



Scottish Intensive Care  
Society Audit Group



# VAP Prevention Bundle

## Guidance for Implementation



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Cuirear am foillseachadh seo ri fhaighinn ann an grunn chànan, clò-bhualadh mòr is Braille (Beurla a-mhàin). Cuir fòn dhan àireamh a leanas airson fiosrachaidh mar a gheibhear eadar-theangachadh an fhoillseachaidh seo nad chànan coimhearsnachd:

يمكن أن يتوفر هذا الإعلان بلغات مختلفة، وطباعة بحجم أكبر، وطباعة برايل (باللغة الإنجليزية فقط). للحصول على معلومات حول ترجمة هذا الإعلان بلغتك المحلية، يرجى الاتصال بالرقم الوارد أدناه.

यह प्रकाशन विभिन्न भाषाओं, बड़े अक्षरों, ब्रेल लिपि (सिर्फ अंग्रेजी) में उपलब्ध कराया जा सकता है। आपके समुदाय की भाषा में इसे प्रकाशन के अनुवाद के बारे में जानकारी के लिए कृपया नीचे दिए हुए नम्बर पर टेलीफोन करें।

এই প্রকাশনাটি বিভিন্ন ভাষায়, বড় ছাপার অক্ষর এবং ব্রেইলী-ত (শুধুমাত্র ইং-রাজী-ত) সরবরাহ করা যে-ত পা-রা। এই প্রকাশনাটি আপনার মাতৃভাষায় অনুবাদ সম্পর্কিত তথ্যের প্রয়োজন অনুগ্রহপূর্বক নিম্নলিখিত নাম্বার-র টেলি-ফোন করুন :

ਇਹ ਪ੍ਰਕਾਸ਼ਨ ਵਖ ਵਖ ਭਾਸ਼ਾਵਾਂ ਵਿਚ, ਵੱਡੇ ਛਾਪੇ, ਬ੍ਰੇਲ (ਸਿਰਫ ਅੰਗਰੇਜ਼ੀ ਵਿਚ) ਉਪਲਬਧ ਕੀਤੀ ਜਾ ਸਕਦੀ ਹੈ। ਇਸ ਪ੍ਰਕਾਸ਼ਨ ਦੇ ਆਪਣੇ ਭਾਈਚਾਰੇ ਦੀ ਭਾਸ਼ਾ ਵਿਚ ਅਨੁਵਾਦ ਲਈ ਜਾਣਕਾਰੀ ਲਈ ਕਿਰਪਾ ਕਰਕੇ ਹੇਠ ਲਿਖੇ ਨੰਬਰ ਤੇ ਫੋਨ ਕਰੋ।

یہ طبع مختلف زبانوں اور بڑے چھاب میں دستیاب کی جاسکتی ہے، برائلی (صرف انگریزی میں) اپنی کمیونٹی کے زبان میں اس طبع کے ترجمے کے بارے میں معلومات حاصل کرنے کے لئے، براہ کرم مندرجہ ذیل نمبر پر فون کیجئے۔

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# Contents

Introduction.....	iv
Avoiding invasive ventilation.....	v
Preventing VAP Care Bundle.....	vi
1. Sedation to be reviewed and, if appropriate, stopped each day .....	1
2. All patients will be assessed for weaning and extubation each day .....	2
3. Avoid the supine position aiming to have the patient at least 30° head up.....	3
4. Use chlorhexidine as part of daily mouth care .....	4
5. Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours.....	5
Method of humidification.....	6
Selective Decontamination of the Digestive Tract .....	7

# Introduction

This care bundle has been agreed by experts in intensive care and infection control, from around Scotland. They have considerable experience in their own areas of care bundle application and infection control through surveillance.

Recommending best practice of this type requires compromise and pragmatism.

The following pages explain the rationale and detail the exclusions for each bundle element, but these lists may require extra local exclusions.

Auditing compliance with bundle elements should take into account valid clinical exclusions.

Further reading can be found at: <http://www.sicsebm.org.uk/welcome.htm>

These measures are part of an overall strategy to reduce acquired infections in intensive care. These include:

- Hand hygiene
- Personal protective equipment
- Environmental cleaning

Clinical practice aimed at preventing ventilator associated pneumonia (VAP) must be seen in the context of managing patients with respiratory failure and especially those who require invasive ventilation.



# Avoiding invasive ventilation

Some patients with acute respiratory failure are suitable for non-invasive ventilation. Randomised controlled trials [RCTs] investigating the benefit of non-invasive ventilation have used primary outcomes such as invasive ventilator days, intensive care days and survival. There is good evidence that non-invasive ventilation improves these outcomes in patients with acute respiratory failure, especially those with an acute exacerbation of COPD, cardiogenic pulmonary oedema and the immuno-suppressed. Non-invasive ventilation may be associated with reduced rates of hospital-acquired pneumonia, but the main benefit is in avoiding invasive ventilation.

