Over Utilization of EMS Needle Decompression

UVA Trauma Performance Improvement Project

Identifying the Problem

- Reports of increased utilization of needle decompressions by EMS noted by ED team, trauma surgeons and Trauma PI Coordinator.
- Incorrect assessment, improper location, or unneeded needle decompression
- 2 cases of patient harm
- Start of project in November 2019

UVA Trauma Registry Data

29 Patients with Prehospital Needle Decompressions
Jan 2016-March 2021
1 each in 2016/2017/2018
11 in 2019
12 in 2020
3 in first 2 months of 2021

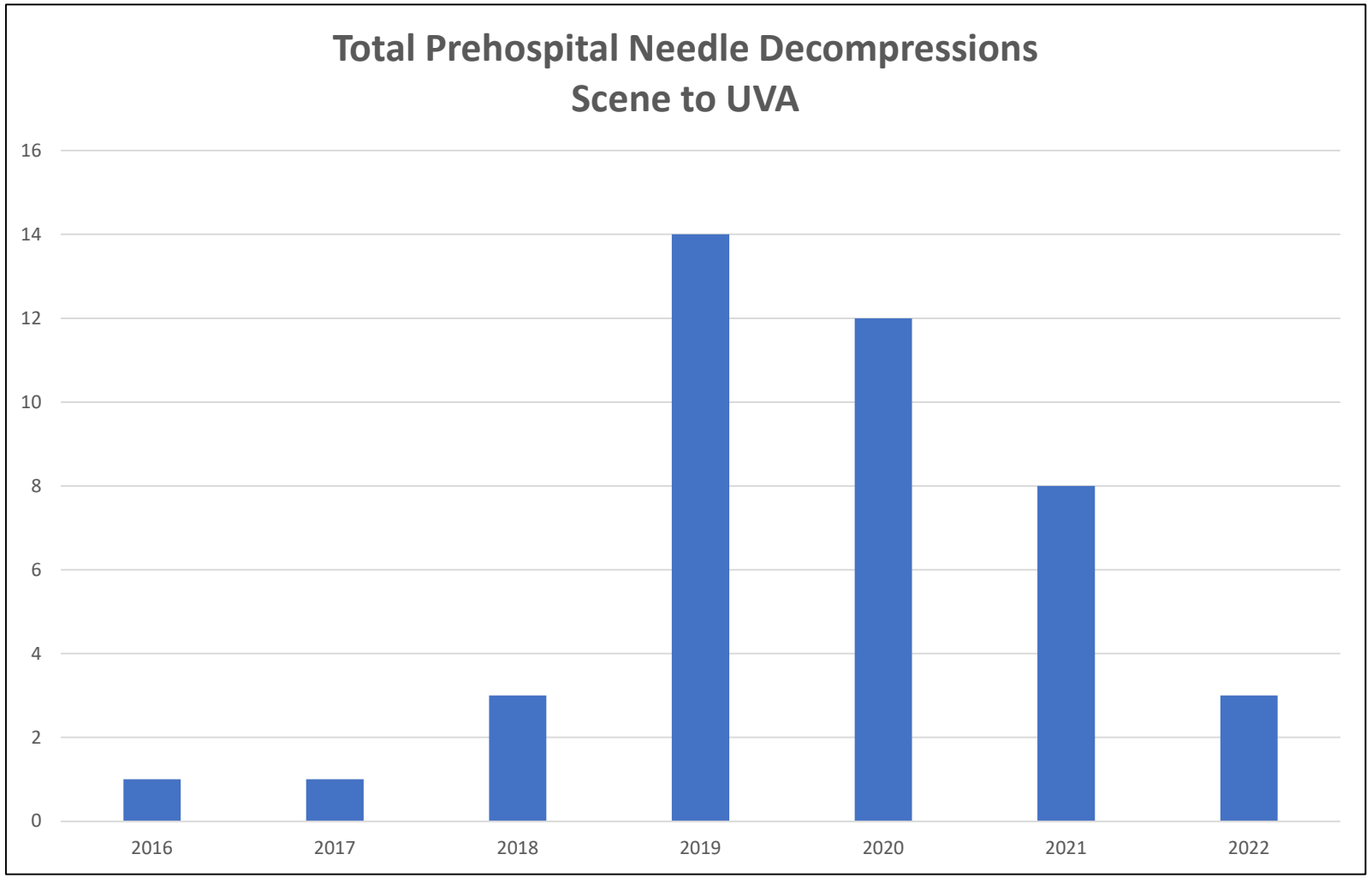
*SI = Shock Index HR/SBP

Periarrest or Cardiac Arrest = 8	Did Receive Chest Tube in ED = 14	Did NOT Receive Chest Tube in ED = 6
Air Medical = 2 911 Response = 6	Air Medical = 3 911 Response = 11	Air Medical = 1 911 Response = 5
Penetrating = 3 Blunt = 6	Penetrating = 1 Blunt = 13	Penetrating = 1 Blunt = 5
1 found to be in SQ Space	GCS >13 = 6 GCS < 13 = 8	GCS >13 = 5 GCS < 13 = 1
	Hypoxic & Hypotensive= 2 Hypoxic & SI > 1 = 3 SI > 1 = 3 SPO2<90 = 4 No VS Documentation = 4	Hypoxic & Hypotensive= 1 Hypoxic & SI > 1 =1 SI > 1 = 1 SPO2<90 = 2 No VS Documentation = 2 But GCS 14-15
	Confirmed Injury = 1 Dart into bronchus GCS 15, 141/109, RR 22/78%	Confirmed Injury = 1 Laceration to lung with pneumothorax GCS 15, 116/85, RR 20/93%
	2 found to be in SQ Space and/or kinked	2 found to be in SQ Space and/or kinked

Intervention

- Trauma and Emergency Medicine drafted a paper for submission to area EMS Medical Directors, Agencies and Providers with updated recommendations.
- Updated protocols for Thomas Jefferson and Central Shenandoah EMS Councils.
- Webinar CE Presentations
  - J. Forrest Calland, MD – TJEMS CE
  - V. Quick, RN – CSEMS CE
- YouTube Video by J. Forrest Calland, MD
- Newsletter – Jeff Young, MD
- Feedback to EMS agencies on subsequent decompressions
- Monitoring overall trends and reporting finding to EMS Councils and agencies

