Alarm Management QA Project

A Weirauch BS, RRT-ACCS; C Culter BS RRT-ACCS; CF Haas MLS, RRT-ACCS, FAARC; P Loik, RRT

Critical Care Support Services, University of Michigan Health System, Ann Arbor, MI

ABSTRACT

Introduction: Alarm fatigue is a growing concern in the health care arena. It has been reported that 80 – 99% of alarms are considered nonactionable. Alarms add to the noise pollution of the ICU causing desensitization leading to decreased response rates. The FDA reported 500 alarm-related deaths in 5 years. Recently The Joint Commission published the need for alarm management as a Hospital National Patient Safety Goals. **Background (Study Objective):** We would like to understand how our department is setting alarm parameters, to determine which alarms are occurring, and their frequency. Our current policy provides guidelines for setting alarms mainly focused on lung protective settings. Prior to this QA, we have not assessed alarm settings at the departmental level for some time. We would like to determine how alarms are set, related to actual measured value, which alarms are triggered most often, are they adjustable vs not, and what level of priority are they? **Methods:** Data was gathered manually from the electronic medical record and downloaded from 41 Draeger V-500 ventilators. The demographics included ICU, shift, Ventilator brand, and mode. Actual values were compared to set high and/or low for RR, VT, VE, Ppeak, Apnea, iNO. Data was collected and summarized in excel, data was then processed using Statistical Package for the Social Sciences (SPSS, IBM). **Results:** Data from 45 patients was obtained, 134 samples total. 75% of Ppeak limits were set >40 cm H2O and 55% were set >50 cm H2O. 90% of Ppeak limits were set >15 cm H2O above the actual Ppeak and 40% were set >25 cm H2O above, regardless of mode of ventilation. 60% of CPAP/PS alarms were set >25 cm H2O above actual Ppeak. Approximately 73% of VT limits were set to 1000 mL and 35% of these result in >15 mL/kg . When set to >1000 mL, 100% of time this is >15 mL/kg. 41 different alarms were identified; 8 of the alarms are user adjustable. For all patients combined, an average of 76 alarms was logged per day (3.1/h); 38 (1.6/h) high priority, 12 (0.5/h) medium and 26 (1.1/h) low priority alarms. Almost 60% of the alarms were triggered by 5 alarms: airway pressure high (adjustable), pressure limited, VT not reached, high PEEP, leakage, and VT high (adjustable). Limitations: We recognize our limitations as being a small sample size, limited to the V500 for downloads on the alarm history, and also being limited to 7 days if data from the downloads. **Conclusions:** The Ppeak high and VT high limits should be adjusted downward when indicated to meet patient safety standards. With this in mind, there is a need to find a balance of safe settings and nonactionable alarms, knowing that the majority of alarms are not adjustable. A drill down into specific cases is necessary to identify management practices that might reduce alarms. Going forward we need to educate staff on the importance of safe alarm settings.

INTRODUCTION

Alarm fatigue is a growing concern in the health care arena 80 – 99% of alarms are considered nonactionable[1]. Alarms add to the noise pollution of the ICU causing desensitization leading to decreased response rates. The FDA reported 500 alarm-related deaths in 5 years. Recently The Joint Commission published the need for alarm management as a Hospital National Patient Safety Goals[2]. We wanted to understand how our department is setting alarm parameters and to determine what alarms were occurring and their frequency. Our current policy provides guidelines for setting alarms mainly focused on lung protection setting PIP 10-15 cm H_2O above actual, setting high VT per clinical judgment, suggested < 12 mL/kg PBW. Prior to this QA, we have not assessed alarm settings at the departmental level for some time. Our objective is to understand within our department how alarms are set, related to actual measured value, which alarms are triggered most often, are they adjustable vs not, and what level of priority are they.

1. Ruskin, K. Alarm Fatigue: Impacts on Patient Safety. Current Opinion. 2015
2. NPSG.06.01.01 2015

RESULTS

Data from 45 patients was obtained,134 samples total

<u>High Ppeak Limit:</u>

- 75% of Ppeak limits were set >40 cm H_2O; 55% were set >50 cm H_2O
- 90% of Ppeak limits were set >15 cm H_2O above the actual Ppeak, 40% were set >25 cm H_2O above, regardless of mode of ventilation
- 60% of CPAP/PS events were set >25 cm H_2O above actual Ppeak

