

Dear Colleagues,

We are pleased to inform you that we have completed the analysis of surveys for the Consortium for Congenital Cardiac Care - Measurement of Nursing Practice (C4-MNP) state of practice assessment regarding chest tube management in pediatric intensive care (ICU).

The purpose of this project was to describe the current nursing practice of chest tube management, manipulation, and knowledge of nursing practice within pediatric ICUs.

The survey questions were developed by Patrick Loughran BS, RN, CCRN of Boston Children's Hospital.

The invitation to participate was sent to 40 C4-MNP centers and 30 completed the survey for a response rate of 75 percent. Below, please find the aggregate result report.

We would like to extend our heartfelt appreciation for your continued commitment to this collaborative as we work to improve outcomes for pediatric cardiovascular patients and their families.

Sincerely,

Patrick Loughran BS, RN, CCRN
Staff Nurse III
Cardiac Intensive Care Unit
Boston Children's Hospital
Patrick.Loughran@childrens.harvard.edu

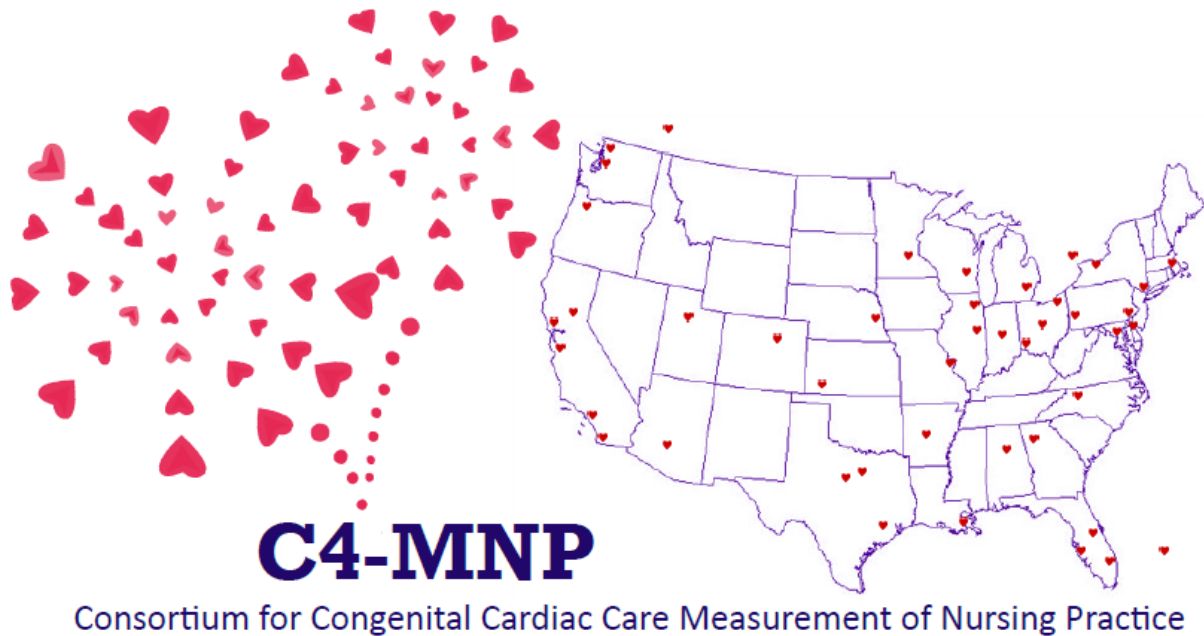
Jean Anne Connor PhD, RN, CPNP, FAAN
Director, Nursing Research
Cardiovascular & Critical Care
Boston Children's Hospital
jean.connor@childrens.harvard.edu

Boston Children's Hospital

Consortium for Congenital Cardiac Care – Measurement of Nursing Practice (C4-MNP)

State of Nursing Practice Assessment Aggregate Result Report: *Chest Tube Management in the Intensive Care Setting*