Similarly, daily assessment of sedation requirement and the suitability for weaning and extubation helps reduce ventilator and ICU days.

We recommend consideration of **non-invasive ventilation, daily assessment of sedation and daily consideration for weaning and extubation** as part of an overall strategy for managing patients with acute respiratory failure.

## Noninvasive ventilation and avoiding intubation should be considered in appropriate cases

**Improved** outcome with initial non-invasive respiratory support trying to avoid intubation has been demonstrated in the following groups:

- Cardiogenic pulmonary oedema
- Acute exacerbation of Chronic Obstructive Pulmonary Disease
- Immuno-compromised patients: Pneumocystis infection and solid organ transplant recipients

**Worse** outcome with initial non-invasive respiratory support trying to avoid intubation has been demonstrated in:

- ICU patients who fail a trial of extubation

## References

Garpestad E, Brennan J and Hill NS. Noninvasive Ventilation for Critical Care. *Chest* 2007; **132**:711–720

Keenan SP, Powers C, McCormack DG and Block G. Noninvasive Positive-Pressure Ventilation for Postextubation Respiratory Distress: A Randomized Controlled Trial *JAMA*. 2002;**287**:3238-3244.

Esteban A, Frutos-Vivar F, Ferguson ND *et al*. Noninvasive positive-pressure ventilation for respiratory failure after extubation. *N Engl J Med* 2004;**350**:2452-60.

# Preventing VAP Care Bundle

These elements have been demonstrated to reduce ventilator days or the risk of VAP in well-conducted RCTs. Compliance with these processes should be audited. The outcome: VAP rates, should be part of an infection surveillance programme.

- 1. Sedation to be reviewed and, if appropriate, stopped each day**
- 2. All patients will be assessed for weaning and extubation each day**
- 3. Avoid the supine position, aiming to have the patient at least 30° head up**
- 4. Use chlorhexidine as part of daily mouth care**
- 5. Use subglottic secretion drainage in patients likely to be ventilated for more than 48hours.**

Each element is explained with references and exclusions on the following pages.



# 1. Sedation to be reviewed and, if appropriate, stopped each day

A RCT of daily sedation breaks v. routine care demonstrated reduced duration of ventilation and intensive care unit stay in those patients having daily interruptions of sedation under the guidance of the research team.

Another RCT demonstrated that a nurse-led protocol reduced ventilator time.

This approach requires each ICU to examine their sedation practice and scoring and develop a system that allows a safe sedation hold policy. The following guidance has been used successfully at Stirling Royal Infirmary.

Sedation breaks should ideally occur **before 10am**. If appropriate consider switching off sedation at the end of the night shift. In order to maintain patient and staff safety, liaise closely with the nurse in charge and colleagues.

- Sedative agents should be stopped, but not disconnected from the patient.
- Allow the patient to wake.
- If the patient is co-operative and able to understand commands leave the sedation off.
- Distressed or agitated patients require re-sedating.
- Recommence the sedation at half the previous rate.
- Administer boluses as appropriate / required to achieve safety.

**It is important to remember to review the patient's analgesic requirements if sedation remains off.**

## Exclusions

1. Paralysed patient
2. Patient with brain injury, sedated with possible ICP problem
3. Patient who is difficult to ventilate- coughing/asynchrony
4. Patient who is difficult to oxygenate  $\geq 70\%O_2$  or PEEP  $\geq 10$
5. Patient receiving therapeutic hypothermia
6. Patient receiving palliative/terminal care

## References

Kress JP, Pohlman AS, O'Connor MF, Hall JB. Daily interruption of sedative infusions in critically ill patients undergoing mechanical ventilation. *N Engl J Med* 2000;**342**:1471–1477.

Brook AD, Ahrens TS, Schaiff R *et al*. Effect of a nursing-implemented sedation protocol on the duration of mechanical ventilation. *Crit Care Med* 1999; **27**: 2609–2615.

## 2. All patients will be assessed for weaning and extubation each day

This has been the subject of a RCT. Daily screening of the respiratory function of ventilated patients, followed by trials of spontaneous breathing in appropriate patients reduced the duration of mechanical ventilation and was associated with fewer complications than usual care.

Other RCTs have demonstrated that weaning protocols reduce ventilator times.

