Research Review 2013

This mega issue of Clinical Update to kick off 2014 pulls together summaries of research published on thoracic drainage in 2013. There were seven randomized controlled trials that examined chest drainage in 2013, according to a clinical search of the PubMed database; all studies examined patients who had or might need pleural chest tubes. An additional eleven review articles were published. Here is a review of all eighteen for your reference.

Managing Occult Pneumothorax in Trauma

The first study we’ll review is a preliminary report on the OPTICC (Occult Pneumothoraces in Critical Care) randomized controlled trial underway in Canada (see On the Web). An occult pneumothorax (OPTX) is defined as a pneumothorax identified on CT that was not suspected on prior AP chest radiograph. By definition, it is asymptomatic. OPTX is present in at least 5% of all trauma patients and half of all trauma pneumothoraces are diagnosed in this way. They most commonly occur in blunt trauma.

The challenge is how to manage these asymptomatic OPTX when patients receive positive pressure ventilation. Remember – before trauma patients routinely received chest CT, these OPTX were never detected and thus, not treated unless symptoms appeared. In this study, patients with OPTX requiring mechanical ventilator support or those who would receive positive pressure ventilation in the OR were randomized to observation or decompression regardless of the OPTX size. Decompression method was left to the attending physician’s discretion, either with traditional chest tube or percutaneous catheter. Patients assigned to observation could have drainage started if there was hemodynamic or respiratory compromise, or if pleural fluid required removal.

This report covers the first enrolled patients: 50 were observed; 40 had drainage. One observed patient developed tension pneumothorax 6 hours after admission; it was quickly recognized and treated without sequelae. Ten observation patients ended up with chest tubes, a majority for effusion. In this preliminary report, there was no known harm in observed patients, while drainage complications occurred 15% of the time – virtually all being malposition. Otherwise, there were no differences in patient outcomes.

Researchers note that while these preliminary findings support observation, clinicians need to determine how quickly decompression could be accomplished in their practice area when balancing the risks and benefits of observation versus prophylactic drainage.

OR Technique for Air Leaks

Two studies looked at the effect of tissue closure techniques on postoperative air leaks in lung resection. One study compared traditional staple technique with surgical laser closure in 44 lobectomy patients (n=22 in each group). While operative time was about 40 minutes longer for laser patients and the procedure was “tedious,” hospital stay was about 3 days less; complications were 77% in the staple group and 36% in the laser group. It takes approximately 300 procedures to recover the initial cost of the laser system. After that, stapling was a mean 77% more costly, considering disposables. Hospital costs were €2497 (~$3406) less in the laser group. These benefits were attributed to reduced postoperative air leaks.

The other study compared traditional stapling/suturing (n=11) with a fibrinogen-thrombin patch (TachoSil®) (n=13) in patients having a second surgery to complete lobectomy after a previous resection. Researchers were particularly interested in this group of patients who have significant pleural adhesions from their prior surgery because they are at significant risk for prolonged air leak.

Duration of surgery was significantly less in the patch patients (0.4 hr) and mean duration of air leak was less by 5.3 days. There was only one prolonged air leak (> 5 days) in the patch group, compared with 7 in the control group, all of whom went home with a chest tube connected to a Heimlich valve. Overall hospitalization costs were €2591 (~$3534) less in the patch group. Suction was applied to all patients’ chest drains.

These promising studies show two ways to reduce postoperative air leaks, but operative technique must be examined in context of postoperative chest drain management and use of positive pressure ventilation.

Chest Drain Suction and Air Leak

Researchers in Italy reported results of the first 500 patients randomized to a chest drain suction or no suction group following lung resections (except pneumonectomy). This study was started because other studies examining effects of suction applied to chest drains were not large enough to allow researchers to make firm practice recommendations. Their goal is to enroll 1600 patients for statistical validity; here, they present data on the first 500.

Patients who were randomized to suction (n=239) used the Thopaz chest drain, and those without applied suction (n=243) used the Drentech drain. Of note, every patient was connected to -15 cmH₂O external suction overnight the first postoperative night, and then the study group was disconnected from suction the following morning. So, all patients initially received suction, making a true assessment of pure gravity drainage impossible. In addition, researchers provide a list of situations in which suc-
tion was applied to patients in the no-suction arm, and suction was stopped in patients in the suction arm. These changes pulled 43 patients out of the analysis.

By POD 7, 59 patients (11.8%) still had the apical chest tube in place because of persistent air leak (PAL). There was no statistical difference between suction groups on PAL. There was, however, a significant difference in patients with anatomic resections (lobectomy and segmentectomy). They had a higher incidence of persistent leak (16.8%) in the no-suction arm than those in the suction arm (9.6% p=0.05).

