

## Sounds of Silence: Reducing Nuisance Alarms in IV Pumps

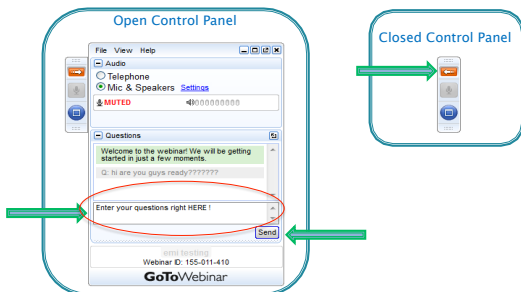
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at University of Pennsylvania Home Care and  
Hospice  
Philadelphia, PA

Provided by an education grant from Dale Medical Products, Inc.



This webinar is presented in association with the Infusion Nurses Society

### Show Your Control Panel



### Our Moderator



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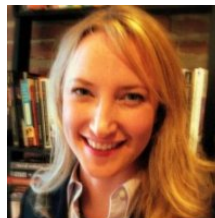
## Sounds of Silence: Reducing Nuisance Alarms in IV Pumps

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## Our Speaker



Katherine Major, MSN, RN

## Disclosure

- Ms. Major disclosed no conflicts of interest in the development of this presentation

## Continuing Education/Accreditation

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### Learning Objectives:

- Describe risks associated with alarm fatigue
- Identify three sources of IV pump alarms
- Recognize the role of IV protection in the reduction of alarms

### What is alarm fatigue?



### POLL Question

- Nuisance alarms can result in alarm fatigue. Which one the following behaviors is a result of alarm fatigue?
  - A. Staff disabling the alarm
  - B. Staff silencing the alarm
  - C. Staff ignoring the alarm
  - D. All of the above

### National Patient Safety Goal

- National Patient Safety Goal 06.01.01

“Make improvements to ensure that alarms on medical equipment are heard and responded to on time”

– The Joint Commission

The Joint Commission, Office of Quality Monitoring. (2013). Sentinel Events. Retrieved from <http://www.jointcommission.org/wp/wp-content/uploads/2013/04/Sentinel-Events-Report-2013.pdf>

## National Patient Safety Goal: Alarm Management

- During 2014:
  - Leaders must establish alarm system safety as a hospital priority
  - Organization must identify the most important alarm signals based on the following:
    - Input from the medical staff and clinical departments
    - Risk to pts if the alarm signal is not attend to or malfunctions
    - Whether specific alarm signals are needed or unnecessarily contribute to alarm noise and alarm fatigue
    - Potential for patient harm based on internal incident history
    - Published best practice guidelines

## National Patient Safety Goal: Alarm Management

- By 2016
  - Establish policies and procedures for managing alarms identified in 2014 to address the following:
    - Clinically appropriate settings for alarm signals ✓
    - When alarm signals can be disabled ✓
    - When alarm parameters can be changed ✓
    - Who has the authority to set the alarm parameters ✓
    - Who has the authority to change the alarm parameters ✓
    - Who has the authority to set parameters to off ✓
    - Monitoring and responding to alarm signals ✓
    - Checking individual alarm signals for accurate settings, proper operation and detectability ✓

## Clinical Alarms

- Why did the Joint Commission chose this initiative?
  - 216 deaths
  - 1 alarm every 90 seconds
  - 90% unanswered

The Joint Commission, Office of Quality Monitoring. (2013). *Sentinel Events*. Retrieved from: [http://www.jointcommission.org/sentinel\\_event.aspx](http://www.jointcommission.org/sentinel_event.aspx)

## Functionality of IV Pumps

- Precision
- Security
- Patency
- Overcomes resistance



Chopra V, McMahon LF. Redesigning hospital alarms for patient safety: alarmed and potentially dangerous. *JAMA* 2014;311(12):1199-1200. doi:10.1001/jama.2014.710.

## Adverse Drug Events

- 90% of inpatients receive IV medications- most of which are delivered on an IV pump
- IV pumps involved with 35-60% of the 700,000 Adverse Drug Events that occur each year

\* Heath, M., Sullivan, C., et al. (2005). Insights from the sharp end of intravenous medication errors: Implications for infusion pump technology. *Qual Saf Health Care*, 14(2), 80



## Patient Impact

- Sleep Disturbance
- Patient Anxiety
- Extravasation
- Infiltration
- Missing Medication



Infusion Nurses Society. Infusion Nursing Standards of Practice. *J Infus Nurs* 2006;29(1suppl):S1-S92


## POLL QUESTION

A vesicant is an agent capable of causing:

