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ATRIUM

Clinical Update

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Different Chest Tubes Present Different Clinical Challenges (Part 2)

In the last issue of *Clinical Update*, we reviewed the use of catheters for postoperative drainage in cardiothoracic surgery patients and how the inner diameter and tube structure affects the flow rate of air and fluids through the tube and out of the chest. In this issue, we'll address the factors that affect patient safety when using drainage systems other than standard chest tubes.

Closed Wound Drains

Closed wound drainage systems were originally designed to remove fluid from closed surgical sites following orthopedic, plastic, general, head and neck, neurological, and gynecological surgery. Sometimes called "grenade reservoirs" because of their shape, these bulb suction reservoirs connect to the drain, and after activation, they create suction to evacuate fluid postoperatively from the surgical site. For the system to work properly, it must be completely closed; any venting to the atmosphere will disrupt the system's self-generated suction.

Pneumothorax

A closed system presents the potential for a catastrophic complication: tension pneumothorax. Chest drains have vents to the atmosphere and positive pressure relief valves, which virtually eliminate reaccumulation of a pneumothorax if the system is patent from the surgical site to the drain. Wound drains do not. Instructions for use state that these devices should "…be used in cardio-thoracic surgery only after the lung is fully expanded and all air leaks have sealed."[1] Whenever an air leak is present, a wound drain must be attached to an appropriate pleural drainage system to prevent tension pneumothorax[1]. However, not all air leaks are immediately apparent, particularly when there is no water seal or air leak indicator. Tension pneumothorax is a serious risk when a closed system without a vent is used.

Fluid Drainage

To use a closed wound drainage (reservoir) system, the nurse typically removes the plug covering the air vent, squeezes the reservoir to push out air, and then replaces the vent plug to close the system. If a reservoir bag is used, suction is activated by bending up the reservoir's bottom flap. In either case, the result is that unmeasured, unregulated suction is created and applied to the surgical site. The suction level is highest when the empty reservoir is first attached to the wound drain, and it drops as drainage collects in the reservoir. How high? When a bulb reservoir is initially compressed and attached to a drain, it generates approximately -120cmH_2O suction — far more than the carefully regulated -20cmH_2O vacuum levels set on a chest drain attached to a thoracic catheter. As the reservoir fills, tissues are exposed to varying levels of suction, and the clinician at the bedside has no way of knowing the level of suction being applied to the pericardial or pleural space. As drainage collects in the reservoir, negative pressures rise to near zero, and the flow rate out of the chest drops.

If a wound drain is not emptied immediately, the pressures between the surgical site and the drain will equalize. A pressure gradient between the patient and any drain is required to facilitate drainage, so if pressures equalize, drainage stops.

When even a small chest drain, such as the Express™ Mini 500, is connected to a thoracic catheter, the drainage system can collect 500cc of fluid drainage and regulated suction at -20cmH_2O can be applied at any time. Negative pressure is constant regardless of how much drainage is in the system. When using a 100cc bulb reservoir instead to drain the chest postoperatively, the nurse must maintain the system to preserve patency and empty the reservoir to maintain suction and keep drainage flowing. If pericardial drainage stops, the patient is at risk for cardiac tamponade. And, without constantly monitoring the drain, the nurse won't realize the patient is in trouble until symptoms appear.

This potential complication is not an isolated occurrence. Consider that in a regional study (21,873 consecutive, isolated, first-time coronary artery bypass graft procedures, in which 87% of patients received a left internal mammary artery [LIMA] graft), approximately 3 percent of all patients had to return to the OR for bleeding[2]. If a center performs four routine CABG procedures per day, approximately one patient per week will need reoperation for bleeding. Furthermore, at least 43% of patients who receive a LIMA graft will develop pleural effusion postoperatively[3]. This is another reason to carefully choose a drainage device that can handle fluid drainage without requiring already busy nurses to spend additional time emptying and maintaining the drainage system.

Safety and Convenience

Nurses who care for cardiothoracic surgical patients postoperatively know better than anyone what is required to assure safe and efficient postoperative care. Which characteristics describe a drain you're most comfortable with?

Chest Drain	Wound Drain
Vents positive pressure	Closed system with no vent
Constant suction level	Suction level variable
Consistent flow rate	Flow rate varies as suction level changes
Drainage occurs as long as drain is below the chest	Drainage can stop if 100cc in reservoir regardless of drain position
Will work even if clinician does not actively maintain drain	Clinician-dependent for proper use
Can be used for all cardiothoracic patients	Cannot be used if patient has an air leak
Remains a closed system (with vent) throughout use	Must be opened periodically to discard drainage

See sources on back page.

Check Your Knowledge...

Q. As thoracic surgery techniques become less invasive, there has been a move toward using smaller thoracic catheters for chest drainage. If a tube's diameter is cut in half, what will happen to flow rate?

Answer on other side

Clinical Update is an educational newsletter provided by Atrium Medical Corporation and is edited by Patricia Carroll, RN,BC, CEN, RRT, MS.

