It's time for our annual review of research done on patients who require chest drainage. A search of PubMed turned up 29 studies from 12 countries published in 2014. We'll review them by the condition investigated.

Thoracic Trauma
A randomized, controlled study from Columbia investigated 110 thoracic trauma patients who had tube thoracotomy for pulmonary parenchymal wounds. Researchers excluded patients with lung disease, those who required mechanical ventilation, and those with significant traumatic brain injury. They connected chest drains for one group of patients to suction at -20 cmH2O, while the control group had gravity drainage. The theory was that negative pressure would promote faster leak closure and promote hemothorax drainage. However, not only did the study show no advantage for decreased hospital stay, persistent air leak, clotted hemothorax, or the need for surgery in patients with suction, but suction limited patient mobility.

A retrospective review from Kansas examined records of 7 patients with retained hemothorax (6 of whom had blunt trauma and rib fractures) who were treated with tissue plasminogen activator (tPA). Median time from injury to chest tube insertion was 11 days, and from chest tube placement to first tPA treatment was 4 days. Four patients were admitted 10 days after their initial trauma. After chest tube placement, 6 patients had additional CT-guided catheters placed into the hemothorax through which tPA was administered. Hemothorax resolved in all patients with no bleeding complications and no need for the previous standard therapy, drainage via VATS. Of note was one patient, an 89-year-old woman who crashed her all-terrain vehicle, sustaining blunt chest trauma. She had prior thoracotomy and sarcoidosis and died on a subsequent admission, unrelated to the tPA treatments.

Lung Resections
Six studies in 2014 examined care of patients following lung resection. A randomized, controlled study from Japan looked at whether surgeons could replace the routine 2 post-op chest tubes with just one after lobectomy or bilobectomy with mediastinal dissection. Of 108 patients, 55 had VATS and 53 had traditional thoracotomy; researchers split the total group evenly between one and 2 chest tubes. Residual lung expansion was good, and no patients required thoracostentesis for fluid. There were no statistically significant differences in the need for pleurodesis, the amount and duration of drainage, patient pain, or analgesia requirements. The authors recommend a single post-op chest tube citing the savings of cost and time as well as the reduced risk for transcutaneous infection.

Another Japanese study looked at whether the amino acid arginine could help heal persistent air leaks after lung resection. Forty-two patients with continuous air leakage (defined as bubbling during the expiratory phase on the day of surgery and the next day) were randomized to regular post-op care or to have an arginine supplement with each meal. Supplementation occurred on POD 2 (median). It took a median of 2 more days to see changes in air leak and 4.5 days for reduced drainage. Mean durations of air leak and fluid drainage were both significantly shorter in the supplement patients (about 2 days) at a cost of $9 daily for the intervention.

Researchers in Alabama retrospectively reviewed their care of patients who developed postoperative chylothorax following pulmonary resection with mediastinal lymph node dissection for cancer. Surgeons diagnosed chylothorax when pleural fluid triglyceride was >110mg/mL with a daily volume over 450mL. Over 12 years, 1.4% of patients developed this complication. Factors associated with chylothorax were lobectomy, robotic surgery, operation on the right side, and N2 stage. N2 indicates metastasis to the mediastinal nodes, and robotic surgery dissects more thoroughly than even thoracotomy. Dietary manipulations consisting of NPO followed by a medium-chain triglyceride diet cleared chylothorax in 90% of patients. Once the milky drainage became clear and <450mL/day, the chest tube was removed, and the patients discharged. The remaining 4 patients had reoperation with pleurodesis and duct ligation.

A prospective study in Japan explored the possibility that chest tube insertion causes nerve damage that can contribute to post-thoracotomy pain syndrome (PTPS). PTPS is “pain that recurs or persists along a thoracotomy scar at least 2 months following a surgical procedure,” occurring in 30% to 40% of thoracotomy patients. Researchers recruited 16 patients having lung resection for primary lung cancer; 5 had VATS; 11, open thoracotomy. Chest tubes were inserted through the 7th intercostal space, using the video camera port location when possible. Surgeons used current perception threshold (CPT) testing to evaluate sensory nerve fibers quantitatively and selectively, allowing correlation with patient reports of pain. Using different frequencies, they were able to differentiate touch and pressure (group A Beta fibers) from sharp pain (group A Delta fibers), from temperature and dull pain (group C fibers). Group A fibers are myelinated; group C is unmyelinated.

