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Sarawak General Hospital, Malaysia
The use of the ventilator care bundle in a Malaysian Hospital, a service
evaluation

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VENTILATOR ASSOCIATED PNEUMONIA (VAP) may develop in artificially ventilated patients, as a result of the micro aspiration of bacteria. VAP is defined as a hospital acquired lower respiratory tract infection that develops 48 hours or more after tracheal intubation and mechanical ventilation. A diagnosis of VAP can be made when three or more of the following features are present in a ventilated patient: pyrexia (oral body temperature greater than 37 degrees centigrade), leucocytosis, purulent secretions, infiltrate on chest radiography. VAP is dissimilar from other types of pneumonia because the micro-organisms responsible for the development of pneumonia differ from those which cause other pneumonias. Treatment of VAP initially involves broad spectrum antibiotic treatment; followed by specific antibiotic treatment which targets the causative organism.

The development of VAP is thought to be associated with poor outcomes for the patient and the health care system respectively, however a recent systematic review demonstrated the outcomes resulting from VAP are not easily quantifiable. Evidence from a large systematic review suggests that the evidence to support that patients with a diagnosis of VAP have a higher mortality rate than patients in the intensive care unit (ICU) without VAP is actually equivocal. Despite this, some smaller scale research has concluded the mortality rate for patients’ with VAP is 46%, compared to 32% for a patient residing in the intensive care unit (ICU) without VAP; length of time in ICU is extended, and cost of care is increased.

Therefore, it is prudent to prevent the development of VAP in artificially ventilated patients. The Ventilator Care Bundle (VCB) was developed in 2004 with the aim of reducing the incidence of VAP, through the introduction of a set of interventions. The VCB has been regularly updated, in accordance with new evidence. The current version used in the UK in 2014 comprises of the following interventions: patient’s head raised between 35 and 45 degrees; ventilator and sedation weaning at an appropriate time; provision of daily mouth care, gastric protection, the use of thromboprophylaxic medication and the use of a subglottic drainage device. The majority of the interventions included in the bundle have a rigorous evidence base: oral care has been shown to reduce respiratory tract infection by 69%, gastric protection, along with ventilator and sedation weaning has been shown to reduce the development of VAP; and it is well known the use of thromboprophylaxis is key in preventing morbidity and mortality in ventilated patients. Interestingly, the optimum usage of subglottic drainage devices is currently debated; and there is no concrete evidence demonstrating that raising the head of the bed for ventilated patients protects against the development of VAP, however, this intervention was included in the VCB due to the recommendation by a number of experts.
The VCB has been shown to be successful at reducing the development of VAP \textsuperscript{14} and therefore reducing cost of patient care, due to the prevention of patients’ requiring long ICU stays due to VAP \textsuperscript{15, 16, 17}.

The VCB is recognised and implemented throughout the world, including Malaysia \textsuperscript{18}, however the precise interventions included in VCBs vary between hospital and country \textsuperscript{9}. Malaysia is a middle income country, but despite this has an effective health care system, with resources comparable to those in a high income country [see figure 1] \textsuperscript{19}. The Malaysian healthcare system is split in to public and private components; with the public sector providing approximately 80% of healthcare \textsuperscript{18}. Despite the Malaysian healthcare system being an effective service, a major problem that was observed in public sector hospitals is overcrowding.

Sarawak General Hospital is the largest and most specialised in the state of Sarawak and it is a referral centre for patients from neighbouring towns with complex problems. The ICU department at Sarawak General Hospital had 18 beds, however a further 23 ventilators are available to be used in other areas of the hospital. Caring for ventilated patients outside of the specialist ICU setting is not advised as such care (outside a specialist setting) is associated with increased patient morbidity and mortality \textsuperscript{20}.

VAP is a preventable disease; therefore VAP prophylaxis is an important measurement which determines the effectiveness of an ICU department. In Europe, on average, the incidence of VAP is 7.0 per 1000 ventilator care days \textsuperscript{9}. In public (government led) hospitals in Malaysia, the incidence of VAP was 7.2 per 1000 ventilator days in 2012 \textsuperscript{21}. Research conducted in Sarawak General Hospital revealed the incidence of VAP in 2012 was 6.3 per 1000 ventilator days \textsuperscript{21} and adherence to the VCB was 97.2\% \textsuperscript{21}.