### Exclusions

1. Paralysed patient
2. Patient with brain injury, sedated with possible ICP problem
3. Patient who is difficult to ventilate- coughing/asynchrony
4. Patient who is difficult to oxygenate  $\geq 70\%O_2$  or PEEP  $\geq 10$
5. Patient receiving therapeutic hypothermia
6. Patient receiving palliative/terminal care

### References

- Ely EW, Baker AM, Dunagan DP *et al.* Effect on the duration of mechanical ventilation of identifying patients capable of breathing spontaneously. *N Engl J Med.* 1996; **335**:1864-9
- Kollef MH, Shapiro SD, Silver P *et al.* A randomized, controlled trial of protocol-directed versus physician-directed weaning from mechanical ventilation. *Crit Care Med.* 1997; **25**:567-74
- Marelich GP, Murin S, Battistella F *et al.* Protocol weaning of mechanical ventilation in medical and surgical patients by respiratory care practitioners and nurses: effect on weaning time and incidence of ventilator-associated pneumonia. *Chest* 2000; **118**:459-467.





### 3. Avoid the supine position aiming to have the patient at least 30° head up.

#### Rationale

Sitting ventilated patients up reduces oesophageal reflux, pulmonary aspiration and may prevent VAP. Semi-recumbent positioning has been the subject of 2 RCTs.

Draculovic *et al.* randomized 90 ventilated patients to supine or semi-recumbent positioning. There was a dramatic reduction in the risk of microbiologically proven VAP in the semi-recumbent group, (5 v. 23%). This means that only 6 patients would need to be treated in the semi-recumbent position to prevent one episode of VAP (95% confidence intervals 3-23).

Nieuwenhoven *et al.* conducted a RCT in 221 ventilated patients. The intended 45° backrest elevation in the experimental arm was not met, despite using research nurses around the clock; however a mean angle of 28° was achieved. In the control group, a mean angle of 10° was achieved. The VAP rates in both arms were low, with little difference (11.6 and 7.3%, respectively).

What can we learn from these seemingly disparate findings? Firstly that it is very difficult to achieve 45° backrest elevation, though elevation to nearly 30° is possible. It may be that avoidance of the supine position, particularly in patients being enterally fed, is more important than semi-recumbency.

#### Notes

Backrest elevation should be done whenever practicable during patient care.

Bed angle can be checked against the SICSAG VAP Prevention Bedside Aide-Mémoire which has lines at 30 and 45°.

#### Exclusions

1. Unstable, shocked patient e.g. requiring fluid challenges, high dose inotropes
2. Unstable pelvic or spinal injury (it may still be possible to tilt the whole bed)
3. Patient receiving palliative/terminal care

#### References

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.

Van Nieuwenhoven CA, Vandebroucke-Grauls C, van Tiel FH, *et al.* Feasibility and effects of the semirecumbent position to prevent ventilator-associated pneumonia: a randomized study. *Critical Care Medicine* 2006; **34**: 396-402

## 4. Use chlorhexidine as part of daily mouth care

### Rationale

Oral antiseptics such as chlorhexidine will reduce oro-pharyngeal colonization and hence VAP. A recent meta-analysis of 7 RCTs involving 1 650 patients showed a reduced risk of developing VAP in those treated with chlorhexidine (relative risk, 0.74; 95% confidence interval, 0.56–0.96;  $p = 0.02$ )

### Notes

Various chlorhexidine preparations have been used in the clinical trials. It is recognized that the probable optimal preparation is 2% chlorhexidine, but this is not commercially available at the moment in Scotland. NICE draft recommendations have suggested the use of 2% chlorhexidine, so this may change. 1% chlorhexidine gluconate gel is available and about 2cm may be applied by a gloved hand to the inside of each cheek, four times a day after oral hygiene.

**Chlorhexidine may become colonised by infective organisms such as pseudomonas if contaminated by careless use.**

### Therefore:

- Tubes of chlorhexidine must be for single patient use- not shared with other patients
- Chlorhexidine gel must be applied with a clean (not sterile) glove donned for the application

### Exclusions

1. Oro-pharyngeal trauma or surgery
2. Known hypersensitivity to chlorhexidine (rare)
3. Patient receiving palliative/terminal care

### Reference

Maciej PC and Safdar N. Topical chlorhexidine for prevention of ventilator-associated pneumonia: A meta-analysis. *Critical Care Medicine* 2007; **35**: 595–602



## 5. Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours.

Subglottic aspiration ports should be aspirated hourly.

### Rationale

Subglottic drainage of potentially contaminated oro-pharyngeal secretions from above the tracheal tube cuff may prevent aspiration, lower airway colonization and hence pneumonia. Subglottic secretion drainage has been the experimental arm of 6 RCTs and one metanalysis of nearly 900 patients.