Results of Intervention

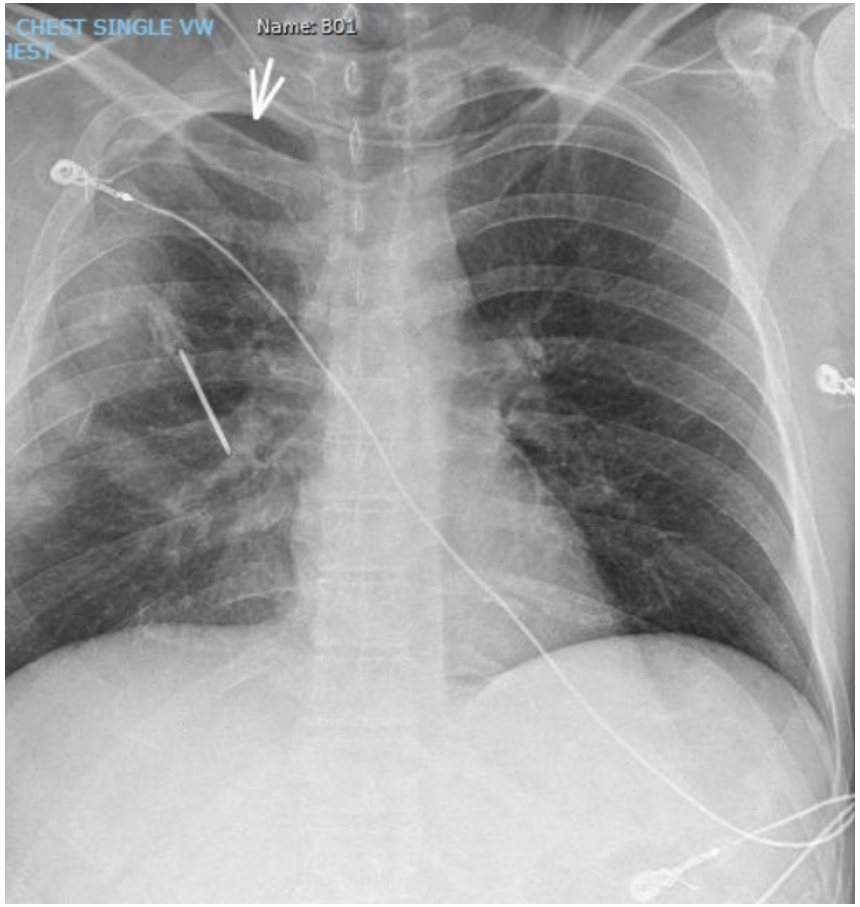


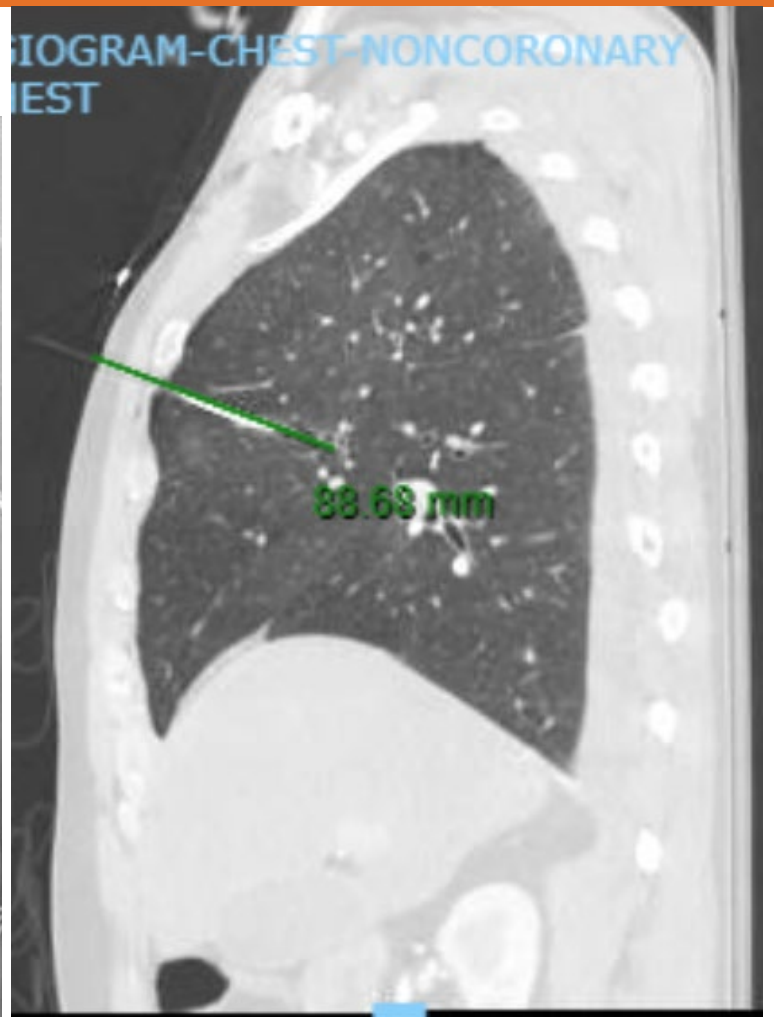
The two patients injured by inappropriate prehospital needle thoracostomy occurred in Nov 2020 and Jan 2021. Significant education and protocol changes began immediately after those incidents. All three occurring in 2022 had SBP <100 with a GCS of 3.