July 23 – September 20, 2019



Project Team:

Patrick Loughran BS, RN, CCRN

Benjamin Cerrato MPH

Courtney Porter MPH, CPHQ

Jean Connor PhD, RN, CPNP, FAAN

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Executive Summary

Survey Overview

The management and manipulation of chest tubes is a well-known practice in hospitals throughout the country. Placement of chest tubes is most common following thoracic surgery to facilitate fluid drainage from the chest cavity. This intervention helps avoid the complications of tamponade physiology. There is a deficit of literature on chest tube management and manipulation in the pediatric post-operative population. The goal of this assessment was to capture a broad yet thorough understanding of the current state of practice of chest tube management, manipulation and knowledge of nursing practice within pediatric ICUs. The survey contained 46 questions divided into four sections: Policy and Competency, Manipulation, Care and Maintenance and Discontinuation of chest tubes.

Key Findings

40 sites received the chest tube survey with 30 sites responding, resulting in a 75% response rate. 28 respondents were from pediatric cardiac ICUs and two were from mixed CICU/SICUs. The individual respondents were predominantly bedside nurses followed by nurse practitioners, clinical nurse specialists and nursing educators all with 5-15+ years of nursing experience. Below are three key findings of the survey:

- **Policy and Competency** – 90% of respondents have an existing policy for chest tube management with 63% having a competency for chest tube management. Only 60% have a policy and 55% a competency regarding manipulation of chest tubes.
- **Manipulation of chest tubes** – 90% of surveyed institutions have nurses engaged in manipulating chest tubes with only 56% reporting having a written order for such practices.
- **Discontinuation of chest tubes** – 20% of respondents have competency approved nurses actually removing chest tubes. 40% report obtaining a chest x-ray (CXR) only when clinically indicated following chest tube discontinuation. 26% state heparin infusions are held prior to chest tube discontinuation.

Conclusion & Next steps

There is an opportunity for improvement in several areas of pediatric chest tube management by nursing staff. Below are conclusions and next steps:

- Assist facilities that lack policies and competencies for chest tube management and manipulation by nurses in the development of this practice. Nursing care is best delivered using evidence-based practice, standardized care and documentation outlining scope of practice.
- Written orders for nurses to manipulate chest tubes should be standard practice.
- An analysis of data and literature should be undertaken to determine the safety and practicality of obtaining a CXR for assessment of a pneumothorax following chest tube discontinuation. If there is a population in which it is safe practice to forego a CXR this could reduce cost, resources, and radiation exposure to patients.
- Holding continuous heparin therapy prior to chest tube discontinuation may not be a necessary practice. Comparative assessment of centers that do and do not hold heparin could provide insight into the safety of this practice. Holding heparin interrupts therapy and often results in addition blood sampling and laboratory costs.

Response Rate

Frequency	%
30 / 40 Eligible Sites Responded	75

Demographics

1. Please describe your unit.

Unit	Frequency (%)
Pediatric ICU	2 (6.7)
Cardiac ICU	28 (93.3)
Mixed Acuity / Acuity Adaptable	0 (0)
Acute Care or Step-Down	0 (0)

2. What is your current job title?

Title	Frequency (%)
Staff Nurse	17 (56.7)
Clinical Nurse Specialist	5 (16.7)
Nurse Educator	2 (6.7)
Nurse Practitioner	2 (6.7)
Nursing Scientist	0 (0)
Nursing Administrator	2 (6.7)
Clinical Leader	1 (3.4)
Quality Manager	1 (3.4)

3. Please identify how long you have been in this position.

Time in Current Role	Frequency (%)
< 1 Year	0 (0)
1 - 4 Years	4 (13.3)
5 - 9 Years	5 (16.7)
10 - 14 Years	12 (40.0)
> 15 Years	9 (30.0)

4. Please identify your overall years of nursing experience.

Years of Nursing Experience	Frequency (%)
< 1 Year	0 (0)
1 - 4 Years	0 (0)
5 - 9 Years	4 (23.3)
10 - 14 Years	7 (13.3)
> 15 Years	19 (63.3)

Section 1: Policy, Competency, and Management of Chest Tubes

1. Does a policy exist at your facility regarding the general management of chest tubes (chest tube care, dressing changes, low wall suction pressure, etc.)