The metanalysis found that subglottic secretion drainage halved the incidence of VAP, particularly during the first week of intubation of patients expected to be ventilated for more than 3 days. Additionally, duration of ventilation was reduced by almost 2 days and intensive care unit stay by nearly 3 days.

The metanalysis was well conducted, recognising the heterogeneity of the 5 trials and attempted to resolve some of the differences between trials by sensitivity analysis. An important difference was the study setting; one trial was conducted in a cardiothoracic intensive care unit, with short periods of ventilation and no statistically significant difference in VAP rates between the two study arms. The method of diagnosis was the most important source of heterogeneity, with only one study relying on quantitative analysis of bronchoscopically obtained secretions. This study demonstrated a reduced chance of VAP in the experimental arm, with 7 patients being needed to treat by subglottic drainage to prevent one episode of VAP (95% CI 4-43).

It is recognised that endotracheal tubes with subglottic drainage ports are not widely stocked in Scottish hospitals. Supplies may be difficult in the first instance. Exclusion number 2 below should be regarded as temporary and will be reviewed as these tubes become widespread.

### Exclusion

1. Intubated prior to ICU admission (the risk of re-intubation must be considered; both the immediate risks of difficult or failed intubation and cardiovascular compromise and late complications such as VAP).
2. Endotracheal tube with subglottic drainage port not available in hospital
3. Patient receiving palliative/terminal care

You may wish to consider providing tracheal tubes with subglottic drainage ports outwith your ICU.

### References

Dezfulian C, Shojania K, Collard HR, *et al*. Subglottic secretion drainage for preventing ventilator-associated pneumonia: a meta-analysis. *The American Journal of Medicine* 2005; **118**:11-18

Leonardo Lorente, María Lecuona, Alejandro Jiménez, María L. Mora, and Antonio Sierra. Influence of an Endotracheal Tube with Polyurethane Cuff and Subglottic Secretion Drainage on Pneumonia. *Am. J. Respir. Crit. Care Med.* 2007; **176**: 1079-1083

Other interventions to prevent VAP have been investigated. These have not been convincingly demonstrated to have an overall beneficial effect, but are worthy of comment.

## Method of humidification

Traditional humidification of ventilator circuits used heated water humidifiers. While these achieve excellent heat and moisture contents of inspired gases, there is a risk of bacterial colonization of the condensate that forms inside the ventilator tubing. This may then be a source for inadvertent lower airway contamination.

Heat and moisture exchange filters may provide adequate humidification and warming of inspired gases. Their use reduces colonization of the breathing circuit.

10 small trials have examined VAP in patients randomized to receiving either method of humidification. Pooling the results of these trials together, without taking methodological differences into account, does not show statistically different VAP rates.

It is likely that the method of humidification does not play a significant role in the prevention of VAP. Heat and moisture exchange filters may be preferred on the grounds of cost and ease of use. However, their dead-space contributes to difficulties in carbon dioxide elimination in patients with ARDS.

### Reference

<http://www.sicsebm.org.uk/VAP/HMEs.htm>



## Selective Decontamination of the Digestive Tract

Application of oral pastes containing a mixture of non-absorbable antibiotics has been used to prevent colonization of the upper airways and ventilator-associated pneumonia.

Over 30 RCTs of selective digestive decontamination (SDD) have been conducted. Several meta-analyses, including a Cochrane review, of these studies have shown a significant reduction in the incidence of VAP, although the effect on mortality has been varied. Those trials using oral antibiotics alone, without a systemic component, have not shown a decrease in mortality, despite a decrease in VAP rates.

However, meta-analyses must consider the quality, as well as the quantity of trials. A meta-analysis of the effects of SDD on pneumonia found that the methodological quality of RCTs had an indirect relationship with the relative risk of pneumonia; studies with better methodological quality showed smaller beneficial effects of SDD on pneumonia rates.

Another reason why SDD has not widely adopted has been concern about the emergence of multi-resistant bacterial strains. This has occurred during two studies, with concern about the emergence of MRSA.

### References

Liberati A, D'Amico R, Pifferi , Torri V, Brazzi L. Antibiotic prophylaxis to reduce respiratory tract infections and mortality in adults receiving intensive care. *Cochrane Database of Systematic Reviews* 2004, Issue 1. Art. No.: CD000022. DOI: 10.1002/14651858.CD000022.pub2.

## Bedside Aide-Memoire

### SICSAG VAP Prevention Bundle

This care bundle has been agreed by experts in intensive care and infection control, from around Scotland.