Case #1

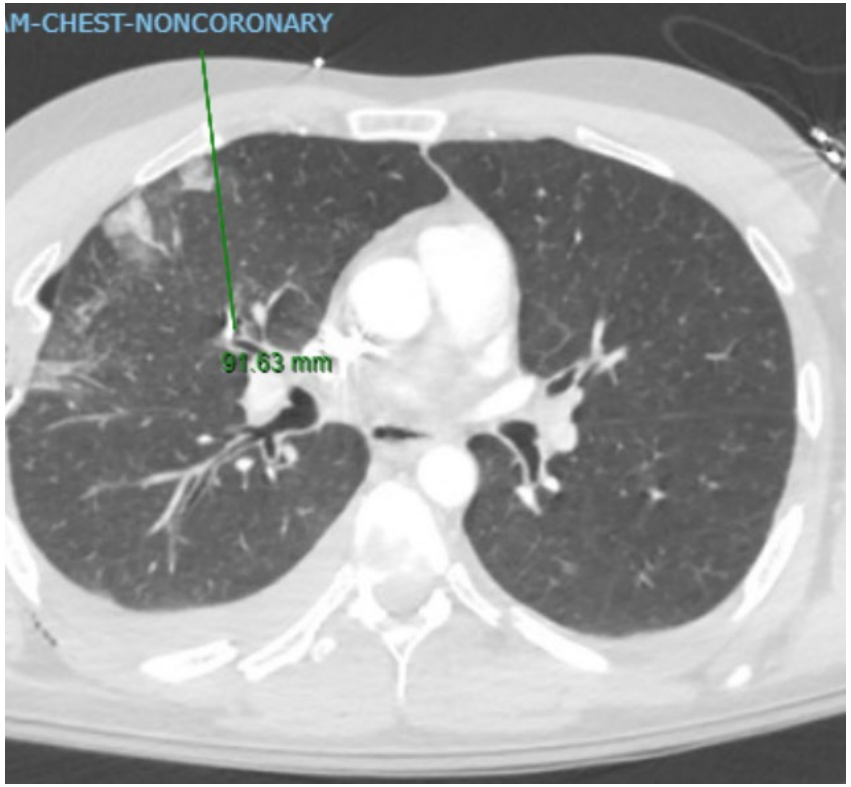
- Blunt Trauma
- Patient presents awake and oriented.
- Obvious signs of chest trauma
- Vital signs
  - GCS 15, BP 134/94, HR 115, RR 22/Shallow, SPO2 78-92%, ETCO2 – not recorded
- Treatment: 3.25” Needle Decompression to 2nd ICS midclavicular