Policy	Frequency (%)
Yes	27 (90.0)
No	3 (10.0)

2. Does a policy exist at your facility regarding the manipulation of chest tubes by nurses (stripping, milking, fanfolding, tapping)?

Policy	Frequency (%)
Yes	18 (60.0)
No	12 (40.0)

Does your institution have a hospital based or unit based competency to validate nursing knowledge and skill for the following?

3. Managing chest tubes (chest tube care, dressing changes, low wall suction pressure):

Competency	Frequency (%)
Single Competency	19 (63.3)
Annual Competency	5 (16.7)
No Competency	6 (20.0)

4. Manipulating chest tubes (stripping, milking, fanfolding, tapping):

Competency	Frequency (%)
Single Competency	16 (55.2)
Annual Competency	4 (13.8)
No Competency	9 (31.0)

5. Removing chest tubes:

Competency	Frequency (%)
Single Competency	12 (40.0)
Annual Competency	4 (13.3)
No Competency*	14 (46.7)

*1 site reports nurses (competent in chest tube removal) are responsible for removal of chest tube

6. Surgeons at your facility place:

Type of Chest Tube/Drain	Frequency (%)
Chest Tube	30 (100)
Blake Drain	24 (80.0)
Pigtail Drain	27 (90.0)

7. Does any policy exist separating the care or manipulation of chest tubes versus blake drains?

Policy	Frequency (%)
Yes	25 (83.3)
No	5 (16.7)

8. Does any policy exist separating the manipulation (stripping, milking, fanfolding, tapping) of mediastinal chest tubes vs pleural chest tube?

Policy	Frequency (%)
Yes	28 (93.3)
No	2 (6.7)

9. At what pressure is the collection chamber set or chest tube drainage on postoperative closed chested patients?

Pressure	Frequency (%)
-10 cmH2O	3 (10.7)
-20 cmH2O	25 (89.3)
-30 cmH2O	0 (0)
-40 cmH2O	0 (0)
-50 cmH2O	0 (0)

10. At what pressure is the collection chamber set for chest tube drainage on postoperative open chested patients?

Pressure	Frequency (%)
-10 cmH2O	9 (33.3)
-20 cmH2O	17 (63.0)
-30 cmH2O	1 (3.7)
-40 cmH2O	0 (0)
-50 cmH2O	0 (0)

Section 2: Manipulation of Chest Tubes

1. Is it within the scope of practice for nurses in your ICU to perform the following manipulations on chest tubes?

Type of Manipulation	Frequency (%)
Stripping	29 (96.7)
Milking	28 (93.3)
Tapping	26 (86.7)
Fanfolding	17 (56.7)

2. Do surgeons, intensivists, or nurse practitioners perform the following manipulations on chest tubes?

Type of Manipulation	Frequency (%)
Stripping	29 (96.7)
Milking	30 (100)
Tapping	29 (96.7)
Fanfolding	24 (80.0)

Are there clinical indications for nurse manipulation of chest tubes stated in your chest tube policy and/or competency?

