衞生防護中心
Centre for Health Protection

Recommendations on Prevention of Ventilator-associated Pneumonia

Scientific Committee on Infection Control, and
Infection Control Branch, Centre for Health Protection,
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Background

The Recommendations on Prevention of Ventilator-associated Pneumonia (VAP) represent the fourth accomplishment of The Scientific Committee on Infection Control (SCIC) in the promulgation of preventive measures for the four major systems - namely, surgical site infection, intravascular catheter associated bloodstream infection, catheter-associated urinary tract infection and ventilator-associated pneumonia. It is believed that the recommendations presented in this report will provide guidance on good practice for the prevention of Ventilator-associated Pneumonia, which would ideally set the standard of care in Hong Kong.

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Recommendations on Prevention of Ventilator-associated Pneumonia

Introduction

Ventilator-associated pneumonia (VAP), as defined by the Centers for Disease Control and Prevention (CDC), is a pneumonia that occurs in a patient who was intubated and ventilated at the time of or within 48 hours before the onset of event. The presenting signs of VAP include new or progressive infiltrates, consolidation, cavitations, or pleural effusion on chest radiographic examination and at least one of the following: new onset of purulent sputum or change in character of sputum, increased temperature, increased or decreased white blood cell count, organisms cultured from blood, or isolation of an etiologic agent from a specimen obtained by bronchial brushing or biopsy. (Annex 1 and Annex 2)

2. Ventilator-associated pneumonia is the most common infection acquired by patients in the intensive care unit. Reported rates range from 9% to 67% and 4.4 to 15.7 cases per 1000 ventilator days. Ventilator-associated pneumonia prolongs lengths of stay in intensive care and hospital, and it increases costs of care and possibly increases mortality. The prevention of this infection is therefore a high priority for infection control in intensive care.

3. The recommendations include both non-pharmacological and pharmacological aspect based on the best practice. They can serve as a model of practice in the formation of strategies, programmes, and plans for the prevention of ventilator-associated pneumonia in individual institution.

1. Infrastructure

1.1 Establish ventilator-associated pneumonia (VAP) quality improvement team in intensive care units and develop a protocol for prevention of VAP. (1-5)

1.2 Promote the use of noninvasive ventilation. (6)

1.3 Establish adequate professional manpower to facilitate quality care for the ventilated patient. (7-9)

2. Staff training

2.1 Integrate VAP prevention program to staff orientation and refreshment program in ICU/ HDU / ventilator wards. (4;6;7;10;11)

2.2 Provide adequate coaching and supervision to staff on intubation and care of ventilated patients until they are competent to work independently. (12;13)

2.3 Educate acute care doctors on non-invasive ventilatory strategies. (6)

2.4 Feedback unit VAP rates to the staff on regular basis to increase their awareness. (6)

3. Shorten the duration of intubation and invasive ventilation

3.1 Consider use of noninvasive ventilation whenever possible to shorten the duration of invasive ventilation as non-invasive ventilation is associated with lower risk of VAP. (6;11;14-16)

3.2 Avoid continuous use of paralytics as far as possible as paralytics may prolong the duration of ventilation and increase the incidence of VAP. (16)

3.3 Ensure appropriate dosage of sedation or narcotics is prescribed. Consider use of sedation scale to avoid over-sedation. (16;17)

3.4 Interrupt or lighten sedations daily at an appropriate time to assess patient's readiness for extubation. (6;7)

3.5 Wean patient off invasive ventilation as soon as possible. (6;14-16;18)

3.6 Prevent unplanned extubation, e.g. patient self-extubation. (6;11;17) Unnecessary re-intubation may increase the risk of VAP. (19-21)

4. Basic principles on preventing contamination

4.1 Apply appropriate infection precautions to prevent patients from exposure to potential nosocomial pathogens. (22)

4.2 Practice of standard precaution should be observed. (15)

4.3 Perform hand hygiene before and after performing respiratory care such as, manipulation of ventilator circuits or tracheal tube. (11;21)

4.4 Wear clean gloves when contact with respiratory secretions is anticipated. Gloves should be changed between patients. (15;23)

5. Tracheal tube intubation

5.1 Maintain aseptic technique in the whole intubation procedure. Mask and gloves should be worn. (16;24-27)

5.2 Insert endotracheal tube via oral route when there is no contraindication. Compared with nasal intubation, orotracheal intubation is associated with low risk of sinusitis and VAP. (6;11;12;14;15;21)

