December 2007

ATRIUM Clinical Update

Atrium Medical Corporation 5 Wentworth Drive, Hudson, New Hampshire 03051 Phone (603)880-1433 Fax (603)880-6718 www.atriummed.com

Identifying Malpositioned Chest Tubes

Traditionally, portable anterior-posterior chest radiographs have been used to assess chest tube position after tubes were inserted percutaneously at the bedside in trauma patients and in critically ill patients. However, recent research has shown that plain radiographs miss a majority of malpositioned tubes that are detected by chest computed tomography (CT). Nurses play a critical role in monitoring patients who have just had chest tubes placed and being alert to any signs or symptoms of an improperly positioned tube.

Based on chest radiographs alone, malpositioned tubes are detected less than 1% to 3% of the time they are present[1,2]. Portable lateral radiographs are impractical in trauma patients because of the risk of additional injury with arm extension[2]. Alternatively, the more three-dimensional view provided by chest CT increases the ability to detect malpositioned tubes, resulting in an incidence of 22% to 37%[2-3]. Chest tubes should be placed in the pleural space and directed anterior and superior to evacuate air and posterior and inferior to drain fluid. Malpositions have been reported in the fissures between the lobes of the lung (intrafissural)[1-3]; in the lung tissue itself (intraparenchymal)[1-3]; in the mediastinum[2] or in an extra-thoracic location[2,3].

	Intrafissural	Parenchymal	Mediastinal	Extra-thoracic	Total
Remerand[1]	22/106 21%	10/106 9%	Not reported	Not Reported	32/106 30%
Lim[2]	3/76 4%	20/76 26%	4/76 5%	1/76 1%	28/76 37%
Huber-Wagner[3]	17/101 17%	4/101 4%	Not reported	1/101 1%	22/101 22%

Factors Associated with Malpositioning

Outside of the operating room, chest tubes are placed with two primary techniques: in one, a trocar is used to punch a hole in the chest wall, through which the tube is inserted. The other technique uses blunt dissection to create the chest wall opening. In addition, clinicians have the option to place the chest tube in an anterior (ventral) location between the second and third intercostal space in the mid-clavicular line or in a lateral location between the fourth and sixth intercostal spaces in the mid-axillary line. Researchers have examined if technique or location are associated with greater incidence of malposition. One study of 101 chest tubes inserted in 68 patients with multiple trauma detected malposition with CT scan in 10% of anteriorly placed tubes and 25% of laterally placed tubes[3]. Another study prospectively examined 106 chest tubes placed in 63 patients and discovered all malpositions occurred in tubes placed with a trocar[1]; of these, 66% were placed laterally on the right side[1]. Lim et al determined a 37% incidence of malpositioning; of these, 79% were lateral, 64% were on the right side[2].

These data might lead clinicians to avoid trocars and lateral placement and to get chest CT scans on all patients, but the key factor is determining the consequences of malpositioned tubes. When a tube ends up in the fissure or in the parenchyma, is the patient harmed? Will the pneumothorax or hemothorax still be treated adequately? Is the malpositioning detectable clinically or is it only an incidental imaging finding?

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

Consequences of Malpositioned Tubes

Malpositioned tubes may go undetected by traditional chest radiograph and evacuate the pneumothorax or drain the fluid despite the malposition, allowing the patient to recover without morbidity[1]. Or malpositioning can be catastrophic, causing lacerations of the lung or subclavian vein[1,4,5], visceral lacerations of the liver and spleen[4], resulting in hemorrhage; or failure to treat the initial pleural condition for which the tube was intended. Clinical outcomes of most malpositioned tubes fall between these two extremes. Other complications include bronchopleural fistula[1], increased risk of infection, such as lung abscess and pleural empyema[1,2,5]. One series determined 16% of patients required surgical procedures to treat complications of tube malpositioning[5].

Clinical Assessment of Tube Positioning

Clinical detection of chest tube malposition has been correlated to imaging studies only 6%[1] to 29%[2] of the time. At the bedside, clinicians may note absence of fluid drainage when the tube is placed to treat hemothorax or pleural effusion; or lack of bubbling in the water seal chamber when a pneumothorax is being treated[2]. A repeat chest radiograph showing persistent pneumothorax or fluid collection is further evidence of a malpositioned tube[2,5]. Lim and colleagues saw persistent pleural abnormalities 53% of the time in chest CT and 50% of the time in chest radiographs when tubes were misplaced, but clinically, only four of the 28 tubes malfunctioned[2]. In Remerand et al's review, physicians suspected malpositioned tubes twice in 32 cases[1]. Landay and colleagues noted clinical documentation of potential malposition before imaging 20% of the time[5]. Huber-Wagner and colleagues identified this challenge of clinical significance and further described their results as those requiring intervention, (inserting a new chest tube) which were 6/101 (6%) and those simply detected by imaging, but functioning: 22/101 (22%)[3].

Nursing Implications

This brief literature review shows strong preference for chest CT imaging for patients with pleural abnormalities, particularly in multiple trauma. However, it's simply not practical for every patient. If a chest radiograph is suspicious for a pleural abnormality and a CT scan is desired for clarification of any other injuries, it makes sense to acquire the CT after placement of chest tube(s), since the CT scan will allow the clinician to evaluate the path of the chest tube with far greater accuracy than a simple chest radiograph. Whenever a chest tube is inserted at the bedside, the nurse should know why the tube is inserted, to monitor for appropriate clinical correlation with the chest drain.