3. Hemodynamic changes:

Policy/Type of Competency	Frequency (%)
Policy	5 (16.7)
Single Competency	6 (20.0)
Annual Competency	2 (6.7)
None	18 (60.0)

4. Evidence of clot formation within the chest tube:

Policy/Type of Competency	Frequency (%)
Policy	9 (30.0)
Single Competency	9 (30.0)
Annual Competency	2 (6.7)
None	10 (33.3)

5. Pleural effusion:

Policy/Type of Competency	Frequency (%)
Policy	3 (10.0)
Single Competency	8 (26.7)
Annual Competency	1 (3.3)
None	18 (60.0)

6. Acute change in amount of drainage:

Policy/Type of Competency	Frequency (%)
Policy	9 (30.0)
Single Competency	6 (20.0)
Annual Competency	2 (6.7)
None	13 (43.3)

7. In your own opinion, what does manipulating chest tubes accomplish for the patient?

Outcome	Frequency (%)
Maintains chest tube patency	29 (96.7)
Can reduce the potential of tamponade	28 (93.3)
Increase/facilitates the amount of chest tube drainage	18 (60.0)
Reduce pleural effusion	17 (56.7)
Other	0 (0)

8. Do nurses medicate patients for pain prior to manipulation of chest tubes?

Frequency	Frequency (%)
Always	0 (0)
Often	2 (6.9)
Sometimes	14 (48.3)
Rarely	8 (27.6)
Never	5 (17.2)

9. Do providers write orders for the manipulation of chest tubes by nurses?

Orders	Frequency (%)
Yes	17 (56.7)
No	13 (43.3)

10. In your opinion, is there a potential harm to the patient when chest tubes are stripped or otherwise manipulated, barring dislodgement of the chest tube itself?

Potential Harm	Frequency (%)
Yes	17 (56.7)
No	13 (43.3)

Of those responding 'Yes,' the potential harms are:

Outcome	Frequency
Excessive negative pressure/increased bleeding	8
Pain	4
Aggressive stripping by staff with little experience is high risk. There is a learned technique to doing the manipulation and assessing the appropriate time for it.	1
Introduce air into the chest depending on technique	1
Tissue damage if too aggressive	1

Section 3: Care/Maintenance of Chest Tubes

1. How are antibiotics prescribed for patients with a chest tube?

Prescription of Antibiotics	Frequency (%)
Antibiotics are prescribed through the duration of chest tube placement	2 (6.7)
Antibiotics are prescribed for a time limited period following the placement of chest tubes	5 (16.7)
No antibiotics are prescribed for chest tube placement	23 (76.7)

Of those who indicated “Antibiotics are prescribed for a time limited period following the placement of chest tubes”, What time period are antibiotics prescribed for?

Respondents (n=5)	
Time Period of Antibiotics Prescription	Frequency (%)
24 Hours	3 (60.0)
48 Hours	1 (20.0)
72 Hours	0 (0.0)
>72 Hours	0 (0.0)
Varies by Provider	1 (20.0)

2. If a patient requires placement of a chest tube outside of the OR setting, is an antibiotic administered prior to placement (assuming the need for placement is not emergent)?

Antibiotic Pre-Chest Tube Insertion	Frequency (%)
Yes	1 (3.3)
No	29 (96.7)

3. How are chest tubes secured to drainage system tubing at point of connection?

Securing Method	Frequency (%)
Tape	11 (36.7)
Plastic Zip Tie	16 (55.2)
Both	1 (3.4)
Other	1 (3.4)

Of those responding 'Other,' the securing methods are:

Outcome	Frequency
Y and straight connectors	1

4. What type of dressing is placed by the MD or other practitioner at the time of chest tube insertion?

Type of Dressing	Frequency (%)
Gauze and occlusive dressing (Tegaderm)	17 (58.6)
Vaseline gauze and occlusive dressing	0 (0)
Lyoform and sleek	1 (3.4)
Ribbon gauze	0 (0)
Allevyn	1 (3.4)
Mepore	1 (3.4)
Varies by Provider	9 (31.0)

5. If a chest tube dressing integrity is compromised (with the chest tube remaining in place), either through purposeful means or incidental, how are chest tube dressings reapplied?