Measurements were made before surgery, while the chest tube was in place, and after tube removal. Values for touch and pressure (group A Beta) rose and stayed elevated even after tube removal. Sharp pain (group A Delta) and temperature and dull pain (group C) rose while the tube was in place but then dropped to near pre-op values once the tube was...
In the Literature

**Acuity or Geography for Assignments?**
Researchers in Miami addressed concerns from clinical partners (their name for nurse’s aides and patient care assistants) about the equity of their assignments. Traditionally, assignments were based on patient location, but with more independent patients placed further from the nurses’ station, this resulted in unequal workloads. The unit implemented the TEAMS acuity system – treatment, education, ADLs, medications, and signs. Each element is assigned a score, allowing patients to be categorized as low, medium, and high acuity. After implementing an acuity-based assignment process, opinion was split on the effect patient assignment “spread over the unit” had on workload. However, there was clear agreement that the new process improved morale, made assignments fairer, and improved patient care. The authors provide detail on their implementation and evaluation process, but did not discuss how these assignments correlated to nursing assignments.


**Simple Can be Best**
A respiratory therapist in New Hampshire conducted and wrote a report about a randomized, controlled study he did to determine if topical ice application reduces pain of arterial puncture. He applied a plastic bag with 12oz crushed ice to the radial puncture site for 3 minutes before drawing blood in the experimental group. To eliminate the variable of technique (other studies had as many as 29 people drawing samples) the author drew each sample with outpatients seated in the same chair. An interesting subanalysis compared those who had previous arterial puncture and those who did not. The simple application of ice reduced pain significantly. This is an excellent example of a small, well-designed, uncomplicated study with clinically useful results that can be implemented easily at the bedside.

Source: Haynes JM: Randomized controlled trial of cryoanalgesia (ice bag) to reduce pain associated with arterial puncture. Respiratory Care 2015;60(1):1-5. PubMed Citation
Related editorial: McSwain et al: Is there an easy, effective, efficient, and inexpensive technique to reduce pain of arterial punctures? Respiratory Care 2015;60(1):141-143. PubMed Citation

**Medical Devices Need Cybersecurity Too**
An update in the Journal of the American Health Information Management Association describes the latest guidance from the FDA on cybersecurity for medical devices. Studies have shown that health care providers’ devices or systems have been breached, and they haven’t been aware of the breach or the vulnerability. The FDA has initially identified five core functions for device manufacturers to address: identify what needs protection, protect by identifying safeguards, detect incidents, respond to contain impact, and recover to restore capabilities. These should be incorporated in product evaluation by clinicians as well. You can also download slides and transcripts of a conference on this topic sponsored by FDA at [http://1.usa.gov/1CCFC8m](http://1.usa.gov/1CCFC8m).

removed. These patterns are similar to those seen with retractor compression during surgery, but the chest tubes were in place an average of 3.8 days. Five of the 16 patients reported more pain at the chest tube site than at the surgical incision. There was a marginally significant correlation between CPT measurements and patients’ reports of pain, but the authors point out the potential for this technology to overcome gender and cultural stereotypes that affect subjective pain assessment.

PTPS has been associated with incisional pain, but this initial study using an objective measurement of nerve activity shows damage to the intercostal nerve from the separate chest tube site. Patients may have trouble discriminating between the two. Since these data indicate damage, not just nerve stimulation during the time the chest tube is in place, future research can be more informed and directed at ways to limit intercostal nerve pressure from chest tubes.

The two remaining studies on lung resections look at volume thresholds for chest tube removal post-op. A Chinese study randomized 90 consecutive patients having lobectomy or bilobectomy into a traditional treatment group with tubes removed when drainage volume is < 100mL/day and an “early removal” group with tubes removed when drainage volume reached < 300mL/day. Excluding those with complications after randomization resulted in 29 in the traditional group (20 VATS, 9 open thoracotomy) and 41 in the experimental group (32 VATS, 9 open). Median chest tube duration was 67h in the traditional management group and 44h in the early removal group (p=0.004); hospital stay was one day less with early removal (p<0.01). There was no difference in pleural effusion, thoracentesis, readmission, or other postoperative complications.

The other study, from Denmark, started with 622 fast-track VATS lung resection patients, losing 23 to follow-up. In order to fast-track, they increased the volume for chest tube removal to 500mL/24h. Median time from surgery to chest tube removal was 2 days; from surgery to discharge was 4 days. When all patient data were analyzed, the median time for discharge was the day after the chest tube was removed. Pleural effusions requiring treatment occurred in 17 (2.8%) patients (12 thoracentesis, 5 chest tubes); 7 required readmission. Cumulative time of readmission was 40 days (1 day for every 15 patients). The researchers support aggressive chest tube removal to enhance patient mobility and respiratory function, and to get them home sooner.

