



Clinical Update

Atrium Medical Corporation

5 Wentworth Drive, Hudson, New Hampshire 03051

Phone (603)880-1433 Fax (603)880-6718

www.atriummed.com

Chest Tube Insertion: Part One

In this issue of Clinical Update we'll let you know what authors of two new papers on chest tube insertion and management have to say about indications, site selection and tube size^{1,2}. Next issue, we'll cover placing the tube, securing it, and when to remove it.

Indications for Chest Tube

One of the challenges of choosing a thoracotomy catheter and insertion procedure is that a number of indications exist for pleural chest drainage:

- Removing air and blood after thoracic (lung and esophageal) surgery.
- Treatment of spontaneous or iatrogenic pneumothorax.
- Drainage of pleural effusion or empyema.
- Emergency management of chest trauma, including hemothorax, hemopneumothorax and tension pneumothorax.
- Relieving isolated tension pneumothorax resulting, for example, from barotrauma during mechanical ventilation in patients ranging from 2-pound premature babies to older patients with emphysematous blebs that rupture when positive pressure ventilation is applied.

Another aspect of chest tube insertion that makes establishing standards difficult: chest tube insertion is not limited to one medical specialty with one consistent philosophical approach to care. Physicians, APRNs, and physician assistants in pulmonary medicine, surgery, emergency medicine, and more recently, interventional radiology all insert pleural catheters as part of their practice.

Choosing the Insertion Site

Air in the pleural space will rise to the highest point in the chest — typically, anterior and superior (assuming there is no scar tissue causing loculations) when the patient is supine, with the head of the bed raised slightly. Fluid, on the other hand, will go to the most gravity dependent area — in this case, posterior and inferior, closer to the diaphragm.

Traditionally, we've all been taught that to emergently relieve the pressure of a tension pneumothorax, a needle should be placed in the second intercostal space in the midclavicular line to act as a vent — and that hasn't changed. But chest tube insertion in the same place is no longer recommended because it requires dissection through the pectoralis muscle and breast tissue, and it leaves a prominent, unsightly scar.

The British Thoracic Society guidelines recommend a location they call the "safe triangle" — an area lateral to the nipple line bordered by

the latissimus dorsi, the lateral border of the pectoralis major, and the apex of the triangle below the axilla (see figure on page 2). This positioning minimizes risk of injury to the internal mammary artery, muscle or breast tissue. A more posterior location may be selected if loculated fluid is present. However, this site is far more uncomfortable for the patient while the tube is in place, and there is a greater risk the tube will kink if the patient lies on it.

Ideally, tubes inserted to drain air should be directed toward the lung's apex, and tubes draining fluid should be directed toward the base. But the experts agree that, in the absence of pleural conditions that could trap air or fluid in a fixed pocket or cavity, a tube placed in the midaxillary line should successfully drain fluid or vent air.

And the Answer Is – "It Depends."

The question? Which chest tube is best?

If the patient has an uncomplicated pneumothorax, a small bore tube (14F or smaller) will act as a vent, allow air to escape, and be less uncomfortable. On the other hand, if a patient has sustained a chest wound and is bleeding heavily, a large bore tube (28F or larger) will allow the blood to drain more quickly, allowing more accurate measure of blood loss. You'll also have the option for collecting the blood for autologous transfusion while preparing to go to the OR. You may also need a tube this large to quickly evacuate large volumes of air from the chest, if the patient has a large bronchopleural fistula and is receiving positive pressure mechanical ventilation, for example.

Today, most chest tubes are in the 10F to 14F range (this measures outer diameter, which correlates to 3.3mm to 4.7mm; the internal diameter will be less.) There are no data comparing tube sizes in similar clinical conditions but we do know that smaller tubes cause less pain and are tolerated better by patients, all other things being equal. However, if a patient has empyema with thick purulent drainage or an infected malignant effusion in which the fluid is thick and hard to remove, a larger tube may be necessary. In addition to considering viscosity of the material being removed, it is also important to think about how quickly fluids are being produced — higher volumes will need higher flow rates and thus larger tubes.

The inner diameter of the thoracic catheter is a significant factor determining flow rate of air and/or fluid out of the chest. The smaller the diameter, the slower the flow. Not all tubes of the same outer diameter French size will have the same flow rates, due to differences in catheter wall thickness and the materials used in the catheter construction.

Once you have considered why the tube is being inserted and selected the appropriate size, it's almost time to start the procedure. More about that in the next issue.