Case #1 - Imaging





Needle placed into bronchus

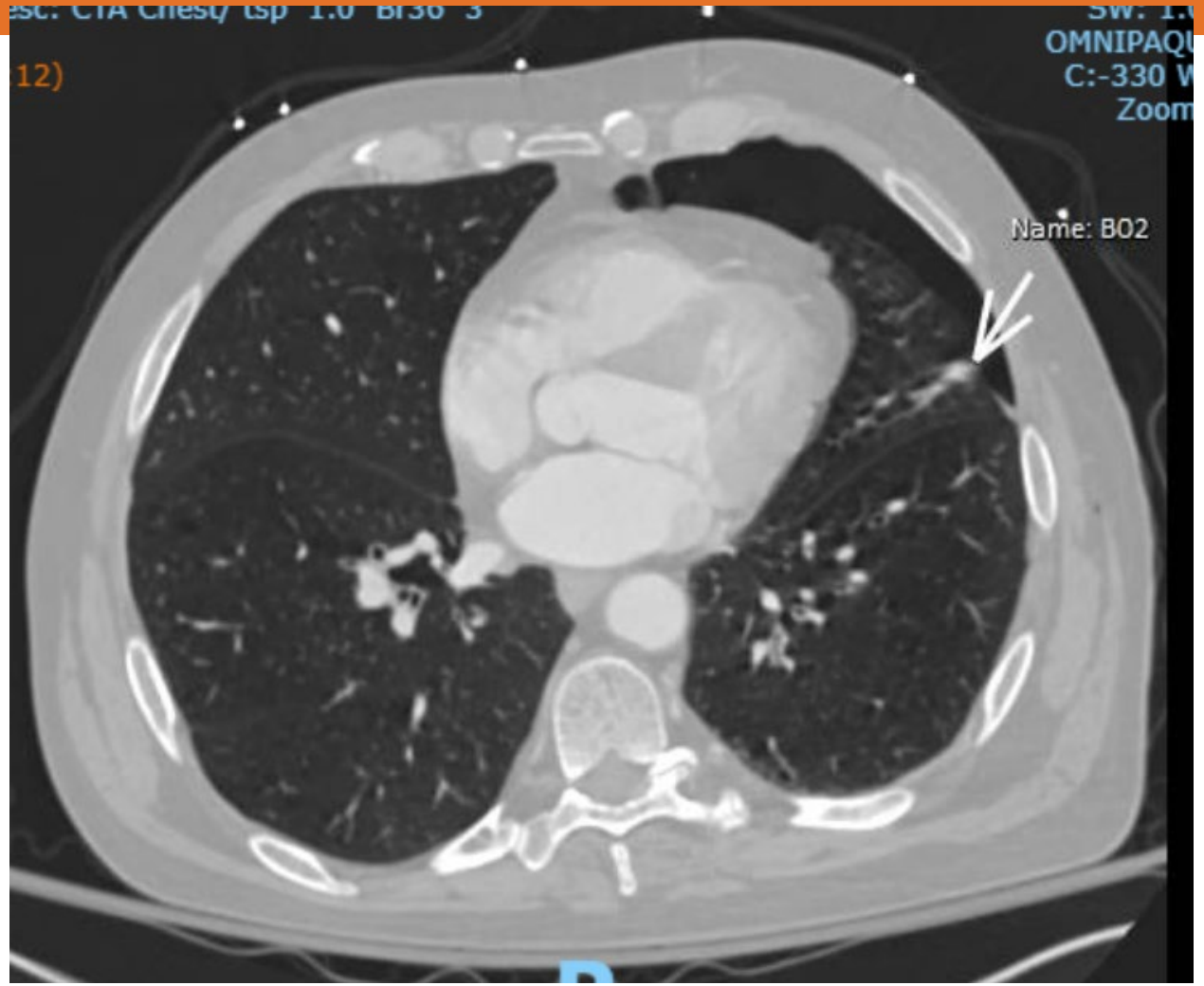


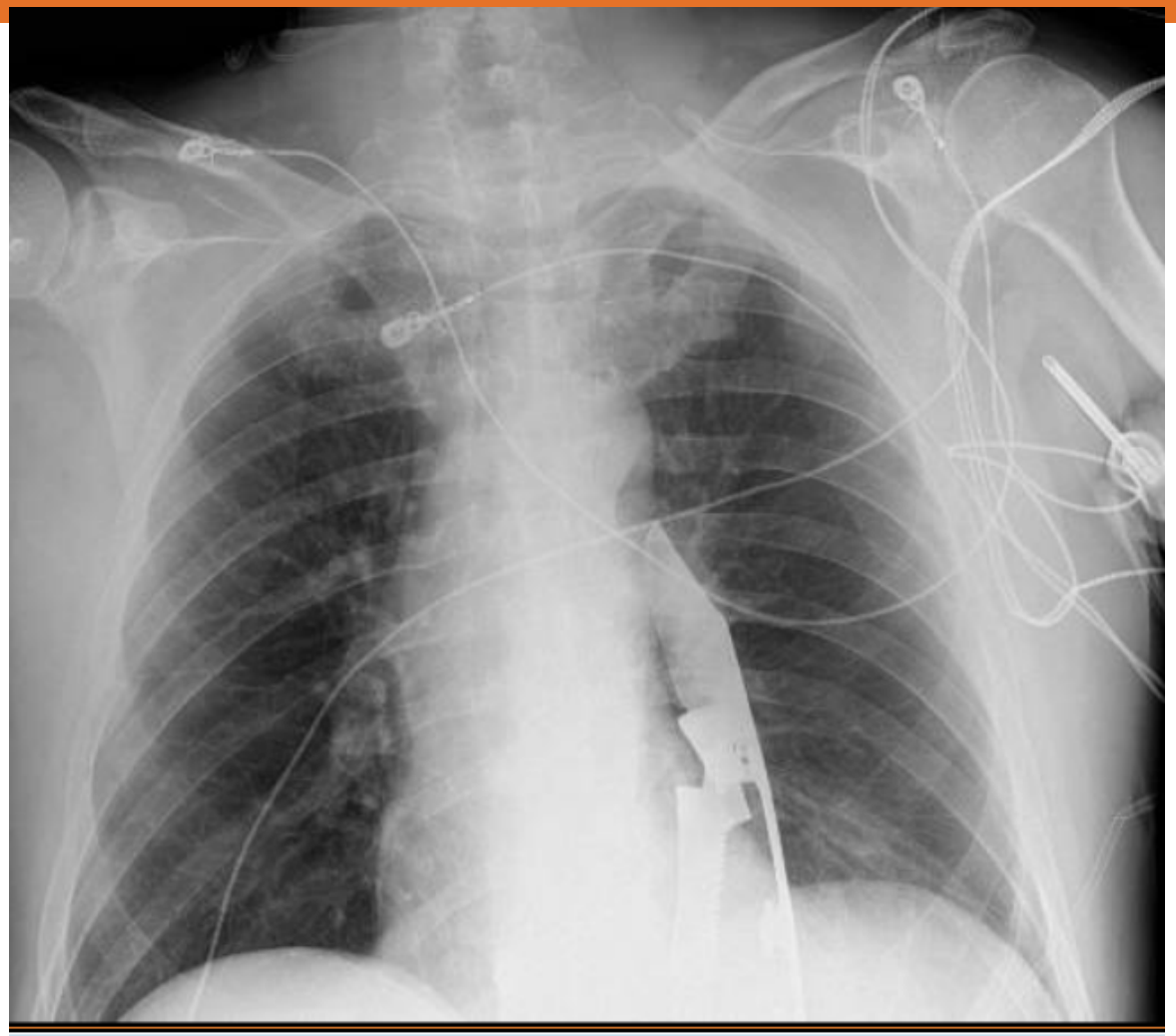
Multiple displaced right-sided rib fractures and subjacent multifocal peripheral airspace opacities, likely reflective of pulmonary contusions/laceration. Trace right apical pneumothorax. ***Chest tube was placed but d/c the next day.***

Case #2

- Self-Inflicted stab wound
- Patient awake and oriented on arrival
- 100 mg Ketamine given due to agitation and concern patient would touch knife
- Vital Signs: GCS 15, BP 162/128, HR 90, RR 22/Labored, SPO2 84-92, ETCO2 40
- Lung sounds found to be diminished
- Treatment: 2” Needle Decompression to mid-axillary line