5.3 Use aseptic technique when replacing a new tracheostomy tube.(15)

6. Perform tracheal suction properly

6.1 Perform suction only when indicated. Avoid routine suction. The depth of suction catheter insertion should be measured beforehand. Care should be taken to suction pressure to avoid damaging the respiratory mucosa. (28;29)

6.2 Perform suction with aseptic technique. The type of suction systems, open or closed, makes no difference in the incidence of VAP. (12;15;21;30-32)

The advantage of closed suction method is that there is no dissemination of aerosols. (33) Therefore, measures to prevent the transmission of infectious aerosols are not required. (34)

6.3 When open tracheal suction method is used:

(a) Use a sterile, single-use suction catheter. (15;16;28)

(b) Perform hand hygiene before wearing gloves.

It is preferable to use sterile gloves than clean gloves for endotracheal suction (15;16;28) If clean gloves are used, ensure the sterility of inserted part of suction catheter is maintained.

(c) When a suction catheter is blocked by secretions, it is preferable to discard it and use a new suction catheter. (15)

6.4 When closed suction method is used:

(a) Wear clean gloves. (28;35)

(b) Change the in-line suction catheter following manufacturer's recommendation or when the suction catheter is visibly soiled. (15)

7. Avoid routine saline instillation

7.1 Avoid the routine practice of using saline instillation to loosen sputum for suction. (36) This practice does nothing to aid the underlying problem of dried and tenacious secretions but has potential detrimental effects such as decreasing oxygenation levels and causing contamination. (37;38)

7.2 If saline instillation is deemed necessary, single dose sterile solution should be used. (37;38)

8. Care of the respiratory care equipment

8.1 Ensure the policies and practices for disinfection, sterilization, and maintenance of respiratory equipments are aligned with evidence-based standards. Re-used respiratory accessories, including the breathing systems used for anesthesia, respirometer, resuscitation bag, nebulizer and test lung, should be properly cleansed and decontaminated after each use. (6;15;16)

8.2 Develop maintenance care incorporated with infection control principles:

(a) Allocate individualized respiratory equipment for each patient as far as possible. (22)

(b) Provide a new set of disposable or high level disinfected ventilator tubing for each patient. (14)

(c) Change ventilator tubing when it is visibly soiled.(7;16;21)

(d) Use sterile water to fill the humidifier of ventilator. It is an acceptable option to set up a closed water-refilling system to minimize manipulation of the humidifier system. (16)

(e) Change suction collection canisters and tubing between patients. (22)

8.3 Handle and store disinfected respiratory equipment or sterile items properly to preserve its sterility.

8.4 Check the expiry date and inspect the package of sterile respiratory items before use.

8.5 Ensure the disinfected respiratory equipment (e.g. nebulizer) is not re-contaminated during rinsing process. Sterile water should be used. (6;15)

8.6 In-line medication nebulizers: Use single dose vial of sterile medication or solution for nebulization whenever available. If multi-dose medication vials are used, ensure its sterility is maintained by proper storage and handling. (15)

9. Prevent condensate from ventilator circuits drain toward the patients

9.1 Position the ventilator's humidifier below the bed level to prevent condensation from draining toward the patients. (6;39)

9.2 Drain the condensate from ventilator tubing to water traps periodically (6;11;21;39).

9.3 Always drain ventilator tubing and remove oral secretion before repositioning patient. (40;41)

10. Prevent leakage of subglottic secretion into the lower airway

10.1 Maintain the tracheal tube cuff pressure adequately to prevent the leakage of secretion into the lower airway. (6;11;14;21)

10.2 Ensure oral and subglottic secretion is cleared before tracheal cuff deflation. (12;15;41)

10.3 Consider use of subglottic drainage endotracheal tube and tracheostomy tube for selected eligible patients. (6;11;42-44)

11. Prevent aspiration

11.1 Place the ventilated patient in semi-upright position between 30 and 45 degrees, especially during feeding and transport, unless there is contraindication. (6;11;12;14-17;45)

11.2 Verify the gastric tube is in proper position every time before feeding. (46)

11.3 Adjust the rate of tube feeding carefully according to individual's tolerance to prevent gastric over-distention. (14;21)

11.4 Consider use of gastrostomy tube feeding for long-term ventilated patient as it is associated with lower risk of aspiration. (47)