Clinical warning signs of a malpositioned tube include a lack of improvement in the patient's condition after chest tube placement, fluid drainage when initial imaging showed pneumothorax only, or lack of fluid drainage when a tube is placed for hemothorax or pleural effusion. Similarly, a significant air leak – visible as bubbling in the water seal chamber – in patients without pneumothorax may indicate a chest tube placed in the lung parenchyma.

If a chest radiograph is taken after tube placement, nurses should monitor results to determine if there is an interval improvement from the initial imaging that identified the pleural abnormality that required the chest tube. If the radiograph is not improved, or if the clinical picture does not correlate to a properly functioning chest tube, a CT scan will provide much more detailed information about potential tube malpositioning.

Sources on page 2.

In The Literature

More Than JCAHO and Magnet

As healthcare becomes more competitive and hospitals search for new ways to market their quality and services to customers, a number of names and designations are making their way onto billboards and into advertisements. A review article in *Nursing Management* provides a concise review of Magnet recognition from the American Nurses Credentialing Center, The Malcolm Baldrige National Quality Award from the National Institute of Standards and Technology, Disease Specific Care certification from JCAHO, Solucient's Top Hospitals (now Thomson's Best Hospitals, which uses CMS data), "America's Best Hospitals" named in US News and World Report, and HealthGrades. The article describes whether hospitals apply for the designation, how the award is determined and how much it costs.

Source: Weeks S, Rubinson D, Tilley DS: The ABCs of organizational credentialing. *Nursing Management* 2007;38(10):28-32,43-44.

See On the Web for the Web sites for these credentialing and award organizations.

When is the Usual Routine an Error?

An article from a recent issue of *Critical Care Nurse* should be required reading for every nurse, regardless of practice setting. Elizabeth Henneman, of the University of Massachusetts school of nursing, describes two brief case studies that initially seem routine to experienced nurses. She describes a series of conversations with a resident to clarify heparin orders on one patient, and another patient whose condition deteriorated overnight, no attending had been notified, verbal orders were given to manage atrial fibrillation with a rapid ventricular response, and a miscommunication occurred about whether the patient had received digoxin. While most of us would consider miscommunications and the need for order clarification to be part of a routine day, Henneman points out that these are actually errors as significant as a dispensing error by the pharmacy. Our nature to consider these as part of our nursing jobs and not reporting them allows patterns of miscommunication to go "under the radar," where they are unlikely to be addressed and fixed. This eye-opening piece will have you thinking about ways to be more aware of everyday problems that need to be tracked and remedied to improve patient safety.

Source: Henneman EA: Unreported errors in the intensive care unit. *Critical Care Nurse* 2007;27(5):27-34.

Is the Grass Really Greener on the Other Side?

The current issue of *MEDSURG Nursing* features a report on a research study conducted to compare job satisfaction between experienced critical care and experienced medical-surgical nurses. The authors note that historically, critical care nurses have been identified more frequently with burnout, decreased job satisfaction, and high levels of turnover. However, in recent years, patients cared for outside the critical care unit are more complex than ever before, and medical-surgical nurses are each responsible for a higher number of patients, so the researchers decided to compare the practice groups. They examined job enjoyment, quality of care, time to do the job, and overall job satisfaction. Surveys of 121 nurses with five or more years of experience showed no difference in satisfaction or individual attributes by work unit. There was also no difference between small and large hospitals surveyed, nor between Magnet and non-Magnet organizations. Since nursing employment is more flexible in most areas of the country than ever before, it would be interesting to determine how much the nurse's ability to work in his or her area of choice contributed to the high level of satisfaction reported.

Source: Davis BA, Ward C, Woodall M, Shultz S, Davis H: Comparison of job satisfaction between experienced medial-surgical nurses and experienced critical care nurses. *MEDSURG Nursing* 2007;16(5):311-316.

On the World Wide Web

For more information about hospital recognition programs, visit these Web sites:

HealthGrades
http://www.healthgrades.com

Joint Commission Disease Specific Care
http://www.jointcommission.org/CertificationPrograms/DiseaseSpecificCare/DSCInformation

Magnet Recognition Program
http://nursecredentialing.org/magnet/

The Malcolm Baldrige National Quality Award
http://www.quality.nist.gov/

Solucient (now Thomson) Top 100 Hospitals
http://www.100tophospitals.com

US News Best Hospitals
http://health.usnews.com/sections/health/best-hospitals

Your friends at Atrium wish you and yours a happy and healthy holiday season!

Sources from page 1:

1. Remerand F, Luce V, Badachi Y, Lu Q, Bouhemad B, Rouby J: Incidence of chest tube malposition in the critically ill. *Anesthesiology* 2007;106:1112-1119.

2. Lim K, Tai S, Chan C, Hsu Y, Hsu W, Lin B, Lee K: Diagnosis of malpositioned chest tubes after emergency tube thoracostomy: is computed tomography more accurate than chest radiograph? *Journal of Clinical Imaging* 2005;29:401-405.

3. Huber-Wagner S, Korner M, Ehrt A, Kay MV, Pfeifer K, Mutschler W, Kanz K: Emergency chest tube placement in trauma care – which approach is preferable? *Resuscitation* 2007;72:226-233.

4. Swain F, Martinez F, Gripp M, Razdan R, Gagliardi J: Traumatic complications from placement of thoracic catheters and tubes. *Emergency Radiology* 2005;12:11-18.

5. Landay M, Oliver Q, Estera A, Friese R, Boonswang N, DiMaio JM: Lung penetration by thoracostomy tubes: imaging findings on CT. *Journal of Thoracic Imaging* 2006;21(3):197-204.