Resuscitation 100 (2016) 1–5

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Short communication

Hospital overnight and evaluation of systems and timelines study: A point prevalence study of practice in Australia and New Zealand☆

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ARTICLE INFO

Article history:
Received 22 August 2015
Received in revised form
10 November 2015
Accepted 30 November 2015

Keywords:
Intensive care unit
Afferent limb failure
Diurnal variation
Rapid response teams

ABSTRACT

Background: Diurnal variation in the performance of rapid response systems has not been fully elucidated. Afferent limb failure (ALF) is a significant problem and is an important measure of performance of rapid response systems.
Objective: To determine the diurnal variation in the detection and response to acute patient deterioration as measured by ALF, completeness of patient observations (Respiratory rate (RR); Pulse rate (PR) and Systolic blood pressure (SBP), and to explore the diurnal variation in the consequences of ALF in unanticipated admissions to the Intensive care unit (ICU) from the ward.
Design, setting and participants: Point Prevalence study conducted on two days in 2012 in 41 ICUs in Australia and New Zealand, examining emergency (unanticipated) admissions to the ICU from the ward.
Results: 51 patients from the ward were admitted as an emergency to the ICU following a rapid response team call, of whom 48 patients had complete datasets and were enrolled; 32 (67%) were men. The prevalence of ALF was 37.5% (18/48). Median age was 62.5 (IQR 51.5–74.0), Median APACHE II score was 21.0 (IQR 17–26). There was no diurnal variation in the prevalence of ALF (day 28% versus night 28%; $p = 0.92$), patient observations documented over time ($p = 0.78$ for RR, $p = 0.95$ for PR and $p = 0.74$ for SBP) or 28-day mortality ($p = 0.24$).

There was a significant diurnal variation between the least recorded observation (SBP) and the most recorded observation (PR) ($p < 0.01$). ALF was more likely (day and night) if a complete set of observations had been taken ($p < 0.01$).
Conclusion: The prevalence of ALF amongst patients admitted to the ICU from the ward is high. SBP is the least recorded patient observation. This study was unable to identify a diurnal variation in the prevalence of ALF, its consequences (i.e. mortality) and the completeness of patient observations. Observational studies with a larger sample are required to explore this important problem.

Introduction

Critical care areas provide critically ill patients with intense observation and treatment that cannot be provided on general wards.[1] In contrast, patients on general wards are less frequently monitored, clinical deterioration may go unnoticed and is associated with higher mortality.[2,3] The detection of, and early Rapid response team (RRT) activation for, at risk patients constitutes the

☆ A Spanish translated version of the summary of this article appears as Appendix in the final online version at http://dx.doi.org/10.1016/j.resuscitation.2015.11.029.

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http://dx.doi.org/10.1016/j.resuscitation.2015.11.029
0300-9572/

afferent limb of a Rapid response system (RRS).[4] Afferent limb failure (ALF)[5] constitutes failure to respond to patients with criteria for calling a RRT and for which there was no activation of a RRT. Delay in transfer of patients requiring intensive care is associated with higher mortality rates.[5]

The term circadian variation/rhythm applies to physiological variations over a 24 h cycle. In contrast, diurnal variation applies more accurately to extrinsic systems. Circadian rhythm has been demonstrated in a multitude of patho-physiological states[6]. For example, there is an association between disrupted circadian rhythms and abnormal vital parameters which includes an anomalous blood pressure,[7] irregular pulse rate,[8] aberrant endothelial function,[9] myocardial infarction,[9] stroke,[10] sleep disordered breathing[11] and its long term consequences of hypertension, heart failure and cognitive impairment.[10–12]

In comparison, diurnal variations has been associated with differences in staffing levels[13] and patient outcomes.[14] There is also diurnal variation in RRT calling rates with most activations occurring during the day.[15] This diurnal variation may be associated with adverse events, especially during periods of fewer RRT activations. Reasons for this are mostly speculative, but nocturnal afferent limb failure may be a factor.