Data regarding adherence to the VCB and prevalence of VAP is not available after the year 2012. As a result, this study aims to determine the adherence to the VCB at Sarawak General Hospital, Malaysia.
AIMS

(1) To explore Sarawak General Hospital’s ICU department’s adherence to VCB
(2) To explore Sarawak General Hospital’s general wards’ adherence to VCB
(3) To provide Sarawak General Hospital with information about their adherence to VCB via a written report
(4) To highlight areas of weakness relating to the VCB and suggest potential improvements to improve patient care

METHOD

In order to determine adherence to VCBs, a cross sectional service evaluation was conducted over a four week period from 5th May until 30th May 2014 in Sarawak General Hospital, a government run public hospital in Kuching, in Malaysian Borneo. Formal ethical approval was not required to complete this service evaluation. Permission was sought and granted from the hospital director and head of anaesthetics department.

The researcher (Rachel Barker) would attend the ICU ward round and following this, collect data about the parameters in table 1 from each patient receiving artificial ventilation in Sarawak General Hospital. Information detailing the location of all patients in Sarawak General Hospital requiring artificial ventilation was available in the ICU department.

The researcher collected the information from each patient, travelling in a clockwise direction around the ICU. Following this, data were collected from each patient in the hospital requiring ventilator support. No patients were excluded from the audit.

Data regarding the parameters in table 1 were collected. Information was retrieved from the following sources: observation of the patient; ICU observation chart; the medical notes recorded for the 24 hours preceding the time of data collection; prescription medication chart; the patient’s nurse. In the original protocol, it was planned that data regarding the angle of the head of the bed would be collected using a protractor, however this was not possible due to infection control reasons, therefore this data was collected by visual observation of the patient.
The cross sectional study design was chosen as it was not possible to access patient notes retrospectively on Thursday 8th, Friday 9th, Monday 12th, Friday 16th, Monday 19th, Wednesday 21st May 2014.

Data were recorded into an anonymised data collection tool. Anonymised data was uploaded to a password protected computer and the paper copies of the completed data collection tools were shredded. Data were analysed in July 2014.

**Table 1:** Parameters included in the ventilator care bundle and how this information was collected

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Method of collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of patient</td>
<td>Notes</td>
</tr>
<tr>
<td>Sex of patient</td>
<td>Notes</td>
</tr>
<tr>
<td>Location of patient (ICU vs. general ward)</td>
<td>Observation</td>
</tr>
<tr>
<td>Diagnosis of patient</td>
<td>Notes</td>
</tr>
<tr>
<td>Form of ventilation</td>
<td>Observation/notes</td>
</tr>
<tr>
<td>Position of patient’s head</td>
<td>Observation</td>
</tr>
<tr>
<td>Daily discussion about the patient’s suitability for</td>
<td>Observation/notes</td>
</tr>
<tr>
<td>ventilator weaning</td>
<td></td>
</tr>
<tr>
<td>Daily discussion about the patient’s suitability for</td>
<td>Observation/notes</td>
</tr>
<tr>
<td>decreasing sedation</td>
<td></td>
</tr>
<tr>
<td>Provision of daily mouth care</td>
<td>Notes</td>
</tr>
<tr>
<td>Provision of gastric protection</td>
<td>Notes</td>
</tr>
<tr>
<td>Provision of thromboprophylaxis</td>
<td>Notes</td>
</tr>
<tr>
<td>Provision of subglottic drainage device</td>
<td>Notes</td>
</tr>
</tbody>
</table>
RESULTS

(a) Patient demographics

In total, data regarding 55 patients requiring artificial ventilation were collected. 44 (80.0%) of the patients were receiving artificial ventilation on ICU and 11 (20.0%) on general medical wards. 40 (72.7%) patients were artificially ventilated using an endotracheal (ET) tube; 15 (17.3%) patients were artificially ventilated using a tracheostomy. 35 (63.6%) of the patients requiring artificial ventilation were male.

