Patient Safety Tip of the Week

April 25, 2017 Dialysis and Alarm Fatigue

We publish details about significant incidents because if an event occurs at one facility, a similar event may well occur at another facility no matter how unusual the circumstances surrounding the event were. One of our earliest introductions to alarm fatigue happened in a dialysis unit. In fact, you've heard us state that we often bet hospital CEO's that we will find a certain number of alarms disabled or otherwise tampered with when we do a hospital visit. One of the areas we know to go to for finding such alarms is the dialysis unit.

Though the incident occurred much earlier, we first discussed our dialysis alarm incident in our March 26, 2007 Patient Safety Tip of the Week "Alarms Should Point to the Problem". An ESRD patient was having his regularly scheduled dialysis session. Since he would be in the dialysis center for several hours, he was in a comfortable lounge chair that tipped back. Also, since it was somewhat cool, he was offered a blanket to keep warm. Midway through the dialysis session, the low-pressure alarm rang. The nurse turned off the alarm and eyeballed the patient and saw no blood. Nothing further was done. Soon thereafter the low pressure alarm triggered again. This time it was recognized that the dialysis catheter had become dislodged and the patient had, in fact, had considerable blood loss. It had not been appreciated immediately because the blanket had been covering up the catheter site and the blood, rather than being visible on the floor, had been pooling in the webbing of the lounge chair.

Anyone who has ever spent time in an ICU or other high tech medical environment knows that the usual first response to an alarm is to turn the alarm off. Proper design of medical equipment therefore should force the responder to focus on the source of the problem. In the case at hand, the equipment and alarm were on the side of the patient opposite from the involved limb so that the visual attention of the responder was not directed immediately to the site the alarm was drawing attention to.

Unfortunately, you all have lots of equipment that have alarms that don't make the responder focus directly at the problem. Faulty response to alarms is one of the "big 3" problems encountered in many root cause analyses of sentinel events. Performing FMEA (Failure Mode and Effects Analysis) is a good way to help anticipate events that might arise in your critical settings.

Fast forward to the present. The California Department of Public Health (CDPH) just published its most recent batch of statements of deficiencies (SOD's) and plans of correction (POC's) regarding incidents in California hospitals. One involved a case with striking similarities to that in our previous column (CDPH 2017). A patient admitted with

an MI suffered deterioration of his chronic renal disease and was begun on continuous renal replacement therapy (CRRT) with a femoral catheter for dialysis access (technically, it was continuous veno-venous hemofiltration or CVVH). For comfort, the patient was covered with a blanket, which obscured the catheter access site. Unfortunately, at some point the return line became loose and disconnected from the femoral catheter which caused massive blood loss and cardiac arrest. He received CPR and blood transfusions and was resuscitated but died several days later.

Review of the CRRT Machine Data History print-out showed that several alarms had been triggered. First was an alarm warning that return pressure was dropping. The print-out indicated that the alarm was cleared 13 seconds after it was issued. The CRRT Machine manufacturer indicated that at the time of that alarm the screen had the sign, "WARNING: Return Pressure Dropping" on top of the screen in red color. On the left side of the screen was written in bold, "Possible leakage, or disconnection of return line or catheter. Patient is moving or being moved. Action: 1. Make sure return catheter is securely connected to both the return line and the patient. 2. To resume treatment press CONTINUE." The Prismaflex screen had touch screen buttons for EXAMINE ALARMS, DISCONNECT, bell icon with X {means MUTE), CONTINUE and HELP. Roughly 3 minutes later another alarm with the warning "Access Extremely Negative" was issued and this alarm automatically stopped the machine.

The "complainant" told the CDPH investigator that family members were at the bedside when the dialysis machine alarmed with a "warning message about return pressure". The complainant stated a nurse "silenced the alarm without checking the patient and walked out of the room for several minutes". The family member called the nurse and when the nurse came back, the patient looked like he was having seizure and was in cardiac arrest. The complainant stated when the nurse pulled the blanket at the time of the cardiac arrest there was pool of blood on the bed and the line was disconnected.

As we typically see in serious incidents with adverse patient outcomes, there was a cascade of events that each contributed to the unfolding crisis. The nurse had earlier temporarily stepped outside the patient's room to take a call from the laboratory about a critical value (high lactate) for that patient and was looking for the physician to tell him/her about that critical value. The patient's nurse at the time was also a "break nurse", covering for the primary nurse who was on break.

We discussed salient distracting features in our January 14, 2014 Patient Safety Tip of the Week "Diagnostic Error: Salient Distracting Features". Salient distractions obviously can apply to more than just diagnosis. In the current case, the lab had just called back a critical value on this patient status post MI. His serum lactate was high (indicating likely inadequacy of tissue perfusion) and that merited prompt intervention. So the nurse had to leave the room to first take the phone call from the lab and then locate and inform the physician about that critical value. The physician then ordered dobutamine and a venous blood gas. And the physician came and talked to the patient's family about the lab results and medications. The nurse also had to respond to those orders. It's not clear what role those events may have played in distracting the nurse from responding correctly to the

alarm. Perhaps there was even an element of confirmation bias in that the physician had just been in the patient's room and had not noticed anything unusual. It is not clear from the CDPH document why the nurse stepped out of the room immediately after clearing the alarm. Perhaps it was to carry out the orders related to the critical value.

The exact timeline is a bit sketchy in one regard. The CDPH document notes that the "break nurse" was expecting to cover for a 30-minute break. That nurse apparently took over at about 7:00 PM. The time of the first "Return Pressure Dropping" warning alarm was 7:54 PM. The CDPH document notes that the primary nurse "returned early" from break because the patient was coding. So we might wonder whether anticipation of a change in nursing coverage played any role.