Case # 2 - Imaging



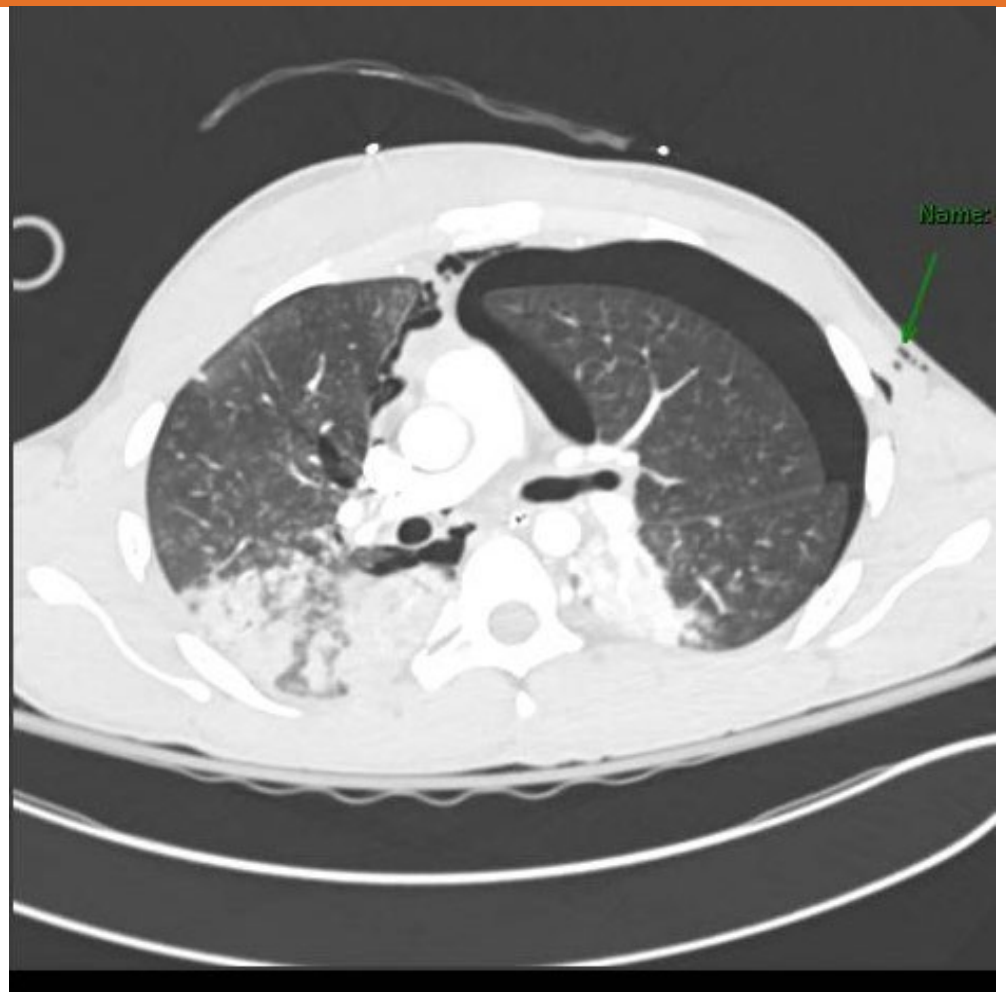


Mild to moderate centrilobular emphysema. Moderate-sized left pneumothorax. Linear densities within the lingula and left lower lobe may represent subsegmental atelectasis. ***Laceration is an additional consideration although this is away from the primary site*** of injury. Found to be superficial and removed in ED. No penetration into pleural space. ***No chest tube was placed in ED, resolved on own.***

Case # 3

- Ejection 25 ft from MVC
- Ddecreased respiratory drive and secretions/gurgling. Intubation attempted by ground crew but gag reflex intact.
- 157/77, HR 50, SPO2 84%
- Pt given medications to assist intubation.
- A few minutes later there was absent sounds noted on left side which was subsequently decompressed
- Pt was later assessed to have an esophageal ET placement