Chest Tube as Therapy

Seven research groups wrote about the therapeutic use of chest tubes, on topics including tube size, imaging used to make decisions about tube removal, procedural pain, and learning how to insert tubes.

Pulmonologists in North Carolina examined a group of patients taking clopidogrel who needed a pleural procedure to determine if there was a significant risk for procedure-related bleeding. Clopidogrel is the standard of care after coronary artery stent placement, and stopping therapy is associated with thrombosis, MI, and death. The prospective experimental group was 25 consecutive patients taking clopidogrel who needed either thoracentesis (n=17) or chest tube (n=8) to remove pleural fluid; researchers matched them with 50 patients not taking the drug. Interventional pulmonologists did thoracentesis with an 8 Fr catheter; chest tubes were 14 Fr and both were placed with ultrasound guidance. One patient taking clopidogrel had hemothorax requiring 2 units PRBC. There were no complications in the other 74 patients.

A paper from Turkey reports on the experience with small-bore catheters (10 Fr) for pleural drainage of fluid (54%), air (43%) or both (2.6%) over 5 years. Mean catheter duration ranged from 3.71d for iatrogenic pneumothorax to 6.69d for parapneumonic effusion. Fifteen patients (4.8%) required 14 Fr catheters when the 10 Fr were ineffective. Four catheters were misplaced outside the pleural space. In comparing their experience with the literature, the authors believe the smaller tube is therapeutically equivalent to larger tubes (> 28 Fr), easier to place, and less painful for the patient.

Virginia researchers compared ultrasound imaging (US) with traditional chest x-ray (CXR) for detecting pneumothorax related to chest tube removal in 129 patients. The first group of 55 had US and CXR before and after tube removal; the second group eliminated the CXR unless there was a significant abnormality on US. US detected all clinically significant pneumothorax with one false positive for 100% negative predictive value. The false positive was in a patient with a large amount of subcutaneous air. False positives for smaller pneumothorax occurred in patients with extensive decortication / pleurodesis and morbid obesity but did not affect care. Researchers concluded US is safe and effective for rapid assessment after chest tube removal; if US is uncertain, a confirming CXR can be done.

Nurse researcher Kathleen Puntillo designed and conducted a prospective, cross-sectional, multicenter, multinational study to assess the characteristics and determinants of procedural pain in ICU. The study included 12 common procedures, but we will just focus on chest tube removal. A 0 - 10 numeric rating scale was used to assess pain “right now” and the “worst pain today.” Patients were asked to rate both the intensity of pain and the degree of distress from pain. After the procedure, the assessment was repeated for the procedure experience. Patients had mild pain before the procedure (intensity 1-4) and a significant increase during the procedure (p<0.001). Chest tube removal was the most painful procedure of those studied, with a median score of 5/10 from a baseline of 2. Factors associated with higher procedural pain were use of opioids for the procedure, higher baseline pain intensity and distress, higher intensity of worst pain on the day of the procedure, and a procedure that is not performed by a nurse.

Three more studies examined clinicians’ behavior placing chest tubes and managing patients. An Australian paper reports on clinicians’ compliance with published guidelines. Medical records were audited to check compliance with British Thoracic Society recommendations. There was no hospital-wide policy on chest tube insertion to direct practice. On the respiratory medicine unit, 90% of tubes were placed during the day, 78% of tubes were placed with ultrasound (US) guidance when draining pleural effusion, 90% had basic, recommended laboratory pleural fluid analysis, 10% had written consent, and 30% documented use of small-bore tubes. On other units, 59% were during the day, 42% had US guidance, 18% had fluid analysis, 14% had written consent and 7% had small tubes. After education about the guidelines,
respiratory medicine clinicians improved written consent and documented small tube selection to 83%. There was no performance improvement for non-respiratory medicine clinicians. The authors believe multidisciplinary guidelines would help bridge the practice gap between medical and surgical clinicians’ approach to chest tubes.