- blistering
- sloughing
- necrosis
- all of the above


### Staff Impact

- Job Satisfaction
- Clinical Complacency
- Anxiety
- Impatience/Frustration



### Effective Alarms

- Appropriate
- Recognition
- Attention




Lee PT, Thompson F, Thimbleby H. (2012) Analysis of infusion pump error logs and their significance for health care. *British Journal of Nursing (Intravenous supplement)* 21(8):S12-S20

### POLL QUESTION

- Which of the following is NOT a part of the definition of an effective alarm?
  - Appropriate
  - Recognition
  - Attention
  - Repetitive

### Types of IV Pumps


- Syringe
- PCA
- Large Volume Infusion




Scott, David A., et al., Detection of Intravenous Fluid Extravasation Using Resistance Measurements. *J. Clinical Monitoring*. 1996; vol. 12, no. 4; 325-330.

### How IV Pumps Work

- Piston- syringe plunger descends at precise intervals, pushing the medication into the patient
- Peristaltic- milks the tubing in chamber to pull fluid from the bottle through tubing into the patient



Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33

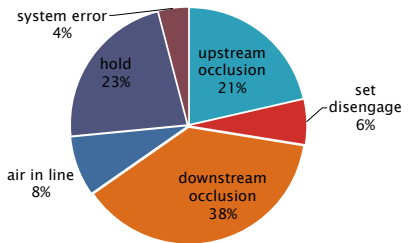


### How IV Pump Alarms Work

- Occlusion alarms- function based on pressure sensors in the chamber
- Air in line alarms- utilizes ultrasonic transmitter and receiver to detect when air is being pumped
- Set disengagement- set sensors in the chamber

Vanderveen T. Alarm management: first things first using reliable data to eliminate unnecessary alarms. *Patient Safety and Quality Healthcare*. Nov-Dec 2014 p38-45

### Types of IV Pump Alarms



Alarm Type	Percentage
downstream occlusion	38%
hold	23%
upstream occlusion	21%
air in line	8%
set disengage	6%
system error	4%

Vanderveen T. Alarm management: first things first using reliable data to eliminate unnecessary alarms. *Patient Safety and Quality Healthcare*. Nov-Dec 2014 p38-45  
 Lee PT, Thompson F. Thimbley H. (2012). Analysis of infusion pump error logs and their significance for health care. *British Journal of Nursing* (nursing supplement) 23(18):S14-S20

## Downstream Occlusions

- Occlusions that occur between the pump and the patient
  - Two different types of downstream occlusions
    - Hard occlusions
    - Soft occlusions

Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33

## Hard Occlusions

- Result of high pressure building in tubing over time
- Hard occlusions are influenced by
  - Rate
    - Faster infusion faster pressure will rise
  - Elasticity of pathway
    - Stiffer the IV pathway faster pressure will rise
    - Elasticity can be influenced by temperature of the room- for example a hypothermic operating room would lead to stiffer tubing

Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33

## Hard Occlusions

- Closed stopcocks
- Kinked tubing
- Kinked catheter



Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33

## Soft Occlusions

- Build up of precipitates/emboli
- Compression of the tubing
- Compression of catheter
- Infusion of fluid into tissue space outside of vessel



Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33



## Soft Occlusions

- Present a restriction but flow still able to get through
- Soft occlusions will take more time to sound alarm
- Soft occlusions account for infiltration and extravasation alarms

Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33

## Resistance Measurements

- Resistance of space outside vein measured at 1.2mmHg for each ml per hour of pumping rate
- Resistance of space inside vein measured at 0.02mmHg for each ml per hour of pumping rate



Scott, David A., et al., Detection of Intravenous Fluid Extravasation Using Resistance Measurements. *J. Clinical Monitoring*, 1996; vol. 12, no. 4: 325-330  
 2 Scott, David A., et al., Resistance to Fluid Flow in Veins. *J Clinical Monitoring*, 1996; vol. 12, no. 4: 331-337

## Important Fact

- IV pumps do not detect or protect patients against extravasation or infiltration
- IV pumps simply measure the pressure in the tubing
- Some extravasations and infiltrations may develop under the detection of the pressure monitors on the pumps

Infusion Nurses Society. *Infusion Nursing Standards of Practice*. *J Infus Nurs* 2006;29(1suppl):S1-S92

## Avoiding Extravasation and Infiltration

- Assessment of the IV site is the only surefire way to ensure that the patient is safe from extravasation and infiltration
- IV alarms will not protect patients from these complications

Infusion Nurses Society. *Infusion Nursing Standards of Practice*. *J Infus Nurs* 2006;29(1suppl):S1-S92