Reapplication Method	Frequency (%)
Area is cleaned with chlorhexidine or alcohol, and gauze and occlusive dressing is applied	14 (46.7)
Area is cleaned with chlorhexidine or alcohol, and Vaseline gauze and occlusive dressing is applied	5 (16.7)
Varies by Provider	5 (16.7)
Other	6 (20.0)

Of those responding 'Other,' the reapplication methods are:

Outcome	Frequency
Area is cleansed with normal saline and occlusive dressing is applied	1
Clean removal of dressing, site cleansed with sterile water using sterile gloves, allevyn applied to blake and standard tubes, CHG gel tegaderm/biopatch with tegaderm used for pigtails, all tubes have a cover roll anchor on edge of dressing and 2 nd cover roll anchor about 1-3 inches below the dressing	1

Cleaned with chlorhexidine biopatch placed, cavalon, tegaderm dressing	1
Reapplies no cleaning	1
Variable: Routine change CHG and island dressing. If leaking, CHG with split gauze and tegaderm	1

6. Are chest tube dressings changed routinely or only when compromised?

Reasons for Chest Tube Dressing Changes	Frequency (%)
Changed routinely	13 (43.3)
Changed only for an issue of concern or if dressing is compromised	13 (43.3)
Varies by Provider	2 (6.7)
Other	2 (6.7)

Of those responding 'Other,' the reasons are:

Outcome	Frequency
Post-op cardiac chest tubes are typically under the incision dressing and changed daily. Non post-op cardiac patients with chest tubes have the dressings changed as needed	1

7. How often are chest tube dressings changed?

Respondents (n=13)	
Frequency of Chest Tube Dressing Changes	Frequency (%)
24 Hours	2 (15.4)
48 Hours	5 (38.5)
72 Hours	2 (15.4)
Weekly	4 (30.8)
Varies by Provider	0 (0)

Section 4: Discontinuation of Chest Tubes

1. Does a policy exist at your facility for the discontinuation of chest tubes?

Discontinuation Policy	Frequency (%)
Yes	17 (56.7)
No	13 (43.3)

Of those responding 'Yes,' the policies are:

Outcome	Frequency
We use Lippincott	1
Advanced practice skill only	1
Calculation of maximum drainage per weight	1
Chest tubes are discontinued within 48 hours of placement in the OR unless certain criteria are met to keep them in. This includes amount of drainage based on weight, chyloous output, fontan procedure, significant instability	1
Conscious sedation procedure/or give a single dose of medication prior (Ketamine)	1
Describes Supplies and supportive role to discontinuing provider, post discontinuation expectations/care	1
Discontinue by cardiovascular surgeon	1
Exact procedure, supplies to obtain, two people, dressing	1
Instruct patient to take a deep breath, then exhale and hold, as developmentally appropriate. After tube is removed and sutures secured, apply petroleum gauze with 2x2 gauze over site and cover with clear occlusive dressing. We also have a guideline regarding when chest tubes and are ready to be removed based on age, drainage amount, and diagnosis	1
Only describing the procedure	1
Performed by physician, PNP, or RN with documented competency. Administer analgesia, hand hygiene, gloves, remove dressing, remove chest tube, cover with petroleum gauze or lubricant and gauze with transparent dressing. Remove dressing after 48 hours	1
Procedure for removal but no specific parameters. At discretion of provider	1
Removal of MSCT vs pleural CT, sealing track with sutures already in place or steristrips and occlusive dressing x 48 hour. Also addresses complications (i.e. pneumothorax)	1
There is not an actual policy stating if chest tube output has been this then it's time to discontinue the chest tube. However, there is a policy regarding the removal of it	1
Unit-based competency for level II nurses	1

2. Prior to the discontinuation of chest tubes, are patients ordered NPO?

Patients Ordered NPO prior to Chest Tube Discontinuation	Frequency (%)
Yes	6 (20.0)
No	21 (70.0)
Varies by Provider	3 (10.0)

Of those responding 'Yes,' the length of time patients are ordered NPO:

Respondents (n=5)	
Length of Time Ordered NPO	Frequency (%)
2 Hours	1 (20.0)
4 Hours	3 (60.0)
> 4 Hours	0 (0)
Varies by Provider	1 (20.0)

3. If a patient is heparinized, is the heparin drip held for a length of time prior to the discontinuation of chest tubes?