How do residents acquire chest tube insertion skills? A French study examined skill acquisition by critical care residents and specifically considered the difference between experience (the number of procedures) and proficiency (the ability to perform the procedure correctly).14 Many policies require a specific number of supervised procedures before the clinician can work independently. But, how skilled are the people doing the supervision and teaching? In this study, over 12 months, the median number of chest tube insertions per resident was 3, with 52% reporting having inserted less than 5, and 31% reporting more than 5. Of 295 procedures, the failure rate was 4.5%; complications were 9.9% (consistent with the literature). Of interest, chest tube insertion was one of the few procedures for which complications did not decrease with experience. The authors explain this by suggesting that residents may have been overconfident or assigned more complex patients.

Neonatologists in Washington, D.C. also confronted the challenge of teaching chest tube insertion.15 There are few opportunities for practice, and simulators are expensive and not realistic. These authors constructed a model using simple hardware materials for less than $50. The model has anatomical landmarks that learners can see and feel, and there is a tactile “pop” when learners correctly insert the tube into the “pleural space.” Learners can use regular equipment to practice. All residents who used the model for training showed significant improvement in tested knowledge and self-assessment of knowledge, comfort and skills at the end of training and one month later.

Cardiac Surgery

Four studies were done on cardiac surgery patients, each examining a different aspect of post-op bleeding. Polish researchers hypothesized that lower preoperative von Willebrand factor (VWF) antigen/activity and increased ADAMTS13 antigen activity would be associated with more chest tube drainage after CABG.16 These substances are essential for platelet adhesion to achieve hemostasis. Median post-op drainage volume for 232 consecutive patients without a history of bleeding disorders was 675mL with the lowest quartile <475mL and the highest >905mL. Those in the highest quartile had 19% lower VWF, 9% higher ADAMTS13 and 14% lower fibrinogen levels. There was an inverse relationship between VWF and transfusions with FFP and PRBC. A linear regression for post-op chest drain volume showed the only independent predictors were preoperative VWF and fibrinogen.

New York researchers evaluated thromboelastograph with platelet mapping (TEG-PM) to assess postoperative bleeding risk in CABG patients taking clopidogrel.17 Seventy-eight patients had TEG-PM measured the same day as on-pump CABG. A multiple regression analysis showed that increased pre-op TEG-PM and decreased BMI could be used to predict post-op bleeding and need for platelet transfusion (obesity is a known risk factor for hypercoagulability).

A study from Australia retrospectively reviewed the records of 2575 patients who had cardiac surgery over 6 years to identify modifiable, independent predictors of chest tube drainage post-op.18 Researchers excluded Jehovah’s Witness patients and those who arrested post-op. Non-modifiable factors associated with increased drainage include internal mammary artery graft, tricuspid valve surgery, bypass time, urgent surgery, redo, left ventricular impairment, male, lower BMI, and higher pre-op hemoglobin. The only modifiable factor identified was the operating surgeon. Surgeons’ hemostasis practices are key. The authors note that bleeding can be reduced by at least 50% in Jehovah’s Witness patients, and ask why can’t bleeding be lowered in everyone? The post-op drainage variation among surgeons was 208mL – enough to cause a range of potentially life-threatening bleedings between 21% and 33%.

Fifty-four consecutive on-pump CABG patients’ records were reviewed by Indian surgeons to determine predictors of postoperative drainage volume.19 Mean 24h drainage was 458mL. Predictors of increased drainage were heparin dose before bypass, intraoperative FFP, and pre-op serum ALT with the strongest predictor being intraoperative platelet transfusion.

Spontaneous Pneumothorax

Two studies from France explored outpatient management of patients with spontaneous pneumothorax (SP) using treatment algorithms. In one, patients with a small pneumothorax were observed and discharged if asymptomatic after 4 hours.20 Those with large primary SP or breathlessness with smaller SP had decompression with an 8.5 Fr pigtail catheter and were then also monitored for 4 hours. CXR was repeated. If the lung was fully reexpanded, the tube was removed, and the patient discharged tube-free. If the pneumothorax increased or the patient became more symptomatic, suction was applied, and the patient was admitted. Otherwise, the patient was sent home with the catheter attached to a Heimlich valve as long as he or she met 5 nonnegotiable criteria: (1) stable condition, (2) will be less than an hour from the hospital, (3) will not be alone, (4) is able to understand and follow instructions and (5) discharge occurs before 10pm. Follow-up was scheduled for the next working day with a pulmonologist.