## Upstream Occlusions

- Occlusion that occurs between the IV solution and the pump
- Can be caused by multitude of factors
- Not all IV pumps recognize upstream occlusion

Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33

## Upstream Occlusion

- Release Upstream Clamp on IV bottle
- Clogged Upstream Filter
- Nonvented bottle used with nonvented IV set

Huber C, Augustine A. IV infusion alarms: don't wait for the beep. *Am J Nurs* 2009;109(4):32-33

## POLL QUESTION

- What type of alarm will signal when the tubing is clamped between the IV bag and the pump?
  - A. upstream occlusion
  - B. downstream occlusion
  - C. air-in-line
  - D. set disengaged

## Troubleshooting Alarms

- Air in line
- Occlusion
- Set disengagement

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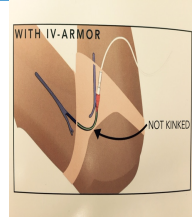
## Potential solutions

- Know your pump
- Customize to accommodate patient
- Technology utilization
- Traditional splints
- Methods to prevent kinking
  - Armboards good for IV, bad for patient
- Protective overlays (new)

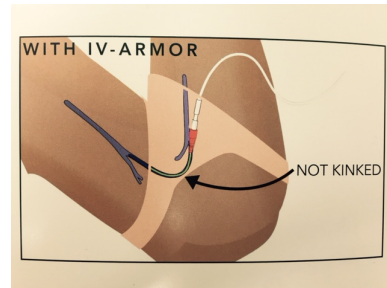
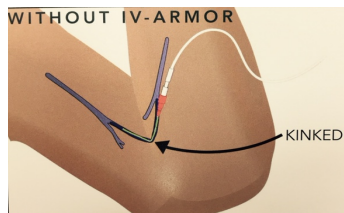
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 Reeves, J. G. "Smart pump technology reduces errors." 2003.  
[www.aspt.org/resources\\_center/newsletter/2003/spring/jama/pump.htm](http://www.aspt.org/resources_center/newsletter/2003/spring/jama/pump.htm) (19 Sept. 2005).

## How can a protective overlay help with IV pump alarms?

- The foam pad splints IV catheter
- Not a securement device
- Used over traditional IV securement
- Allows patient mobility while splinting the line
- Reduction of kinked catheters leads to reduction of new IV starts



Courtesy Dale Medical Products, Inc.



### Case Study A

- Patient is disoriented and agitated. IV site in left arm antecubital is stable but not running continuously due to patient bending arm. IV alarm signaling once every five minutes. RN turns down the volume of the IV pump alarm so that it does not agitate the patient further.
  - What type of occlusion is occurring?
  - Did the RN take the correct action?
  - What would you do in this situation?

### Case Study B

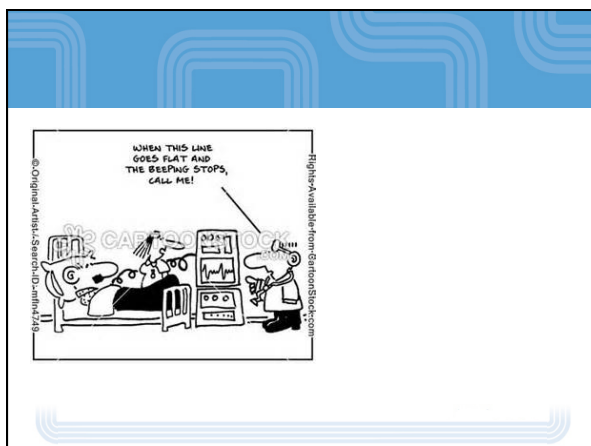
- The RN changes the bag of IV fluid in room 7. A few minutes later she hears the IV alarm and notices the message "upstream occlusion" on the pump.
  - How can the RN troubleshoot this alarm?
  - What are some reasons why an "upstream occlusion" alarm would sound?

### Case Study C

- Patient IV pump is alarming every time the patient bends her wrist. The patient is becoming increasingly frustrated at the interruptions and is refusing a new IV in a different location. As a last resort the RN shows the patient how to restart the IV pump and silence the alarm.
  - What would you do in this situation?
  - Do you think patients should be allowed to control their pumps?

### Case Study D

- IV pump alarming that there is an occlusion downstream. What is the first thing that the RN should look for when assessing the line?



## Summary

- Risks associated with alarm fatigue
  - Alarms silenced, ignored or disabled
- Sources of IV pump alarms
  - Occlusion, air in line, set disengagement
- Role of IV protection in the reduction of alarms
  - Prevents kinking of the IV catheter

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CNEs are available for the archived version.

Questions



Katherine Major, MSN, RN