Heparin Drip Held Prior to Discontinuation of Chest Tube	Frequency (%)
Yes	8 (26.7)
No	14 (46.7)
Varies by Provider	8 (26.7)

Of those responding 'Yes,' the length of time heparin drip is held:

Respondents (n=8)	
Length of Time Heparin Drip Held	Frequency (%)
2 Hours	3 (37.5)
4 Hours	2 (25.0)
> 4 Hours	1 (12.5)
Varies by Provider	2 (25.0)

4. Who is responsible for the actual removal of chest tubes at your facility?

Profession	Frequency (%)
Nurses (competent in chest tube removal)	6 (20.0)
Nurse Practitioners	22 (73.3)
Physician Assistant	17 (56.7)
Physician	17 (56.7)

5. Is there a policy for the type of dressing applied to the discontinued chest tube sites?

Dressing Policy Post Chest Tube Discontinuation	Frequency (%)
Yes	15 (50.0)
No	15 (50.0)

Of those responding 'Yes,' the policies are:

Policies	Frequency
Guaze and tegaderm or mepilex	1
If open, occlusive xeroform dressing for 48 hours	1
We use Lippincott	1
Occlusive dressing with Vaseline gauze	5
Occlusive dressing for 48 hours	1
Occlusive dressing with Vaseline gauze and 2x3 and tegaderm. If purse string intact then dressing remains on for 24 hours. If purse string is not intact then dressing remains on for 48 hours,	1
Small gauze and tegaderm – occlusive	1
Sterile and occlusive dressing, Vaseline gauze, tegaderm typically	1
Vaseline gauze and occlusive tegaderm dressing for 48 hours	1
Vaseline gauze occlusive dressing for 24 hours	1
Vaseline gauze, gauze, tegaderm to provide completely occlusive site	1

6. After discontinuation, are chest tube sites approximated with any of the following?

Type of Approximation	Frequency (%)
Anchoring Suture	3 (10.0)
Purse-String Suture	19 (63.3)
Gauze and Occlusive Dressing	12 (40.0)
Vaseline, Gauze, and Occlusive Dressing	23 (76.7)
Other	3 (10.0)

Of those responding 'Other,' the types of approximation are:

Type of Approximation	Frequency
Dry dressing (Vaseline only if needed)	1
Steristrips	1
Vaseline gauze occlusive dressing is used if purse string suture is incompetent or not present	1

7. How many days after chest tube discontinuation are sutures removed?

Respondents (n=21)	
Suture Removal	Frequency (%)
1 – 3 Days	1 (4.8)
4 – 7 Days	7 (33.3)
8 – 14 Days	4 (19.0)
> 15 Days	1 (4.8)
Varies by Provider	8 (38.1)

8. Following chest tube discontinuation, how long does the dressing remain in place?

Duration Dressing Remains in Place	Frequency (%)
24 Hours	6 (21.4)
48 Hours	16 (57.1)
72 Hours	4 (14.3)
Other	2 (7.1)

Of those responding 'Other,' the durations are:

Length of Time	Frequency
Initial dressing removed after 48 hours, if site remains open, occlusive dressing replaced for 48 hours. If edges are approximated, it is left open to air if dry or covered with allevyn if there is any drainage	1
Not within policy. Typically continue with Q48 schedule and OTA if clinically indicated/appropriate	1

9. Following the removal of chest tubes, what is your method of assessing for pneumothorax?

Pneumothorax Assessment Method	Frequency (%)
Physical assessment only	0 (0)
Chest X-ray	2 (6.7)
Physical assessment and chest X-ray if indicated	12 (40.0)
Physical assessment and chest X-ray routinely	16 (53.3)

10. If a Chest X-Ray is NOT taken following the discontinuation of chest tubes or drains please briefly describe your practice for this.