11.5 Avoid use of large-bore gastric tube unnecessarily as it affects the sphincter closure and increases the risk of regurgitation. (48)

12. Proper humidification of the inspired gas

12.1 Comparing the use of heated humidifiers and heat and moist exchangers (HMEs), there is no significant difference in the incidences of VAP in patients among the two groups. (15;21;49;50) However, HME can be considered an acceptable option because it is easier to use, and it can save manpower and thus reduce the healthcare cost. (21)

12.2 Make sure the patient has no contraindications when using heat moist exchanger. (12;21;49)

12.3 Change a HME when it becomes visibly soiled. (6;15;51)

12.4 Adjust the heated humidifier setting to provide optimum airway humidification. The inspired gas should be warmed to achieve physiological body temperature of 37^{O}C and physiological humidity. (52)

13. Provide oral care to ventilated patients

13.1 Include oral care as a part of standard ventilator care protocol. (15;53-56) Poor oral hygiene may increase the risk of VAP. (54) Implementation of oral care can be facilitated with oral care kits. (53-55)

13.2 Consider use of antiseptic oral rinse such as 0.12% Aq. Chlorhexidine at set interval. (6;11;53-55)

14. Selective Digestive tract Decontamination (SDD) / Selective Oropharyngeal Decontamination (SOD)

14.1 SDD is to selectively eliminate aerobic Gram-negative bacilli and yeast from the aerodigestive tract using a combination of topical and parental antibiotics.

14.2 Studies (57-59) have demonstrated that SDD reduces the incidence of VAP. However, reduction in mortality can only be demonstrated in certain populations such as trauma and surgical ICU patients, but not in medical patients which is the majority group.

There is concern over the issue of antibiotic resistance; and the cost-effectiveness of SDD is of unknown magnitude. More evidence is needed before SDD can be recommended.

14.3 SOD is using only topical antibiotics to selectively eliminate aerobic Gram-negative bacilli and yeast from the aerodigestive tract.

No decrease in mortality is observed in SOD alone; the long-term risk for emergence of antibiotic-resistant bacteria when topical antibiotics are administered in the digestive tract or the trachea is unclear and is potentially harmful. (60, 61) SOD is not recommended.

15. Stress Ulcer Prophylaxis

15.1 Stress ulcer prophylaxis is not recommended in very low risk patients for clinically important bleeding to minimize the risk for VAP.

Histamine type 2 receptor blockers, proton pump inhibitors and antacids are known risk factors for the development of VAP. (62-64)

15.2 The risk of bleeding should be balanced against the risk of VAP when using prophylaxis for stress ulcer in high-risk patients*. (65)

* High-risk patients: Patients requiring mechanical ventilation for >=48 hours or have coagulopathy (platelet count<50,000/μL, international normalized ratio [INR] greater than 1.5 or partial thromboplastin time more than twice the control value)]

15.3 Sucralfate is an acceptable option for the prevention of stress ulcer but it should be noted that there is conflicting results in respect to VAP risk. (62;66-68)

16. Prophylactic Antibiotics

16.1 Prolong use of prophylactic antibiotics is not recommended because prior administration of antibiotics was found to have increased risk for the development of late-onset VAP and the potential for development of antibiotic-resistant pathogens. (69;70)

16.2 There is no firm evidence that the use of short course (less than 24 hours) prophylactic antibiotics in high risk patients (trauma, severe head injury, coma, high-risk surgical procedure) following intubation, surgery, or the initial trauma (71) reduced the risk of VAP. More evidence is required before this can be recommended.

16.3 Avoid unnecessary use of antibiotics. Do not routinely administer prophylactic antibiotic to prevent VAP.

17. Quality improvement Programs

17.1 Process measures: Perform direct observation of compliance with VAP-specific process measures at set interval. (6;11)

(a) Compliance with hand-hygiene. (6)

(b) Compliance with daily sedation interruption and assessment of readiness to wean. (6;17)

(c) Compliance with regular antiseptic oral care. (6)

(d) Compliance with semi-recumbent positioning. (6)

17.2 Outcome measures: Conduct ongoing active surveillance for ventilator-associated pneumonia in ICU or high dependent area. (6;72;73)

17.3 Continue quality improvement: Establish a system to review the updated evidences on VAP prevention strategies, identify the areas for improvement in the units and develop best practices. (2;3)