Of 60 consecutive patients, 48 had large pneumothorax. Forty percent (n=24) were hospitalized for initial treatment with suction. Of the 36 discharged after observation, 6 were readmitted after the follow-up CXR showed incomplete lung reexpansion. The success rate (lung reexpansion by day 7) was 83% overall. Ten patients had VATS for persistent air leak that was appropriately identified and managed through the algorithm. There were no complications. The cost of the catheter and valve was €107 ($121), hospitalization was €1194/day ($1352). With hospitalization a mean of 2.3d, the approximate cost under the algorithm was €2710 ($3068). However, if you factor in the patients who go straight home without hospitalization (that previously lasted 4 days), this approach brings at least a 38% drop in costs, more than €114,000 ($129,068).

The other paper also reports on ambulatory management of 132 patients with large primary and secondary SP – six
hours away from the previous study location in France.21 As in the previous study, all patients were treated with an 8.5 Fr pigtail catheter attached to a Heimlich valve with care then dictated by the study's care algorithm (which is different from the prior study). Patients were discharged within 2 hours of catheter placement and then assessed on day 2 and day 4 by a pulmonologist who tried to aspirate air from the catheter manually with a syringe. If there was no air, a CXR was done, and if the lung was reexpanded, the catheter was removed. If air was aspirated on day 2 (indicating lack of healing), the patient was admitted for chest tube suction at -20cmH2O. If the leak persisted at day 6 or beyond, surgery was done. Success (reexpansion by day 4) rate was 83% overall and 78% for the 103 patients treated exclusively as outpatients. Two patients had kinked catheters that were identified on day 2; they were asymptomatic. Eleven patients were admitted initially; 7 were discharged, cured, by day 4, and could have been managed as outpatients except for the abundance of caution at the beginning of the study. The other 4 were hospitalized for comorbidities. Another 18 were admitted on day 4 when the pneumothorax persisted. Eleven patients were cured after suction was applied to the chest tube and the 11 remaining patients had VATS pleurodesis. The mean cost per patient was $926 for outpatient management compared with $4276 for traditional management.

Effusions and Empyema

Thai researchers did a retrospective review of 412 pleural effusions drained by ultrasound-guided small-bore catheter over a six-year period.22 After placing a sheathed needle in the pleural space, a catheter, ranging from 8 Fr to 14 Fr depending on the fluid's viscosity, was inserted. Catheters were in place for a median 10 days; 52% were parapneumonic effusion/empyema and 30% were malignant effusion. The overall clinical success rate was 76.5%. Malignant effusions had a statistically lower success rate, and the authors attribute this to the palliative nature of their care. Five patients (1.2%) had complications during the procedure: 3 pneumothorax and 2 hemotorax – this compares with 7% complications with large-bore tube placement. The most common complications of drainage were catheter blockage (9%) and accidental dislodgement (4.1%).

A Chinese study examined the relationship of hospital caseload/volume on outcomes for patients with pleural infection.23 Traditionally, with a higher caseload, there are greater care efficiencies, more experience, and better results. In this review, patients treated in higher caseload hospitals were younger and more complex; the hospitals were in more urban areas. Researchers categorized hospitals into quartiles by number of cases per hospital year. Patients treated in the highest caseload quartile had 27% less risk of hospital mortality. However, once researchers made adjustments for diagnosis, case-mix, and treatment differences, the mortality advantage vanished.

Thoracic surgeons in South Korea reviewed records for 120 patients with empyema who were treated with VATS drainage and decortication to see if there is an optimal time for surgery once patients became symptomatic.24 Researchers separated patients into 3 groups for analysis: surgery less than 2 weeks after symptoms, between 2 and 4 weeks, and longer than 4 weeks. Patients treated within 4 weeks had shorter chest tube duration and hospital length of stay. The operative procedure was significantly longer when surgery was done more than 2 weeks after symptoms appear, and there was a significantly higher incidence of prolonged air leaks when surgeons operated after 4 weeks.

Pediatrics

Five studies on children with chest tubes were published in 2014. A multicenter observational study in the U.S. collected data on the proportion of occult pneumothorax in children with blunt torso trauma and the rate of treatment with tube thoracostomy.25 CXR were done on 8020 children with blunt trauma; 372 (4.6%) had pneumothorax. Of these, 148 (1.8%) were diagnosed on CXR and 224 (2.8%) by subsequent CT scan. Of note, 200 were diagnosed on abdominal CT. Children with occult pneumothorax were less likely to have hemothorax or rib fractures. Patients with pneumothorax were more likely to have an abnormal physical examination compared with those with occult pneumothorax, and those with occult pneumothorax were more likely to have abnormal exam compared with those without pneumothorax. Chest tubes were placed in 57% of children with pneumothorax and 15.6% with occult pneumothorax.