Check Your Knowledge...

Q. In addition to the inner diameter of the chest tube, three other factors affect flow rate of fluid or air out of the chest. Name two.

Answer on other side

Sources:

1. Baumann MH: What size chest tube? What drainage system is ideal? And other chest tube management questions. *Current Opinions in Pulmonary Medicine* 2003;9:276-281.
2. Laws D, et al: BTS [British Thoracic Society] guidelines for the insertion of a chest drain. *Thorax* 2003;58(Supp II):ii53-ii59.

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

Loves Me, Loves Me Not

The July issue of *Nursing Management* includes a gem of an article on nurse-physician relationships. The authors interviewed staff nurses and managers from 14 Magnet hospitals to determine what constitutes a "good" relationship. What makes this observational research so well done is that the researchers did not begin with a definition of "good" but rather let it flow from the nurses' descriptions. From their interviews, the authors were able to develop a five-category scale:

1. Collegial: equality, different but equal power and knowledge
2. Collaborative: mutual trust, respect and cooperation, but not "equal"
3. Student-teacher: physicians discuss, explain and teach; power is unequal, information is one-way, but outcomes are beneficial
4. Neutral: information exchange with absence of feeling of a professional relationship
5. Negative: frustration and hostility and poor patient outcomes resulting from power struggles

This article is must-read for information on enhancing relationships that can optimize patient outcomes on your unit.

Source: Kramer M, Schmalenberg C: Securing "good" nurse-physician relationships. *Nursing Management* 2003;34(7):34-38.

Why Is CE Attendance Declining?

Those of us involved in nursing CE programs have noticed a decline in attendance in the past few years. Wisconsin researchers surveyed nurses in their target audience to determine factors influencing nurses' decisions to earn contact hours.

The researchers found that nurses were more likely to attend continuing education activities if they were certified, if they were not self-conscious about attending, and if they received positive feedback for their personal characteristics of "willingness," "dedication" and "initiative." Those who attended did not need external rewards for motivation – their sense of professionalism was their motivation.

Nurses who did not attend cited a number of barriers: trouble fitting CE time into their already overloaded lives, budget cuts that eliminate financial support for nurses to attend CE activities, and lack of relevance of the CE content to the nurses' everyday practice.

Researchers recommend that CE planners explore ways to encourage staff members to choose to attend, rather than making it just another assignment. Reach out to nurses: invite them to attend, welcome them when they come and show them you appreciate their attendance. Nurses who feel an enhanced sense of professionalism and self-esteem by regularly participating in CE activities make those activities a regular part of their nursing life.

Source: Kubsch S, et al: Factors influencing accrument of contact hours for nurses. *Journal of Continuing Education in Nursing* 2003;34(5):205-212.

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On the World Wide Web...



Nursing research findings are now easily accessible on the Web – for free.

The Registry of Nursing Research <http://www.stti.iupui.edu/VirginiaHendersonLibrary>

This online resource is provided by Sigma Theta Tau and the Virginia Henderson International Nursing Library. Here you can search by researcher, keyword, or study title. For example, if you search on "chest tube" you'll get 8 studies to review. Abstracts are provided with links to full text where available; author contact information rounds out this information treasure house. The entire library was hacked in summer 2003, and the folks who established this resource have been working feverishly to rebuild the database from scratch. From this link, you can see what is available and what remains to be restored.

National Institute of Nursing Research <http://www.nih.gov/ninr/news-info/resdir.html>

This link takes you to capsule summaries of selected nursing research studies supported by this division of the National Institutes of Health. From here, you can move around the site and learn about research funding and programs, conferences, and access a great page of links relating to research and healthcare.

Nursing Research at the Agency for Healthcare Research and Quality <http://www.ahrq.gov/about/nrsrcsix.htm>

This special page on the AHRQ Web site highlights research conducted by nurses. Here you can subscribe to the nursing research listserv, read press releases about research findings, learn about funding opportunities, link to additional tools and resources, and read summaries of funded research findings.



Illustration of the "safe triangle"

Check Your Knowledge...

A 1. Length. The longer the tube, the greater the resistance to flow. 2. Connectors used to attach the chest tube to the drainage unit. Often these connections are the narrowest (and thus most restrictive) part of the whole chest drainage system. 3. The design of the chest drainage system itself. According to Baumann¹ flow rates through chest drains range from 10.8 to 42.1 LPM when the suction control is set at -20cmH₂O.