Case # 3 - Imaging

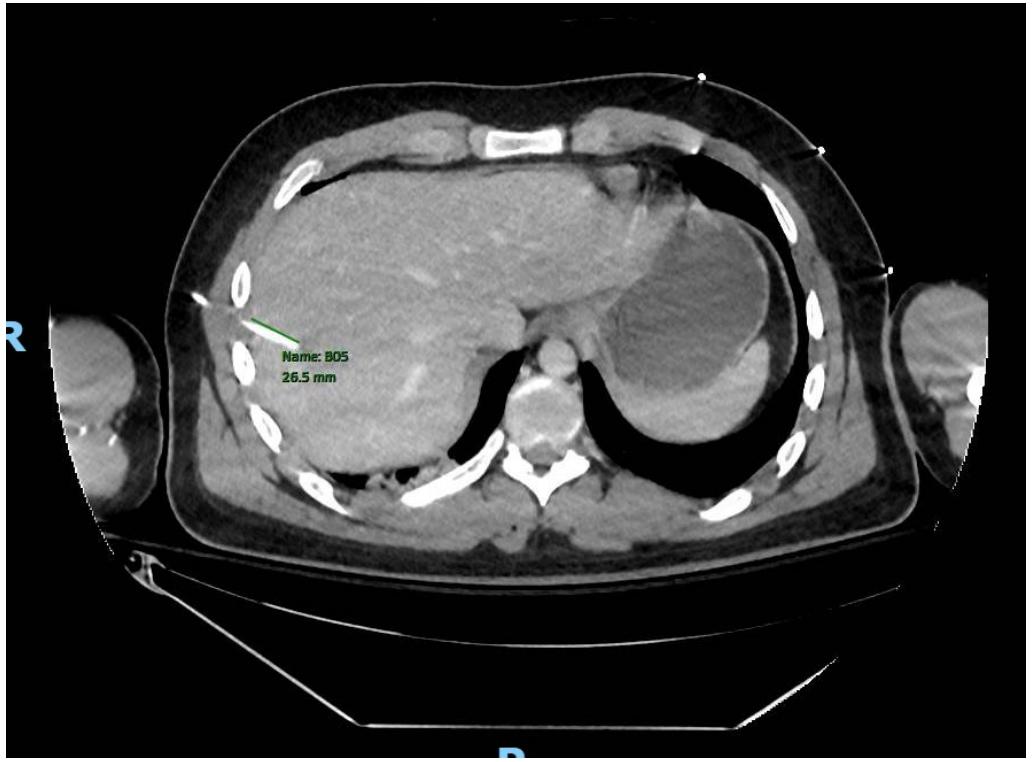


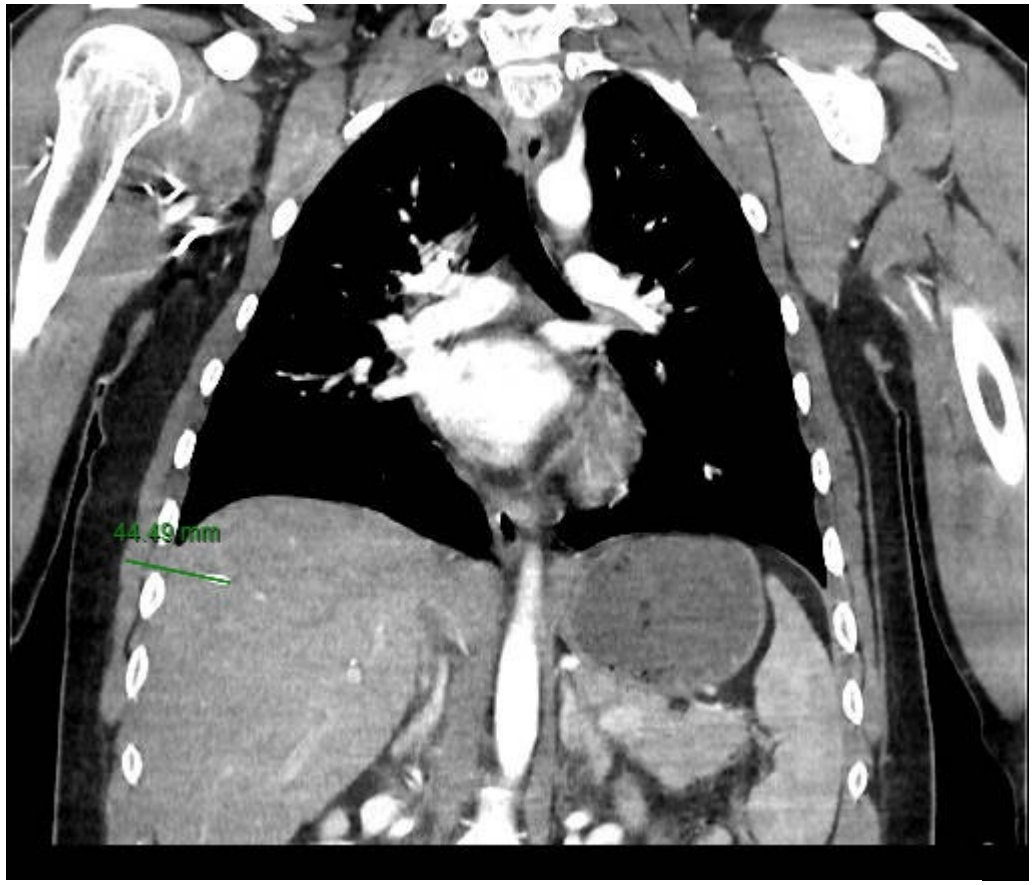
Chest CT –
Large left pneumothorax with mild rightward mediastinal shift and questionable diaphragmatic inversion concerning for developing tension. Given axillary subcutaneous emphysema, this may be related to prior needle decompression.
No left rib fractures present

Case #4

- MVC
- Initially able to state full name but was repetitive with speech
- Absent lung sounds on his right side
- 138/80, HR 107, RR 10/shallow, SPO2 80%, GCS 12, No ETCO2
- Right Chest Decompression – mid axillary

Case # 4 - Imaging





CT Abd: Liver: No hepatomegaly. Smooth surface contour. Normal attenuation. Metallic foreign body extending (2.6 cm) (series 3, image 48) into hepatic segment 7/8.
CT Chest: Right lower lobe pulmonary laceration with small traumatic pneumatoceles, Comminuted mildly displaced mid right clavicle fracture, Nondisplaced right anterior 1st- 3rd and posterior 2nd rib fractures

Indications for a Needle Decompression Changes to EMS Protocols

UVA Health

1. Bilateral needle decompressions may be considered for patients with significant torso trauma **where medical providers have witnessed a traumatic cardiac arrest** or the patient is unconscious with agonal breathing & absent pulses/bradycardia.
2. Severe/progressive respiratory distress, hypoxemia, an absence of breath sounds, significantly altered mental status (GCS < 8) associated with ***signs of shock*** (HR >120<50, SBP <90, altered mental status, poor skin perfusion, absent peripheral pulses) or clinical deterioration of vital signs may indicate the need for needle decompression in a patient with penetrating or severe blunt chest trauma.

TraumaTeam

Recommended Provider Qualifications

In order to ensure a safe and efficient level of competency for both initial and ongoing approval to perform the procedure. The following recommendations should be considered:

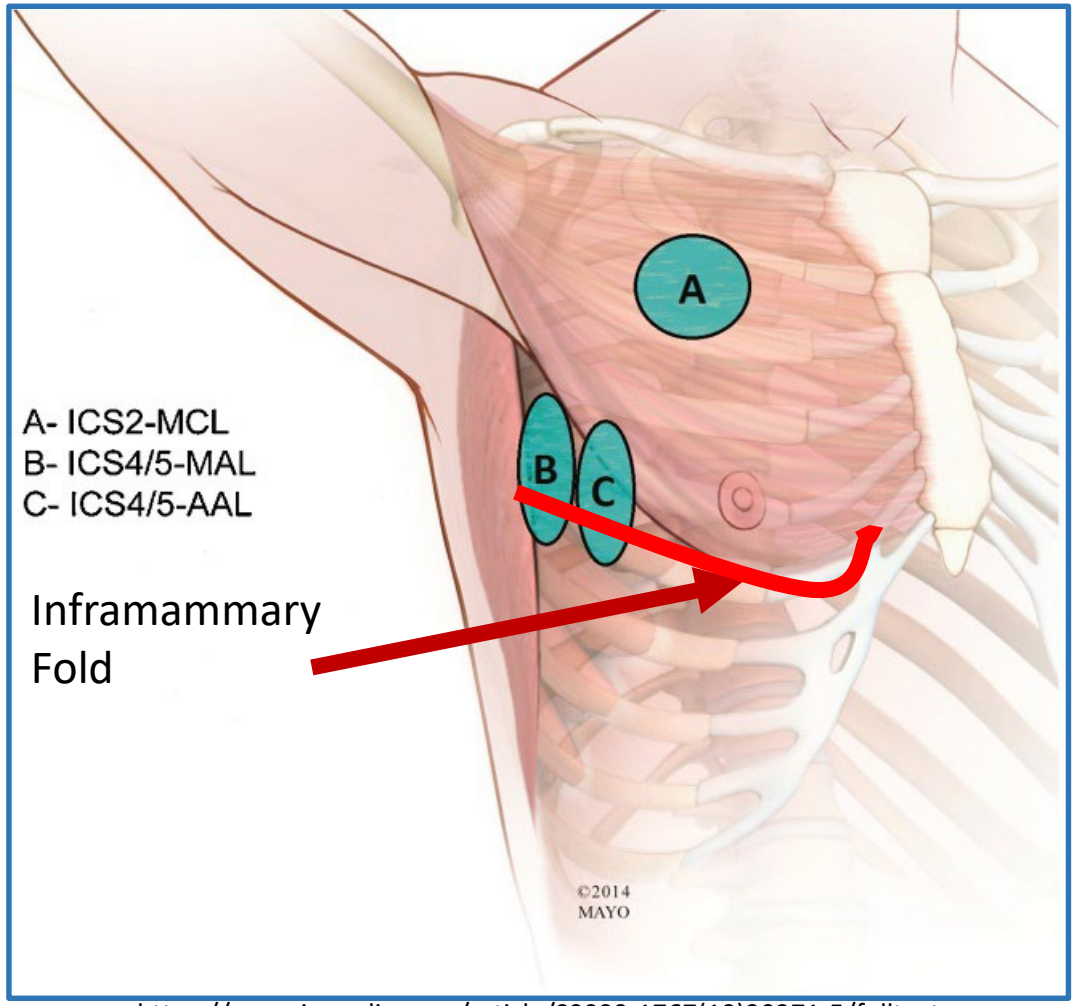
- Actively practicing intermediate (EMT-I) or paramedic (EMT-P) for the past 2 years