Turkish researchers report on their experience over 12 years with traumatic diaphragmatic rupture in 22 children.26 Ten of 22 were blunt trauma (fall from height, motor vehicle crash); 12/22 were penetrating (gunshot, stab); 20 had organ herniation, most commonly the stomach. Diagnosis was made on initial CXR in 14 children; 20 children had injury on the left side. Researchers note the diagnosis can be easily missed when obvious, serious injuries are present.

A study from Denmark reviewed 17 years of records of 100 children diagnosed with parapneumonic effusions.27 Annual incidence rose from 0.5 to 2.6/100,000. Median age was 5 years. Chest tube drainage occurred in 88% of children, with an overall failure rate of 50% and a median hospital length of stay of 11 days. Treatment failure was related to younger patient age, suggesting that tube size may have contributed to the problem. Those children required open surgery.

Researchers conducted a retrospective review of 189 consecutive children treated with extracorporeal membrane oxygenation (ECMO) at 2 U.S. referral centers over 15 years to determine outcomes of children who had chest tubes placed while fully anticoagulated.28 Median age was 2 days; 47 children had air or fluid in the pleural space, and 27 received chest tubes. Children with pneumothorax who got a chest tube had a 48% mortality versus 25% with no chest tube. There was no difference in mortality between those with and without chest tubes for pleural effusion. Major bleeding occurred in 6 children, 3 of whom died following pulmonary laceration (2) and left ventricle injury.

A retrospective, case-match study was done by researchers in Michigan and Massachusetts to try to identify risk factors for developing plastic bronchitis (PB) after Fontan surgery.29 This multi-stage palliation diverts venous blood directly to the pulmonary arteries in children with a single functional ventricle. PB is characterized by large, rubbery plugs or casts that form in the airways, with a 5-year mortality as high as 50%. The authors matched children with the
complication 1:2 with those who did not have it post-op. Children with PB had significantly longer duration of chest tube drainage after stage 2 repair (>6 d) and after the Fontan procedure (>13 d) than those without PB. As the pathophysiology of PB is unclear, authors point to examining whether the increased chest drainage is from a hemodynamic abnormality, problem with lymphatic drainage, or inflammatory response that could contribute to PB.

Clinical Applications

To summarize, suction is not required for routine pleural chest tubes, and one tube is sufficient after lung resection. Arginine is a low-cost, simple dietary supplement that may help heal prolonged air leak. Post-op chylothorax can almost always be resolved with dietary changes and careful observation. Pleural tubes can be safely removed when drainage is 300mL/day; the threshold of 500mL/day may be a bit aggressive – this practice required subsequent drainage in 2.8% of patients.

Patients taking clopidogrel can have chest tube or thoracostomy with minimal risk of significant bleeding; TEG-PM can help predict the risk of bleeding when these patients need CABG. However, it’s very risky to place a chest tube for pneumothorax in anticoagulated infants on ECMO.

Small chest tubes or catheters 8.5 Fr to 10 Fr can be used for pneumothorax and simple pleural effusion; they may be too small for empyema. Patients with uncomplicated spontaneous pneumothorax can be safely discharged from the ED with a small chest tube attached to a Heimlich valve as long as there is a solid plan for follow-up. Outpatient management saves about $3000 per patient. Bedside ultrasound imaging can be used to assess the pleural space, replacing chest radiograph. Ultrasound guidance is helpful to guide tube placement and other procedures, such as instilling tPA to break up retained hemothorax or directed drainage for empyema.

Chest tube removal was the most painful procedure in a list of 12 routine ICU procedures. The tube can damage intercostal sensory nerves, resulting in pain sensations after tube removal.

It’s challenging to teach residents how to insert chest tubes properly because there are not many opportunities outside the OR or ED. However, there isn’t necessarily a connection between the volume of patients treated for pleural infection and their outcome. When patients need surgery to treat empyema, the best outcomes are when it is done between 2 and 4 weeks from initial symptoms.

Bleeding after cardiac surgery can be forecast by examining von Willebrand factor and ADAMTS13 pre-op and monitoring whether patients received platelets and FFP in the OR. Ultimately, the most important variable is probably the operating surgeon.

Children with blunt chest trauma have almost twice as many pneumothorax identified with abdominal CT scan than with CXR. Those with traumatic diaphragmatic rupture can be diagnosed with CXR provided caregivers are not distracted by other injuries.

Children with prolonged chest drainage after any stage of Fontan palliative surgery should be carefully monitored for the risk of developing plastic bronchitis.

Sources