Aims

The objectives of this study were to determine the prevalence of ALF, its diurnal variation and associated effects on outcomes for ward patients who had an unanticipated ICU admission. We also determined the diurnal variation in patient monitoring for all unplanned ICU admissions and whether this was related to the risk of ALF occurrence.

Methods

Study design

This Observational study was conducted under the auspices of the Australian and New Zealand Intensive Care Society Clinical Trials Group (ANZICS CTG) Point Prevalence Program (PPP), which studies all patients who were present in participating ICUs at a 10 am census point on the designated study days. Human research ethics committee approval was obtained for each site (HREC/12/RAH/157).

Definitions

"Observation" was defined as a vital sign (i.e. Respiratory rate; Pulse rate; Systolic blood pressure).

"Complete set of Observations" was defined as all three (Respiratory rate; pulse rate; systolic blood pressure) recorded simultaneously.

"Day-time" defined as a time period between 08:00 and 17:59 h "Night-time" defined as a time period between 18:00 and 07:59 h.

'Afferent limb failure' defined as a deranged vital sign which fails to trigger an RRT call.

Data collection

Data were collected on either 10th November 2012 or 10th December 2012 in 41 ICUs across Australia and New Zealand. Trained research coordinators identified all patients who were an unanticipated admission to the ICU from the wards. Data relating to the 24 h prior to ICU admission were collected, in particular, documentation of vital signs and RRT activation as well as patient demographics.

Data analysis

A computerised statistical package SAS 9.3 (SAS Institute Inc., Cary, NC, USA) was used for data management, analysis and descriptive statistics. The Chi-squared test was used to analyse primary events and their antecedents, statistical significance was set at $p < 0.05$. To investigate the difference in the frequency of observations between day and night, the data were first put into a long format with a line for each possible hour of observation, as there could be up to 24 measurements for each patient. Repeated measures on each patient were accounted for by using logistic Generalized Estimating Equations (GEE). The outcome variable for each GEE model was Respiratory Rate documented (Yes/No), Heart Rate documented (Yes/No), or Systolic Blood Pressure documented (Yes/No).The predictor was whether the observation was documented at night or in the day.

Results

Patient characteristics

Fifty one patients were an unanticipated ICU admission from the ward, of whom, 48 (94%) had complete datasets and were included in the analysis. Thirty two (67%) were male, median age of 62.5 years (IQR 51.5–74.0), median APACHE II score of 21.0 (IQR 17–26) and a 28 day mortality of 22.6%, (11 patients). Overall, 28 (58%) were admitted during the night and 20 (42%) were admitted during the day ($p = 0.94$). Twenty four (50%) patients were admitted following a cardiac arrest (none of them had afferent limb failure); the remainder was admitted following a RRT call.

Diurnal variation and afferent limb failure

The prevalence of ALF in the 24 h prior to ICU admission was 37.5% ($n = 18$). ALF occurred during the day, the night and both day and night time in 28% ($n = 5/18$), 28% ($n = 5/18$) and 44% ($n = 8/18$) of patients, respectively ($p = 0.94$). Hospital mortality of patients with ALF was 44% ($n = 7/18$) and in those without ALF was 47% ($n = 14/30$) ($p = 0.67$). Binary logistic regression analyses demonstrated that ALF was no more likely to occur in an admission to the ICU during the night than during the day ($p = 0.76$) (Table 2).

Observations

The pulse rate (PR) was the most recorded observation and the systolic blood pressure (SBP) the least recorded observation during the night and day (Table 1). There was no statistically significant association between the observations documented and day or night period, adjusting for repeated measures over time ($p = 0.78$ for RR, $p = 0.95$ for HR and $p = 0.74$ for SBP). PR was measured more frequently than BP on an eventual ICU admission irrespective of time of day of assessment of the patient ($p < 0.01$).

Complete set of observations and afferent limb failure

A complete set of observations was available for only 340 of the maximum possible 1152 time periods (24 h × 48 patients) (i.e. 30%). After adjustment for factors likely to affect the rate of ALF, we noted that the odds of having afferent limb failure were higher in patients who had a complete set of observations irrespective of time (Table 2).