- Periodic and ongoing competency based training utilizing simulation for proper assessment, needle placement and management

Location/Size (Change from 2 MCL)

For patient's requiring immediate needle decompressions, the size of the catheter must be long enough to enter the pleural space.

- 14-16 gauge Catheter 8 cm (3.25) length in the 5th intercostal space anterior to mid-axillary line is the recommend site of needle placement per ATLS 10th edition guidelines.



https://www.jenonline.org/article/S0099-1767(19)30271-5/fulltext

Quality Assurance/Improvement Activities

- ***Concurrent and retrospective*** quality assurance and improvement activities ***with physician oversight*** should occur for all cases of prehospital needle decompressions. Each case review should include pre and post vital signs, physical assessment, general management and disposition.
- Outcome review, provided by the receiving hospital, noting further interventions (i.e. chest tube, intubation), imaging, injuries, and complications that may have occurred should also be a routine part of each care review.
  - **The UVA Trauma Team will be regularly providing this to the agency EMS Physician and Training Officer for all prehospital traumatic needle decompressions**

UVAHealth

EMS Feedback to Training Officer & EMS Medical Director

UVAHealth

EMS - Trauma Alert Feedback

Privileged & Confidential Quality Assurance Document under Virginia Code Section 8.01 - 581.17.

EMS Report		
Time on Scene: 25	**Transport Time:** 9	**Notification to Medcom:** 10 (Goal <15 mins)
Type of Spinal Motion Restriction: ☒ C-Collar ☒ Long Board ☐ None, Reason:		
IV/IO Placed Prior to Arrival (if indicated): ☒ Yes ☐ No	**Pain Management Utilized:** 100 mcg Fentanyl	
Assessment Notes: Truck through fences and into tree with moderate damage to vehicle. He was not wearing seatbelt and the steering wheel was broken. Pt was speaking in 2-3 word sentences, subcutaneous air felt throughout the majority of the pt's left anterior chest, breathing was fast and shallow due to pain when taking a deep breath. Lung sounds were initially clear on the right, diminished in the left upper and absent in the left lower that improved to clear in the right, clear in the left upper and diminished in the left lower after decompression to the left side of the pt's chest. Pt had significant step off found on his lower spine that was about an inch deep with no discoloration and significant pain on palpation. Pt had some swelling present around his laryngeal prominence that was also discolored to a blue and about half an inch in diameter. Pt had a bruise in the shape of a quarter circle that started at his xiphoid process and curved up and to the left of the pt's chest and ended on his left mid axillary line around the 2nd or 3rd intercostal space. Pt was alert and able to answer questions appropriately but often asked "I beg your pardon?" the first time you asked a question then answered appropriately the second time, Pt does not remember the wreck or what caused it (no bystanders saw the event happen and the pt was alone in the truck). PMS present in both arms and the pt's left leg with the pt's right leg showing a loss of sensation with a pulse still present and the pt still able to move the leg but not the foot by its self. -CSS, PERRL, GCS of 13 on initial evaluation and the same after arriving at the hospital. Pt was constantly moving his arms and legs and trying to grab things throughout treatment and assessment despite prompts from the medic crew. Vitals noted by EMS prior to needle decompression – BP 153/82, HR 126, RR 30/Shallow, No SPO2, GCS 13 Crew called and talked to medical command – presented him with patient decreased lunch sounds and absent in base, SQ air and bruising to trachea. Vitals given: HR 150, BP 152/82. The physician gave permission for a needle thoracostomy.		

Hospital Course and Findings						
Trauma Alert Level: ☒ Alpha ☐ Beta ☐ Gamma						
Reason for Trauma Alert: Difficulty breathing – chest decompression						
BP: 130/75	**HR:** 122	**RR:** 24	**SPO2:** 100%	**ETCO2:** 33	**GCS:** 13	**Temp:** n/d
Injuries: L nasal bone fx, LT eyelid lac s/p repair 11/15, Type 2 dens fx, R V1 dissection, R thyroid cartilage fx, L sided PTX s/p CT, 3 column fxs include: C6 + epidural hematoma, T12, L1, L2, Left 4-8 rib fx, L 5-6 rib fx, LLL pulm contusion, RP hematoma						
Hospital Course: He was intubated for airway protection. Chest tube placed by trauma team. Was taken to CT scanner and admitted to trauma ICU. Initial XR and Chest CT included below – demonstrating hemopneumothorax.						

Performance Improvement Follow Up: Use of absent or decreased lung sounds are difficult to use when differentiating between a tension pneumothorax and other potential injuries. As in his case, he did have a flail segment and a hemopneumothorax, as well as a thyroid fracture which would account for the presence of difficulty breathing, subcutaneous emphysema and diminished lung sounds.