These preliminary results show no reduction in overall postop complication rate with suction; there were more cases of pneumothorax with no suction (4% vs 12% p=0.04), but clinical significance was not clear.

Another group of Italian researchers used an electronic chest drain to compare air leak duration in 100 lobectomy patients. Group 1 (n=50) received preset suction depending on lobectomy location, ranging from -11 cmH2O for middle lobe resection to -20 cmH2O for upper bilobectomy. Group 2 (n=50) was a “water seal” group maintained at -2 cmH2O (because the drain used in the study could not maintain zero suction levels).

Statistically, there was no difference between the groups for air leak duration, number of patients with prolonged air leak, or other complications. Researchers concluded that the “water seal” was “at least as effective and safe” as regulated, custom suction for postoperative lobectomy.

Are Postop Antibiotics Needed for Chest Tubes?

Researchers at a New England hospital compared a postop regimen of cefazolin sodium (or alternate for allergy) (n=121) for 48 hours or until chest tube removal (whichever was sooner) with placebo (n=124) in elective thoracic surgery patients requiring postop chest drainage. All patients received the same antibiotic within 30 minutes of incision preoperatively, according to protocol. Average chest tube duration has been 1 to 3 days; hospital LOS in this population has historically been 2 to 5 days; 54% of operations were VATS. Wedge resections were done in 60% and lobectomy in 31% of patients. There was no difference in surgical site infection or pneumonia between the study groups and no cases of *Clostridium difficile* colitis.

There were no benefits attributed to routine postop antibiotics, and that conclusion is reached without even needing to weigh potential hazards of antibiotic exposure and drug resistance.

Is there an Optimal Chest Tube Removal Technique?

Researchers in Alabama examined chest tube removal technique in patients who had elective open thoracotomy for lung resection (no VATS were included). In one group, chest tubes were removed at full inspiration (n=179) and in the other group, at full exhalation (n=163). All patients performed Valsalva maneuver regardless of lung volume. Chest drains were connected to suction on the day of surgery and then disconnected from suction on POD 1. Tubes were removed when the electronic chest drain showed < 20 mL/min for 4 consecutive hours and fluid volume < 450 mL/day. All patients had Xeroform™ gauze dressing covered with cloth tape over the chest tube site.

There was a significantly higher incidence of new or expanded pneumothorax after tube removal in the full inspiration group (32% vs 19%, p = 0.007); however, it was clinically significant in only 5 patients overall (2 in the exhalation group). Researchers stopped the study early based on the presence of pneumothorax without waiting to see if there were statistically significant differences in pneumothorax requiring treatment between the two removal techniques.

The study findings were the opposite of what the researchers expected, and they stress the importance of questioning surgical dogma and biases not supported by research. Our hunches are not always accurate.

Takeaway Points

Based on these studies, researchers recommend watchful waiting before treating occult pneumothorax in trauma as long as decompression can be quickly accomplished if indicated. Surgical laser closure of parenchymal incisions or applying a fibrinogen-thrombin patch can reduce duration of postoperative air leaks, particularly in high-risk patients. Suction and no suction groups were essentially equivalent with respect to prolonged air leak and overall complications except for those with anatomic resections who had a higher incidence of persistent air leak when no suction was applied.

There was no benefit detected when postoperative antibiotics were routinely administered to patients with chest tubes after elective thoracic surgery. Removing pleural tubes while the patient is in full exhalation and performing Valsalva maneuver resulted in fewer post-removal pneumothorax cases.

Sources


In addition to those RCT, 11 more clinical papers addressed chest drainage; one examined bleeding after cardiac surgery and the rest covered pleural drainage. Here’s a quick-hit summary of the other papers.

The study on cardiac surgery did a retrospective review of 11 patients who received Factor IX Complex (a combination of vitamin K-dependent clotting factors: Factor II, VII, X and IX manufactured from pooled human plasma) for severe postop bleeding of ≥ 300 mL/hr. Patients who received it had a statistically and clinically significant reduction in mean chest tube output; it dropped to < 100 mL/hr within 5 hours. Factor IX
A systematic review of randomized controlled trials examining treatments of primary spontaneous pneumothorax (PTX) identified three key elements of PTX management: potential for life-threatening respiratory compromise, the air leak, and risk for recurrence. Their review did not yield recommendations because treatment objectives were not clarified in the studies. Instead, the authors offer objectives: recover respiratory function, avoid dysfunction and any subsequent complications.

