2005; 50:774-85.
2. Han J, Liu Y. Effect of ventilator circuit changes on ventilator-associated pneumonia: a systematic review and meta-analysis. Respir Care 2010; 55:467-74.

III. Ensuring appropriate sedation and pain relief, avoiding oversedation

Background

Sedatives and analgesics should be used appropriately during mechanical ventilation. Oversedation can prolong the mechanical ventilation period and elevate the incidence of VAP.

Practices

(1) Richmond Agitation-Sedation Scale (RASS) is recommended as a scale for sedation.
(2) The level should be adjusted to keep the RASS score in the range between -3 and 0.
(3) The medical records (nursing records, etc.) should have columns for recording the status of sedative/analgesic use and the evaluation of sedation. Evaluation should be made several times a day.
(4) Daily interruption or reduction for sedatives during daytime should be considered. If needed, use of sedatives is resumed at a dosage half the preinturruption dosage. Analgesics can be persisted without inturruption.
(5) Continuous infusion of muscle relaxants should be avoided unless there is a special reason.
(6) The objectives of sedation and the target sedation score should be discussed and evaluated within the medical team, so that all members of the team can have common awareness.

How to suspend sedatives

(1) Prerequisites
    1) Absence of convulsion and excitation
    2) Absence of alcohol withdrawal symptoms
    3) Absence of paralysis
    4) Absence of signs of coronary ischemia
    5) Absence of signs of intracranial hypertension
(2) Criteria for evaluation
    1) Absence of anxiety, excitation and pain
    2) Absence of tachypnea (<35 rpm)
    3) Absence of hypoxemia ($SpO_2 \geq 90\%$)
    4) Absence of signs of respiratory distress
    5) Absence of arrhythmia
(3) Measures to be taken after suspension
    1) Checking the consciousness and responses
    2) Resuming continous sedation at a dose level half the previous dosage, as a rule, when resumption of sedation is judged to be necessary.

References

1. Fagon JY, Chastre J, Domart Y et al. Nosocomial pneumonia in patients receiving continuous mechanical ventilation. Prospective analysis of 52 episodes with use of a protected specimen brush and quantitative culture techniques. Am Rev Respir Dis 1989; 139:877-84.

2. Ely EW, Shintani A, Truman B et al. Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. JAMA 2004; 291:1753-62.
3. Sessler CN, Gosnell MS, Grap MJ, et al. The Richmond Agitation-Sedation Scale: validity and reliability in adult intensive care unit patients. Am J Respir Crit Care Med 2002; 166:1338-44.
4. Dries DJ, McGonigal MD, Malian MS, et al: Protocol-driven ventilator weaning reduces use of mechanical ventilation, rate of early reintubation, and ventilator-associated pneumonia. J Trauma 2004; 56:943-51.
5. Girard TD, Kress JP, Fuchs BD, et al: Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial. Lancet 2008; 371:126-34.

Dataset 1: Richmond Agitation-Sedation Scale (RASS)

Definition of scores
+4: Aggressive: Combative, violent, danger to staff
+3: Very excited: Pulls or removes tube(s) or catheters; aggressive
+2: Excited: Frequent nonpurposeful movement, fights ventilator
+1: Restless: Anxious, apprehensive , but not aggressive
0: Alert and calm
-1: awakens to voice (eye opening/contact) >10 sec
-2: light sedation: briefly awakens to voice (eye opening/contact) <10 sec
-3: moderate sedation: movement or eye opening. No eye contact
-4: deep sedation: no response to voice, but movement or eye opening to physical stimulation
-5: Unarousable: no response to voice or physical stimulation

IV. Daily evaluation for weaning from the ventilator

Background

Endotracheal intubation is a risk factor for VAP. To shorten the duration of endotracheal intubation, it is advisable: (1) to set a protocol for weaning from the ventilator and to evaluate periodically, and (2) to assess the possibility of weaning once daily with the use of a spontaneous breathing trial (SBT).

Practices

(1) A ventilator weaning protocol, tailored to individual facilities, should be prepared and applied.
(2) On each patient receiving mechanical ventilation, the possibility of SBT is discussed and evaluated daily during the morning conference, or at other occasions. The results of discussions and evaluations should be shared among all staff members.
(3) SBT should be implemented if the criteria are fulfilled. The results should be written in the medical records (nursing records, etc.).