Please see SICSAG VAP Prevention Bundle, Guidance for Implementation document for more information.

Further reading can be found at:

[www.sicsebm.org.uk](http://www.sicsebm.org.uk),

[www.sicsag.scot.nhs.uk](http://www.sicsag.scot.nhs.uk)

and

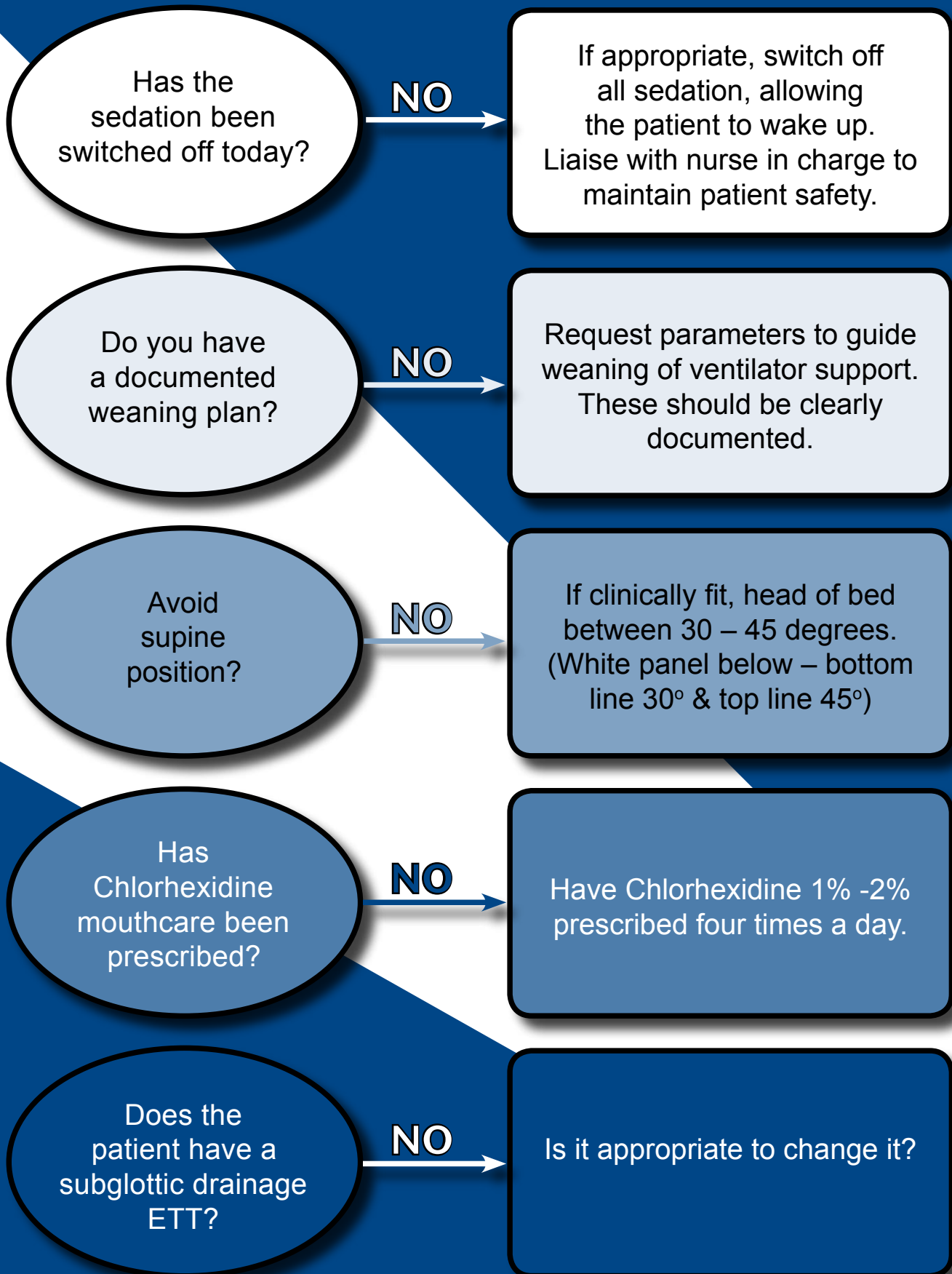
[www.hps.scot.nhs.uk](http://www.hps.scot.nhs.uk)

### Bundle Elements

- Sedation to be reviewed and, if appropriate, stopped each day
- All patients will be assessed for weaning and extubation each day
- Avoid supine position, aiming to have the patient at least 30° head up
- Use Chlorhexidine as part of daily mouth care
- Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours



# Scottish Intensive Care Society Audit Group



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