Another review looked at ambulatory treatment of spontaneous and iatrogenic pneumothorax with a Heimlich valve; the literature search strategy specifically included “Heimlich valve” and returned 18 studies, but only one was high quality. The primary focus of the review was treatment with the Heimlich valve without larger chest tube and/or surgery. The authors state there are enough data to support use of the valve for non-traumatic PTX. Success with outpatient treatment was reported as 78% in primarily younger patients with minimal comorbidities. The most common complication was dislodged valve and/or catheter. Currently, authors estimate 3000 annual admissions for spontaneous PTX in the UK, with a mean hospital stay of 5 days. Shifting 80% of these patients to outpatient treatment with a Heimlich valve would save 12,000 bed-days in the first year alone.

Authors in France prepared a “best evidence” review of whether routine daily chest radiographs (CXR) are necessary after pulmonary surgery. The seven studies reviewed unanimously recommended changing practice from routine daily films to ordering studies when clinical changes occur. Eliminating routine daily CXR reduces the number of studies per patient and cost without increasing mortality, length of stay, readmission rates or adverse events. However, the authors note that the “on demand” strategy requires close monitoring to detect clinical changes early.

A study from Greece analyzed fluid drainage volume and drainage duration in 38 lobectomy cases (upper n=20, lower n=18) and 15 wedge resection cases. A greater amount of fluid is drained after lower lobectomy than upper lobectomy or wedge resection, and of these, right lower lobectomy produced the most fluid drainage. This increased drainage volume resulted in longer chest tube duration and hospital length of stay. The authors relate this drainage to surgical disruption of the normal function of the mesothelial cells that work with the lymphatic network to redistribute normal pleural fluid.

Surgeons in Michigan reported clinical outcomes of 313 trauma patients whose chest tubes were managed by an institutional protocol algorithm. Blunt trauma occurred in 87% of patients with penetrating injuries in the remaining 13%. Complications occurred in 15 patients (4.8%): persistent air leak (6), persistent PTX (6), recurrent PTX (2) and clotted chest tube (1). Average tube duration was 6 days with hospital LOS 10 days. The decision tree is provided in the article, and the authors believe the standardized management has improved outcomes in trauma patients who require chest tubes.

Authors in the U.K. prepared a “best evidence” review of how long chest tubes should remain in place following VATS for pleurodesis for spontaneous pneumothorax. The eight studies reviewed agreed that absent complication, chest tube duration determined hospital LOS. There was no contraindication to removing drains on POD 2 with discharge the following day. They also note that discontinuing chest drain suction after a brief period is beneficial in reducing chest tube duration.

Brazilian researchers conducted a study by dissecting 30 cadavers to carefully examine anatomy related to chest tube placement. A 24 Fr steel chest tube was inserted in the 2nd intercostal space along the midclavicular line on both sides of the chest. The chest was then opened and measurements were made to assess distance from the tube to main bronchi, upper lobe bronchi, subclavian vessels, pulmonary arteries, the aorta, and other anatomical landmarks. Researchers are using these data to explore a new approach to managing COPD with hyperinflation.

Korean surgeons reported on an unusual case of bilateral spontaneous tension pneumothorax in a 46-year-old man who presented with severe shortness of breath. Cardiac arrest followed, with emergent placement of bilateral chest tubes. Lungs were fully inflated, but with severe pulmonary edema on the right. The reexpansion pulmonary edema, however, did not complicate the patient’s clinical course.

German authors reported on a review of trauma patients who had chest tubes placed in the field by physicians assigned to a civilian air rescue service. Over four years, 49 patients (9%) received prehospital chest tubes; excluding those who died and those who were transferred, 42 were available for follow-up. Blunt trauma occurred in 95%; most were motor vehicle crashes. Nine tubes were malpositioned when evaluated by CT, with 5 in the interlobar gap of the lung, 3 in the parenchyma, and one extrathoracic in the soft tissue; these patients were more severely injured than those without malposition. Malposition was recognized and corrected usually within one hour (upon hospital admission imaging), and there was no difference in clinical course or outcome for malposition patients compared with those whose tubes were correctly positioned on insertion.

Researchers in Taiwan did a retrospective review of 106 ventilated patients with chest tubes for pneumothorax. Patients were placed in one of two groups: chest tube duration > 18d (n=34) and ≤ 18d (n=29). Patients with longer chest tube duration had longer ICU stay (34d v 20d p=0.001), longer hospital stay (63d v 35d p=0.004), mechanical ventilation after pneumothorax (35d v 15d p=0.003), higher ICU mortality (38% v 7% p=0.006), and higher hospital mortality (50% v 24% p=0.04). Subcutaneous emphysema after chest tube insertion and high ventilator peak inspiratory pressures within 24 hours of tube thoracostomy were independent predictors of prolonged chest tube duration.