The thrust of our March 26, 2007 Patient Safety Tip of the Week "Alarms Should Point to the Problem" was that alarm system setups should focus visual attention to that part of the system where the problem originates. The current incident would seem to indicate that does not work. The readout on the screen seems to clearly indicate where the responder should focus and even indicates what actions should be taken.

But there are at least 2 factors important in that regard. First is the location of the alarm screen. In the incident we described in our prior column the alarm system was positioned on the side opposite the dialysis access site, causing the responder to be visually focusing away from the site of the problem. We don't know where the alarm screen was positioned in the current incident. But given that the low pressure alarm is probably the most important alarm (because you can bleed out if the problem is not promptly corrected) wouldn't it make sense to position the alarm screen in a place that would force the responder to visually inspect the access site?

The second consideration is the complexity of the alarm screen. We don't know what that screen looked like in the current incident. While the description of the readout sounds straightforward, we don't know that it was the only element visible on the screen. Some of the screens of monitoring equipment can be incredibly complicated. That complexity may lead to responders simply taking the easy way out and clearing the alarm, particularly if they anticipate the alarm will be re-triggered if something serious is really going on.

But the best interventions are **forcing functions**. We'd suggest that these alarm systems program in **a "hard" stop** for this particular alarm that requires the responder to verify that he/she has inspected the access site. That verification should then become part of the medical record. Note that in the current event, there was no section in the electronic health record for documenting the monitoring of dialysis access and blood lines.

There were several other deficiencies or lessons learned in the CDPH case:

- The facility discarded the access catheter and lines, which should have been checked for defects or other factors possibly contributing to the incident.
- The CRRT machine was not removed from service pending investigation. In fact, it was continued to be used on the index patient until his death a couple days later.

- There was no place for documenting access site status

In the immediate aftermath of a serious event it is important to sequester any equipment and materials that may have been involved in the incident. That is important for two reasons: (1) to identify and mechanical defects that may have contributed and (2) to prevent using potentially defective equipment on other patients. Every facility should have ready access to a checklist for responding to serious incidents. Typically, with a serious event like the one described today, the nursing supervisor or the administrator on-call should be immediately notified. That individual would then access the checklist. The checklist should specify who needs to be contacted and what action steps need to be taken, including sequestering equipment. See our sample Serious Event Response Checklist.

The facility's plan of correction included the following:

- Staff were educated regarding issues related to the dialysis access site.
- Policy was revised so that all dialysis access sites must remain visible and that it be documented at least hourly that the site is visible.
- The practice of covering the access site with blankets for comfort and privacy was stopped.
- Changes were made in the CRRT flow sheets in the electronic medical record documentation system to include accurate documentation of site visibility and security of access.
- Auditing procedures were put in place.
- Staff education was undertaken regarding sequestering of any medications, equipment, or supplies potentially involved in any incident.

One of the elements in the facility's POC was to stop use of blankets in patients receiving CRRT. Frankly, we don't know how practical that is, let alone how patient unfriendly that may be. It should not be difficult to create blankets that would provide both warmth and privacy for patients, yet leave critical dialysis access sites uncovered. Note that the facility's response technically did not ban blankets per se but just says blankets cannot cover the dialysis access site.

We often use lessons learned from these CDPH documents because events they describe might be replicated at other hospitals. The fact that this current event almost duplicates one we described many years ago is evidence that the circumstances, root causes, and contributing factors present at one facility may well also be present at other facilities. We hope that our readers will look at today's cases and evaluate their own facilities to see if their practices might render them vulnerable to similar events.

Prior Patient Safety Tips of the Week pertaining to alarm-related issues:

- March 5, 2007 "Disabled Alarms"

- March 26, 2007 "Alarms Should Point to the Problem"
- April 2, 2007 "More Alarm Issues"
- June 19, 2007 "Unintended Consequences of Technological Solutons"
- April 1, 2008 "Pennsylvania PSA's FMEA on Telemetry Alarm Interventions"
- February 23, 2010 "Alarm Issues in the News Again"
- March 2, 2010 "Alarm Sensitivity: Early Detection vs. Alarm Fatigue"
- March 16, 2010 "A Patient Safety Scavenger Hunt"
- November 2010 "Alarms in the Operating Room"
- February 22, 2011 "Rethinking Alarms"
- February 2013 "Joint Commission Proposes New 2014 National Patient Safety Goal"
- May 2013 "Joint Commission Sentinel Event Alert: Alarm Safety"
- July 2, 2013 "Issues in Alarm Management"
- August 2013 "Joint Commission Formalizes 2014 NPSG on Alarm Management"
- February 4, 2014 "But What If the Battery Runs Low?"
- October 2014 "Alarm Fatigue: Reducing Unnecessary Telemetry Monitoring"
- December 15, 2015 "Vital Sign Monitoring at Night"
- February 9, 2016 "It was just a matter of time…"
- August 16, 2016 "How Is Your Alarm Management Initiative Going?"
- February 21, 2017 "Alarm Fatigue in the ED"
- April 18, 2017 "Alarm Response and Nurse Shift Duration"

References:

CDPH (California Department of Public Health). Complaint Intake Number: CA00471877; posted 4/20/2017 http://www.cdph.ca.gov/certlic/facilities/Documents/2567_Kaiser220012544_IJAP_SanFrancisco.pdf

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