The duration the patients’ in the study had received ventilator support varied from 0 days to 34 days, the median time for patients’ included in the study to receive ventilator support was for 4 days. The diagnosis of patients’ on the ICU (figure 2 and figure 3), patient’s age (figure 4) varied within and between locations.
(b) Results of service evaluation

Patient positioning

In accordance with guidelines, 55 (100.0%) patients had the upper part of their bed elevated to between 30 and 45 degrees. 47 (85.4%) patients had their heads elevated to 45 degrees. 8 (14.6%) patients had their heads elevated to 30 degrees.

It should be noted data collected regarding patient positioning was collected on a visual observational basis, rather than measurement of angle using a protractor. This was due to the risk of spread of infection if a measurement implement was used.

Ventilator weaning

According to documentation in patient notes and observation during the daily ward round, the medical team taking care of all 55 (100%) patients assessed the patients’ in their care need for continued ventilation on a daily basis.
Peptic ulcer disease prophylaxis

Documentation confirmed 51 (92.7%) patients had received peptic ulcer disease prophylaxis. 25 (45.5%) received pantoprazole alone. 2 (3.6%) received pantoprazole and esomeprazole, 1 (1.8%) received pantoprazole and ranitidine. 14 (25.5%) received esomeprazole alone. 8 (14.5%) received ranitidine alone. 5 (9.09%) did not receive any peptic ulcer disease prophylaxis medication.

Regarding patients’ whom were not prescribed medication to prevent the development of peptic ulcer disease; there were 3 (6.8%) such patients on ICU and 2 (18.2%) patients on general medical wards in these categories.

Venous thromboembolism prophylaxis

According to documentation 18 (32.7%) patients received some form of venous thromboembolism prophylaxis on the day the audit was conducted; namely subcutaneous enoxaparin (Clexane) (7 patients), intravenous heparin (9 patients), anti-thromboembolism stockings (2 patients).

The numbers of patients’ not receiving venous thromboembolism prophylaxis was high: 31 (70.5%) patients on ICU and 7 (63.3%) patients on general medical wards.

Sedation review

According to documentation in patient notes and observation during the daily ward round, the medical team taking care of all 55 (100%) patients assessed the patients’ in their care need for continued sedation on a daily basis.

Mouth care

It was documented in patient notes that 40 (72.7%) patients received mouth care. 11 (100.0%) of the patients who did not receive mouth care were located on general medical wards, rather than in the ICU.
Provision of mouth care varied as a result of the location of the patient: 11 (100.0%) patients on the general ward did not receive mouth care, whereas only 5 (11.4%) patients residing on ICU did not receive mouth care.

Subglottic secretion drainage device

Subglottic secretion drainage devices were not available in Sarawak General Hospital; therefore 0 (0.0%) patients had one in situ. However, manual suction was undertaken every 4 hours.

(c) Overall results

During the study period, overall adherence to the VCB was 70.6%. Adherence varied depending on the location in which the patient was being cared for: the patients’ receiving care in the ICU were cared for with a higher rate of compliance to the VCB (73.1%), whilst patients’ residing on general wards were cared for with a lower rate of compliance to the VCB (61.0%).
DISCUSSION

(a) Implications

This service evaluation has evaluated the adherence of staff to the VCB in two areas of Sarawak General Hospital (the ICU and the general wards). Adherence was evaluated through the collection of data from patients regarding the interventions stated in table 1. It has shown that adherence to the VCB is poor (70.6%) and therefore suggests management and staff should work to improve adherence to 100% adherence to the VCB to provide the best outcomes for patients 24.

Overall, evidence collected illustrated staff fully adhered to some parts of the VCB, namely patient positioning, ventilator weaning, sedation review. Despite this, care was poor in the VCB domains of peptic ulcer disease prophylaxis, venous thromboembolism prophylaxis.

There are no obvious reasons for the variations in adherence to the VCB which are related to the different VCB domains. However, it is interesting the domains which are poorly adhered to are those which involve the prescription of medication. This may be the result of poor team-working between nursing and medical staff because doctors are responsible for prescribing medication, whilst nurses are responsible for administering medication. Poor nurse – doctor team working is a well-documented cause of poor patient care 25, 26, 27.