Sources:

Continued from page 2
In the Literature

Moral Distress Persists

Nurse researchers assessed the frequency, intensity and type of moral distress experienced by 51 California emergency nurses. Situations with the highest levels of moral distress related to competency of other health care providers and following family wishes to continue life support when it is considered futile. Distress was associated with leaving a job for 7% of nurses studied, 20% had considered resigning in the past, and 13% were currently considering resigning because of the pressure from moral distress. The survey elements are provided so readers can replicate the survey.


Hand Hygiene a Waste of Time?

A prospective, randomized, controlled trial examined health care workers entering contact isolation rooms in 7 ICUs. Workers were randomly assigned to perform hand hygiene (with a commercial hand rub) before gloving (n=115) or to directly glove without hand hygiene (n=115). The dominant hand of each worker was cultured at baseline, and post-gloving hand/glove cultures were also done.

Total bacterial colony counts did not differ between the two groups. S. aureus was identified from three cultures. Hand hygiene before gloving did not decrease already low bacterial counts on gloves used for patient care. This “unnecessary” hygiene takes up 19 minutes of a typical 12-hour nursing shift. It may be time to put gloves used for patient care. This “unnecessary” hygiene takes up 19 minutes of a typical 12-hour nursing shift. It may be time to put gloves used for patient care.


iBundle for Point of Care

Experts from ECRI collaborated with a nurse infection preventionist to develop a common-sense bundle to reduce infection risk associated with mobile handheld devices used at the point of care. In brief, recommendations are: (1) use a waterproof or water-resistant barrier over the device, (2) disinfect the device with an approved disinfectant for noncritical items, (3) set an alarm on the device to remind the user to disinfect regularly, (4) perform hand hygiene before and after use.

Source: Manning, ML: iPads, droids and bugs: infection prevention for mobile handheld devices at the point of care. AJIC 2013;41(11):1073-1076. PubMed Citation

Florence Nightingale: Shhhhh

When patient satisfaction surveys revealed disturbing noise levels at night in a Boston medical-surgical unit, nurses took the initiative to implement a plan to meet a Nightingale principle: unnecessary noise...is that which hurts the patient. Sleep is essential for physical functioning, emotional well-being, immune system function and healing. Their report provides many effective strategies for noise reduction, results of the interventions, and what happened when the plan was expanded beyond the pilot unit.

Source: Murphy G et al: Quiet at night: implementing a nightingale principle AJN 2013; 113(12):43-53. PubMed Citation

Enteral Drug Administration: Tradition or Science?

A survey of 823 nurses explored nurses’ knowledge of evidence-based guidelines for drug administration through enteral feeding tubes and their daily practice habits. The questions ranged from tube flushing, volume administered, and medication timing to preventing and managing complications such as tube clogging, nutrient interactions, and inadequate medication delivery. There is a significant gap between recommended best practices and the translation of these recommendations to the bedside routine.


Sources continued from page 3


5. Kouritas VK, Zissis C, Belenis I: Variation of the postoperative fluid drainage according to the type of lobectomy. Interactive Cardiovascular Thoracic Surgery 2013;16(4):437-440. PubMed Citation


7. Dearden AS, Sammon PM, Matthew EF: In patients undergoing video-assisted thoracic surgery for pneumoedema in primary spontaneous pneumothorax, how long should chest drains remain in place prior to safe removal and subsequent discharge from hospital? Interactive Cardiovascular Thoracic Surgery 2013;16(5):686-691. PubMed Citation


Occult Pneumothoraces in Critical Care (OPTICC) Trial

This is the online home for the study tracking occult pneumothorax in Canada trauma patients. http://www.opticc.com/

Nursing Annual Reports

An article in the current issue of Nursing Economics describes the advantages of a nursing annual report. These reports provide a record of accomplishments; disseminate the mission, vision, and values of nursing practice in the organization; and can be a powerful tool to recruit new staff members and communicate nursing’s value to community members. Weaver SH, Ellerbe S: The value of a nursing annual report. Nursing Economic$ 2013;31(6):309-310. Available at: http://www.nursingeconomics.net/necfiles/13ND/309.pdf

These samples demonstrate the wide variety of approaches to writing a nursing annual report:

University of Maryland Medical Center
Memorial Medical Center Springfield, IL
St. Luke’s Treasure Valley Idaho
Dartmouth-Hitchcock Health System New Hampshire / Vermont