<u>High VT Limit:</u>

- ~73% of limits (81/111) were set to 1000 mL; 35% of these result in >15 mL/kg
- When set >1000 mL, 100% of time this is >15 mL/kg; when set to <1000 mL, 100% of time this results in <15 mL/kg
- >95% of limits are set >12 mL/kg; 42% are set >15 mL/kg Because VT can vary with pressure ventilation, it is important to protect against excessive ventilation, yet ~50% are set to >15 mL/kg

<u>Alarm Frequency, Priority, and Trigger</u>

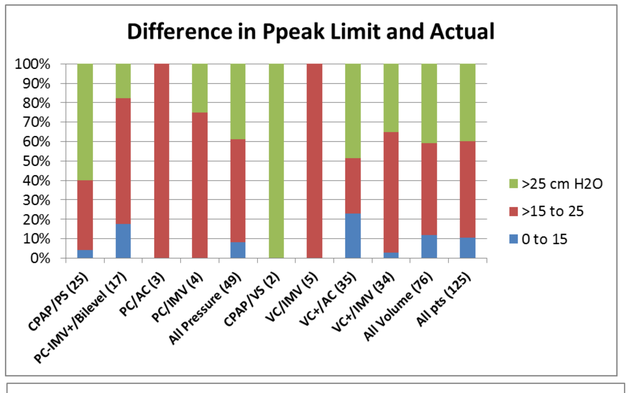
- For all patients combined, an average of 76 alarms was logged per day (3.1/h); 38 (1.6/h) high priority alarms, 12 (0.5/h) medium and 26 (1.1/h) low priority.
- 20% of the alarms are user adjustable; 80% are not adjustable, although possibly influenced by management strategies
- Almost 60% of the alarms were triggered by 5 alarms:
  - Airway pressure high (1193, 16%); *adjustable*
  - Pressure limited, VT not reached (1193, 16%)
  - High PEEP (844, 11.3%)
  - Leakage (662, 8.9%)
  - VT high (508, 6.8%) *adjustable*

METHODS & MATERIALS

Data gathered manually from the electronic medical record (MiChart-Epic) and also the 7-day trend, alarm and log data was downloaded from 41 Draeger V-500 ventilators. The demographics included ICU, shift, Ventilator brand, and mode. Actual values were compared to set high and/or low for RR, VT, VE, Ppeak, Apnea, iNO. Data was collected and summarized in excel, data was then processed using Statistical Package for the Social Sciences (SPSS, IBM)

CONCLUSIONS

- The Ppeak high and VT high limits should be adjusted downward when indicated to meet patient safety standards
- Need to find a balance of safe settings and nonactionable alarms
- Educate staff on the importance of safe alarm settings
- A drill down into specific cases is necessary to identify management practices that might reduce alarms
- A majority of alarms are not adjustable
- General alarm settings may not be ideal for all disease states



(>/= 1/hr (>.5 & <1/hr)

(Note: value represents mean number of times the alarm sounded per hour, of those with a given alarm, ie, 0.5 = 1 alarm every 2 hours, 0.2 = 1 alarm every 5 hours)

		Dept (41)			Dept (41)
High Priority	Airway obstructed?	0.15	Medium Priority	Apnea Ventilation	0.07
	* Airway pressure high	0.95		Battery activated	0.14
	* Airway pressure low	0.08		Check CO_2 cuvette	0.87
	Airway pressure negative	0.04		Flow measurement inaccurate	0.05
	Apnea	0.02		Nebulizer uses Air only	0.01
	Battery discharged	0.01		PEEP high (Med P)	0.45
	Battery low	0.02		Perform device & circuit check	0.02
	CO_2 measurement failed	0.71		Pressure measurement inaccurate	0.04
	CO_2 sensor	0.16		Rotary knob stuck or pressed too long	0.01
	CO_2 zero calibration?	0.02		* VT high	0.19
	Disconnection?	0.19		VT high (minimum pressure)	0.42
	* CO_2 high	0.32		* VT low	0.03
	* $etCO_2$ low	0.30	Low Priority	Air supply low, GS500 active	0.08
	Flow sensor? Ventilation impaired	0.04		Continuous nebulization activated	0.06
	* MV high	0.06		Leakage	0.20
	* MV low	0.10		MEDIBUS communication failed	0.05
	No O2 supply	0.12		Nebulization finished	0.05
	PEEP low	0.04		Pressure limited	4.03
	Respiratory rate high	0.19		Pressure limited! VT not reached	1.04
	Standby mode activated	0.08		Suction maneuver overused?	0.07
				VT not reached	0.15
				* User adjustable alarm	