In The Literature

Leaders in More Ways Than One

In healthcare today, retention can be even more important than recruitment. It's expensive to hire new staff members; retention saves money. According to a recent article in *Nursing Management*, the number one reason people leave organizations (other factors being equal) is the relationship they have with their manager.

This article describes how to implement three best practices to retain staff:

- **Begin retention planning from day one**. Talk with staff members about how they are doing, perhaps with a formal "retention interview" every few months. Better to hold frequent "retention interviews" instead of exit interviews — when it's too late.
- **Maximize staff knowledge, experience and skills**. When people spend more time doing what they love to do and are good at, morale will soar. Hold a staff meeting at which nurses share what they love to do — undoubtedly, nurses will discover that work one person dislikes is someone else's favorite task. By simply adjusting assignments, staff members can feel like they have a new job — one that they love and want to stay in.
- **Become a coaching manager**. Think of how coaches in sports motivate, teach and get the best from their athletes. You can do the same with nursing staff. To take the sports metaphor a step farther, when you develop and coach a team, team members will be more likely to pitch in and spirits will rise when they feel part of something greater than themselves.

This article provides practical tips that allow you to begin implementing these strategies immediately.

Source: Martin CA: Turn on the staying power. *Nursing Management* 2004;35(3):20-27.

To Sleep, Perchance to Dream

Sleep deprivation is a common problem for patients in critical care units. A study in the latest issue of the *American Journal of Critical Care* notes that when patient care activities are not clustered, patients can go for days without more than an hour of uninterrupted sleep.

This retrospective study reviewed 50 patients' medical records to determine when nursing activities were performed. Data were collected from patients in the surgical ICU, neurosurgical ICU, medical ICU, and coronary care unit. Researchers found that a mean of 43 individual care interactions occurred per night (from 7pm to 7am). Overall, the most interactions occurred in the midnight hour, and fewest between 3am and 4am, when 33% of patients were undisturbed. However, patients received 56 of 83 routine daily baths between 2am and 6am!

These researchers present a detailed description of their data collection and analysis that can be replicated for other units. If your units do not have a sleep promotion plan in place, this research will help identify the care patterns in your units, to help you customize and cluster interventions for your patients, and thus establish blocks of uninterrupted time for patient sleep.

Source: Tamburri LM, DiBrienza R, Zozula R, Redeker NS: Nocturnal care interactions with patients in critical care units. *American Journal of Critical Care* 2004;13(2):102-115.

No Bones About It

Patients with pelvic fractures can be challenging to care for, because an isolated pelvic fracture rarely lands a person in ICU; thus, critical care nurses manage pelvic fractures in the context of other traumatic injuries.

The current issue of *Critical Care Nurse* contains an excellent review article on pelvic fractures (approved for CE credit, making the article a handy self-study resource for busy nurses). After a review of anatomy, the authors review assessment strategies, fracture types and classification, pelvic stabilization and bleeding management, resuscitation, fracture repair and potential complications.

This is a must-read for nurses in units that care for multiple trauma patients.

Source: Frakes MA, Evans T: Major pelvic fractures. *Critical Care Nurse* 2004;24(2):18-24,26-30.

On the World Wide Web...

Atrium is delighted to announce the all-new, user-friendly Atrium Web site at http://www.atriummed.com The site is designed to load into your browser quickly and to make it easy for you to find what you need.

The education section now includes full online access to all of Atrium's Instructions for Use documents and the small handbooks about chest drainage. You can print them whenever you need them, or you can read them online. The back issues of Clinical Update are also archived there.

Please visit before July 9 and fill out our education survey. It will take just 5 minutes, and we need your input! We have a number of exciting educational initiatives in mind for 2004-2005, but we need to hear from you about which format will work best in your practice setting and what topics you'd like help teaching. Visit http://www.atriummed.com/edsurvey and tell us what we can do to make your job easier! Two nurses selected at random from those who respond will receive a $50 gift certificate for the Nurse's Station catalog.

Check Your Knowledge...

A. According to Poiseuille's law, flow rate through a tube is directly related to the internal diameter — but to a factor of four. Thus, cutting the diameter by half will decrease flow rate to one-quarter the original flow rate. If at 12mm ID, the flow rate is 60LPM, at 6mm ID, the flow rate would be close to 15LPM.

Sources:

Kam AC, O'Brien M, Kam PCA: Pleural drainage systems. *Anaesthesia* 1993;48:154-161.

Tattersall DJ, Traill ZC, Gleeson FV: Chest drains: does size matter? *Clinical Radiology* 2000;55:415-421.

Sources

1. Ethicon, Inc: J-Vac Closed Wound Drainage System. Author. Somerville, NJ 1997.
2. Leavitt BJ, O'Connor GT, Olmstead EM, et al.: Use of the internal mammary artery graft and in-hospital mortality and other adverse outcomes associated with coronary artery bypass surgery. *Circulation 2001*;103:507-512.
3. Daganou M, Dimopoulou I, Michalopoulos N et al.: Respiratory complications after coronary artery bypass surgery with unilateral or bilateral internal mammary artery grafting. *Chest 1998*;113(5):1285-1289.