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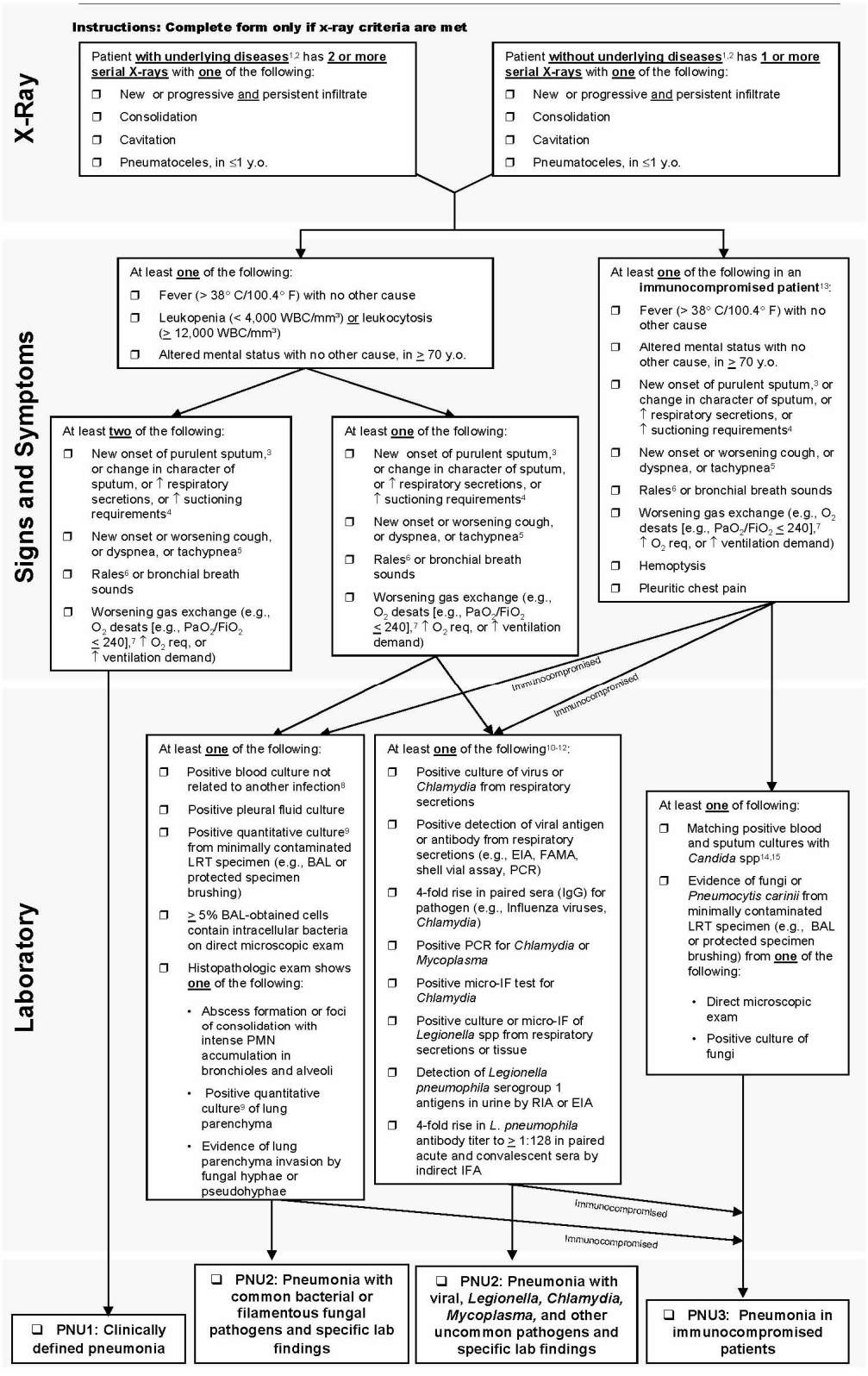
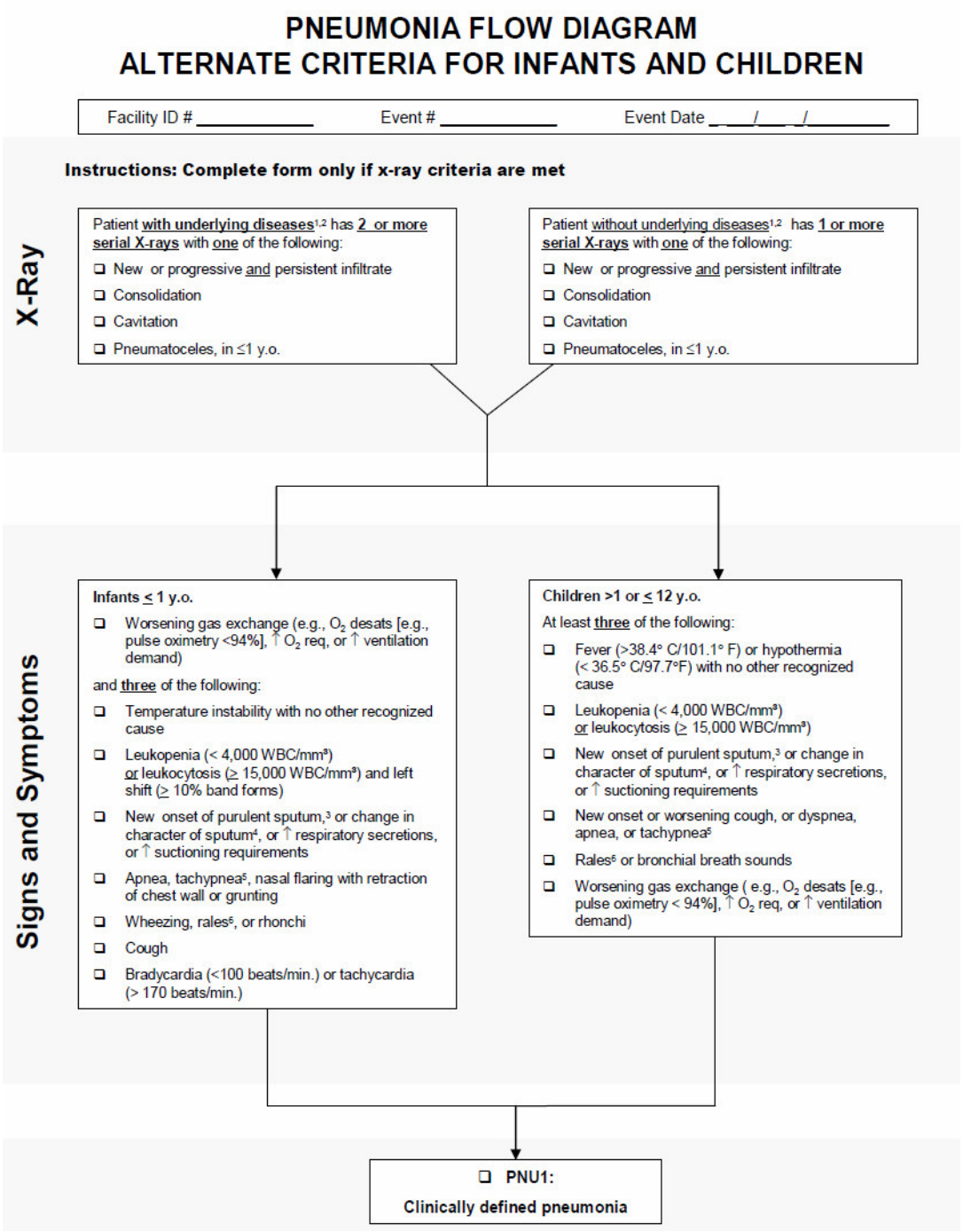
Annex 1: CDC Surveillance - Pneumonia flow diagram

SO: CDC. Ventilator-Associated Pneumonia (VAP) Event. March, 2009 Available from: URL: ww.cdc.gov/nhsn/PDFs/pscManual/6pscVAPcurrent.pdf



Annex 2: CDC Surveillance – Alternate pneumonia flow diagram for infants and children up to 12 years old

SO: CDC. Ventilator-Associated Pneumonia (VAP) Event. March, 2009 Available from: URL: ww.cdc.gov/nhsn/PDFs/pscManual/6pscVAPcurrent.pdf



Hong Kong Bundle to Prevent VAP

1. Elevate the head of patient to at least 30^0 unless contraindicated.
2. Use antiseptic oral rinse to provide oral care to ventilated patients on regular basis.
3. Perform hand hygiene before and after each respiratory care.
4. Review sedation at least on daily basis
5. Assess readiness to wean and to extubate at least on daily basis
6. Prevent condensate from entering patient's airway.
7. Maintain proper care of the respiratory consumables and equipments.
8. Conduct ongoing active VAP surveillance.