Respondents (n=0)

11. In the case of a patient with multiple chest tubes or blake drains in place, is it practice to remove one at a time or are they pulled simultaneously by multiple providers?

Multiple Chest Tube/Drain Removal Practice	Frequency (%)
Each tube is removed individually	10 (33.3)
More than one tube can be removed simultaneously	13 (43.3)
Varies by Provider	7 (23.3)

12. Prior to the discontinuation of a chest tube, is the low wall suction turned off?

Low Wall Suction Turned off Prior to Discontinuation of Chest Tube	Frequency (%)
Yes	20 (66.7)
No	5 (16.7)
Varies by Provider	5 (16.7)

13. Prior to the discontinuation of chest tubes, is the chest tube clamped close to the insertion site?

Respondents (n=14)	
Chest Tube Clamped Close to Insertion Site Prior to Discontinuation	Frequency (%)
Yes	14 (46.7)
No	10 (33.3)
Varies by Provider	6 (20.0)

14. Prior to the discontinuation of blake drains, is the suction on the bulb released?

Suction on Bulb Released Prior to Discontinuation of Blake Drain	Frequency (%)
Yes	15 (53.6)
No	5 (17.9)
Varies by Provider	8 (28.6)

15. Prior to discontinuation of blake drains, is the drain clamped close to the insertion site?

Blake Drain Clamped Close to Insertion Site Prior to Discontinuation	Frequency (%)
Yes	10 (37.0)
No	12 (44.4)
Varies by Provider	5 (18.5)

16. Do nurses medicate patients for pain prior to discontinuation of chest tubes?

Nurse Medication for Pain Prior to Discontinuation of Chest Tubes	Frequency (%)
Always	15 (50.0)
Often	9 (30.0)
Sometimes	5 (16.7)
Rarely	1 (3.3)
Never	0 (0)

17. What medications are typically used?

Medications Used	Frequency (%)
Morphine	24 (80.0)
Fentanyl	15 (50.0)
Midazolam	10 (33.3)
Ativan	8 (26.7)
Ketamine	2 (6.7)
None of the above	0 (0)
Other	3 (10.0)

Of those responding 'Other,' the medications are:

Medication	Frequency
Oxycodone	2
Propofol	1

18. Are chest tubes removed at the patient's bedside or are they transported (when possible) to a treatment room for this procedure?

Chest Tube Removal Location	Frequency (%)
Bedside	30 (100)
Treatment room or similar	0 (0)

19. Additional thoughts, questions, or concerns regarding the management, manipulation, and discontinuation of chest tubes.

Additional Comments
Occasionally -10cm water seal is ordered, but usually based on size of patient, not whether procedure is open or closed heart.
Open chest tubes will depend on MD but usually <10cmH ₂ O (usually 5cmH ₂ O) on closed chests chest tube suction ranges from 5, 10 15 ,20 depending on size of patient and MD (surgeon preference).
Our chest tubes are routinely placed to 15mmhg suction whether the chest is open or closed.
Our standard chest tube suction is -15 cm H ₂ O; however, that was not an option.
Post-op cardiac patients with chest tubes and non-cardiac patients with chest tubes are treated differently in our unit with is a combination PICU & CICU.
There is no standardized dressing for after removal of chest tubes. It varies by provider depending on their experiences.
This work is so important. Great job!
Type of dressings we used was not an option so left blank. We use biopatch with tegaderm for dressing. Sometimes we will add an anchor for the tubing if patient is very active.
We have never dressed chest tubes placed intraop as long as I've been here. I am not aware of any adverse events associated with not dressing them but would like to see evidence for pediatric cardiac postop that supports routinely dressing the insertion site.
When will we receive the results of this survey? There are advanced practice nurses at my hospital that speak to the dangers of stripping or milking the chest tube. I would like to know what other institutions are doing.