The quality of care provided differed according to the locations in which the patient was cared for. This potentially can be explained by the variations between staff working in the ICU and in general medical wards. The nurses working in the ICU worked on a one nurse to one patient ratio and have been trained specifically to manage critically ill patients requiring ventilator support 20. On medical wards, quality of care for patients on ventilators is poorer as they were not cared for on a one to one basis and the nurses caring for them are not necessarily highly trained in caring for acutely ill patients 20.

Subglottic drainage devices were not available in Sarawak General Hospital; therefore 0 patients were ventilated using such device. Despite a body of evidence demonstrating such devices to be effective at preventing VAP 11; the use of subglottic secretion devices is debated in clinical practice due to the optimal patient group and optimum time of implementation of the subglottic drainage device being yet to be determined 12.

Research published in 2012 stated the adherence to the VCB in Sarawak General Hospital ICU was 97.2%, however data collected in May 2014 illustrates adherence in the ICU to be 73.1%. The
disparity between the two results may be real, for example due to poor training of staff, poor record keeping, poor patient care or poor leadership; or it may be as a result of the limitations of the study which are discussed below. Unfortunately the incidence of VAP in Sarawak General Hospital for 2014 has not yet been calculated; therefore it is not possible to comment upon the incidence of VAP resulting from the level of adherence to VCB.

(b) Limitations and strengths

This service evaluation study was conducted by a medical student from England, whom was completely independent from Sarawak General Hospital. Despite collaboration with local staff and having adequate time to collect data, Rachel Barker, whom was responsible for the collection of data, may not have accessed the correct information, for example by not looking at the correct place in the patient’s notes. It is also possible that some medications do not need to be prescribed in the same manner as they are in the UK, for example subcutaneous enoxaparin. If so, this could account for a falsely low adherence to the VCB. Furthermore, it is well known that individual hospitals adhere to individual bundles, therefore interventions included in the bundles may differ.

The cross sectional nature of the study only provides a snapshot of the care the patient receives at that point in time; therefore this may not be a true representation of patient care during the month or, in fact the year. In an attempt to overcome this, information was collected once a week for four weeks, on different week days.

Over the years, there have been numerous publications and updates of the VCBs and multiple versions are available. The disparity between the results from 2012 and 2014 could be the use of a different VCB, using different interventions to be adhered to. However, the data the service evaluation would collect was discussed with ICU staff at Sarawak General Hospital, so it would be surprising if this was the reason for the disparity of results.

(c) Suggestions

The data collected in this service evaluation is specific to Sarawak General Hospital; however the suggestions for improvements may be useful for other hospitals poorly adhering to VCBs. The team caring for patients requiring artificial ventilation should aim to improve adherence to VCBs, in order to reduce the risk of the development of VAP and the implications associated with this condition.

Improving adherence to VCBs can be done in a number of ways: firstly the provision of education and training about VCB and VAP should be available to all staff (nurses and doctors) caring for
patients on the ICU. The communication and team working between nurses and doctors should be improved, in order to reduce barriers to effective communication, such as hierarchical relationships 
care 25, 26, 27.

The adherence to VCB should be regularly re-audited in order to measure improvements or decline in care, as re-auditing can help to improve the quality of care provided to patients by providing staff with a reminder to adhere with the bundles 7. In addition to regular re-audits, an audit tool could be included in the notes of all patients receiving artificial ventilation; this would provide a reminder of the VCB to staff each time they look in patient’s notes and therefore increase adherence to VCB.

The results of this service evaluation will be fed back to the staff at Sarawak General Hospital and the head of department.

CONCLUSIONS

The VCB is an important tool, with 7 main domains, which when adhered to, can reduce the incidence of the development of VAP in patients receiving artificial ventilation. Ideally, adherence to VCB should be 100%, in order to provide the best clinical outcomes for patients. Poor adherence to care bundles should be prevented by training staff; improving team work between staff; and regular re-audit of VCB.
REFERENCES