Judgment on SBT implementation

(1) Prerequisites
    1) Evidence for reversal of the underlying disease for respiratory failure.
    2) The capability of spontaneous secretion drainage.
(2) Criteria for start
    1) Adequate oxygenation: PEEP≤8 cmH2O, PaO2/FIO2≥150 mmHg
    2) Stable hemodynamics: HR≤140/min. No inotropic support or dopamine < or = 5 μg/kg/min). No fatal arrhythmia. No sign of myocardial ischemia.
    3) Consciousness is stable: Sedative can be interrupted without any problem. The patient is arousable. The patient is rated as awake according to the sedation score used at the facility.
    4) No abnormality in electrolyte/acid-base balance: For example, severe respiratory/metabolic acidosis and abnormal potassium level are absent.

How to implement SBT

(1) Oxygen level: identical to that during mechanical ventilation.
(2) Setting: One of the following spontaneous breathing settings
    1) T piece
    2) 5 cm H_2O PEEP + pressure support 5-7 cm H2O
(3) The patient is observed for 5 minutes. During this period, changes in respiratory load (e.g., tachypnea) are often evaluated. The patient needs to be frequently checked by the staff at the bedside during this period. If any problem is found, SBT is abandoned.
(4) If no problem is found, SBT is implemented. Observe for 30-120 minutes.
(5) Patients satisfying the following criteria are deemed as “passed.”
    1) Vital signs
        i) Respiration rate < 35 rpm

ii) SpO2 ≥90%

iii) Absence of hypertension/hypotension (systolic pressure: >180 mmHg, <80 mmHg), or tachycardia/bradycardia (>140 min < 60/min, a 20% or greater change). Absence of serious arrhythmia.

2) Assessment of the patient

i) Changes in consciousness: Absence of unrest and no aggravation of anxiety

ii) Signs of circulatory disorders: Absence of wet and cold peripheral skin

iii) Signs of respiratory load: Absence of aggravation in respiratory pattern, no use of auxiliary respiratory muscles, and absence of extraordinary respiration.

If judged as "passed" in SBT

(1) If weaning is judged to be possible by SBT, the endotracheal tube can be removed.

(2) If there is some time until start of removal, ventilator assist is resumed until extubation.

If judged as "not passed" in SBT

(1) The level of ventilator assist is returned to the level before SBT

(2) SBT is scheduled again on the following or later days.

References

1. MacIntyer NR. Evidence-based guidelines for weaning and discontinuing ventilatory support. Chest 2001; 120:375S-95S.

2. Robertson TE, MD, Mann HJ, HyzyR et al; Partnership for Excellence in Critical Care. Multicenter implementation of a consensus-developed, evidence-based, spontaneous breathing trial protocol. Crit Care Med 2008; 36:2753-62.

3. Girard TD, Kress JP, Fuchs BD, et al: Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial. Lancet 2008; 371:126-34.

V. Avoid maintaining mechanically ventilated patients in a supine position

Background

If the patient is managed in the supine position, gastric contents can regurgitate into the oral pharynx, elevating the risk for VAP. If the patient assumes a position with the head of the bed elevated, the incidence for VAP is lower than that in the supine position.

Practices

The head is elevated unless this is contraindicated. The angle of elevation is indicated at 30 degrees. The medical staff members should periodically check the head position of the patient lying on the bed.

(1) The nurse in charge records the status of head elevation at a prescribed point of time into the medical records (nursing records, etc.).

(2) All staff members discuss and evaluate the status of head elevation periodically and share information.

(3) Head elevation should be implemented particularly during tube feeding.

1) In case of tube feeding, the feeding plan should be arranged to avoid increase of residues in the stomach.

2) If there are large amounts of residues in the stomach or the risk for regurgitation is high, feeding via the duodenum or small bowel is selected.

References

1. Torres A, Serra-Batles J, Ros E, et al. Pulmonary aspiration of gastric contents in patients receiving mechanical ventilation: the effect of body position. Ann Intern Med 1992; 116:540-543.

2. Orozco-Levi M, Torres A, Ferrer M, et al. Semirecumbent position protects from pulmonary aspiration but not completely from gastroesophageal reflux in mechanically ventilated patients. Am J Respir Crit Care Med 1995; 152:1387-1390.

3. Drakulovic MB, Torres A, Bauer TT, et al. Supine body position as a risk factor for nosocomial pneumonia in mechanically ventilated patients: a randomised trial. Lancet 1999; 354:1851-1858.

4. van Nieuwenhoven CA, Vandenbroucke-Grauls C, van Tiel FH, et al: Feasibility and effects of the semirecumbent position to prevent ventilator-associated pneumonia: a randomized study. Crit Care Med 2006; 34:396-402.