The recently updated regional guidelines state, "severe/progressive respiratory distress, hypoxemia, an absence of breath sounds, significantly altered mental status (GCS < 8) associated with signs of shock or clinical deterioration of vital signs may indicate the need for needle decompression in a patient with penetrating or severe blunt chest trauma." The highlighted passage is more indicative or true tension physiology. When performing a needle decompression in a patient that doesn't have a tension pneumothorax there is an increased risk of injury to the lung.

However, the EMS providers did appropriately call for medical command and presented a patient with a significant mechanism of injury, broken steering wheel, "diminished and almost absent breath sounds", subcutaneous air and vitals of HR 150s and BP 150/82. GCS and respiratory rate/quality or SPO2 was not relayed or asked for by medical command. The request for needle decompression was granted. We will be providing feedback to medical command to clarify the current standards so that there is consistency across the continuum.

In addition, he was provided 100mcg of Fentanyl just prior to the decompression. Although this is an acceptable dose, elderly (he was 87 in our records) patients often need decreased doses.

Note: I personally had a conversation with the two providers about tension physiology which was received very well. It is often difficult for hospital providers to appreciate the chaotic scene and initial patient presentation. This patient is severely injured with many challenges presented to both prehospital and hospital staff. As always, we appreciated your collaboration and essential care to our injured patients.

Please contact us if you have any further questions on this patient.

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TraumaTeam

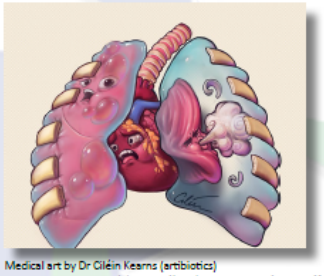
Central Shenandoah EMS Council Newsletter

UVA Health

Grape Expectations

Chest Decompression — To Dart or NOT to Dart

We are making changes to our Chest Decompression Protocols to further clarify which patients might benefit from chest decompression and which patients will not. As you recall chest decompression is indicated for patients who are in shock secondary to a tension pneumothorax. This means that if your patient is not in shock they do not need a chest decompression procedure. It is relatively rare that you will find a patient meeting the requirements for chest decompression unless they are receiving positive pressure ventilation. Beyond the rarity of a clinical situation requiring decompression, needle decompression is known to be associated with many complications (pneumothorax, hemothorax, emphysema, and bronchial or cardiac/vascular injury) some of which are fatal. Pneumothorax in a hemodynamically stable patient does not require pre-hospital treatment unless the patient progresses to shock. That said it does occur in patients breathing normally and it is an essential life saving tool for Paramedics and Intermediates in our pre-hospital system.



Medical art by Dr Cilèin Kearns (artibiotics)

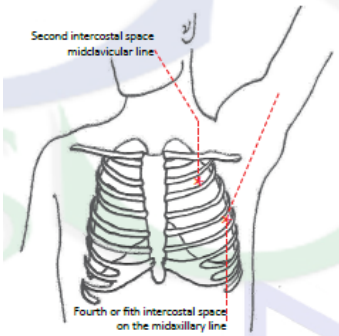
Let's say you have someone who is shot in the right chest by a handgun at close range. They have a blood pressure of 110/70, HR =140, Pulse ox of 80% that goes up to 94% with a non-rebreather mask. On examination you notice that they have jugular venous distension and there are no breath sounds on the right side. They are mentating (GCS=15) normally but in a lot of pain and having trouble breathing. Should this patient receive a needle decompression? Is there any harm in doing one if you are not sure?

Last question first. Is there any harm in doing a chest decompression? Needle chest decompression is one of the most dangerous procedures that we perform in EMS. Complications from this procedure can include cardiac tamponade, hemorrhaging due to pulmonary artery or intercostal vessel injury, and nerve injury at the insertion site. Additionally, despite our best efforts we can inadvertently cause an infection. So, we have to be really sure that when we do this procedure, we are doing it correctly and that we are doing it on a person who really needs it. What about our case above?

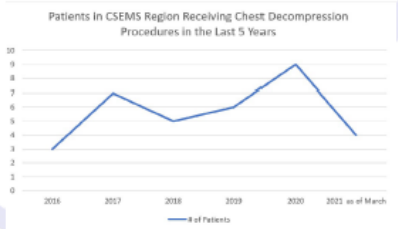
Remember, you must have a person in shock who likely has a tension pneumothorax. First question: Is this person in shock? No. They have a blood pressure that is high given the circumstances. The patient is in trouble -- that's for sure -- there is a high shock-index (more on that in another newsletter!), but the blood pressure is sufficient and most importantly they have a normal mental status. So right away you know that this person is not a candidate for chest decompression.

But wait?!? What about the neck veins and the absent breath sounds???

Well, they are concerning, and the patient likely does have a pneumothorax, perhaps even a pneumothorax that has developed some tension given that he is short of breath, but he is not in obstructive shock which is the indication for a decompression. Note it is possible that he might meet criteria for a decompression in a few minutes; if he were to drop his pressure to 70/p then it would make sense to dart his chest. If you are going to intubate him and put him on positive pressure it is quite likely that he might develop obstructive stock from a tension pneumothorax. Any patient who is on positive pressure ventilation is at a much higher risk of developing obstructive shock from a tension pneumothorax.



What about surgical chest decompression or "finger thoracostomy"? Several air medical programs are using surgical techniques to decompress the chest in certain clinical situations. These techniques involve making an incision with a scalpel into the chest wall, forceps are used to enter the pleural space. This will release any accumulated air under tension and is particularly good if there is a large amount of air leaking from the injured lung. The protocols for these procedures usually limit their use to patients who are nearly dead or who have a leak too large for a needle decompression. Will this technique begin to be used by EMS Paramedics? The jury is still out on that one, and we will be keeping a close eye on the pre-hospital literature to see if we can find evidence that expansion of this skill would be helpful to our patients.



That's all for now! Remember – don't decompress someone's chest unless they are in severe shock – low blood pressure, altered mental status, AND they have findings on examination to suggest a tension pneumothorax.

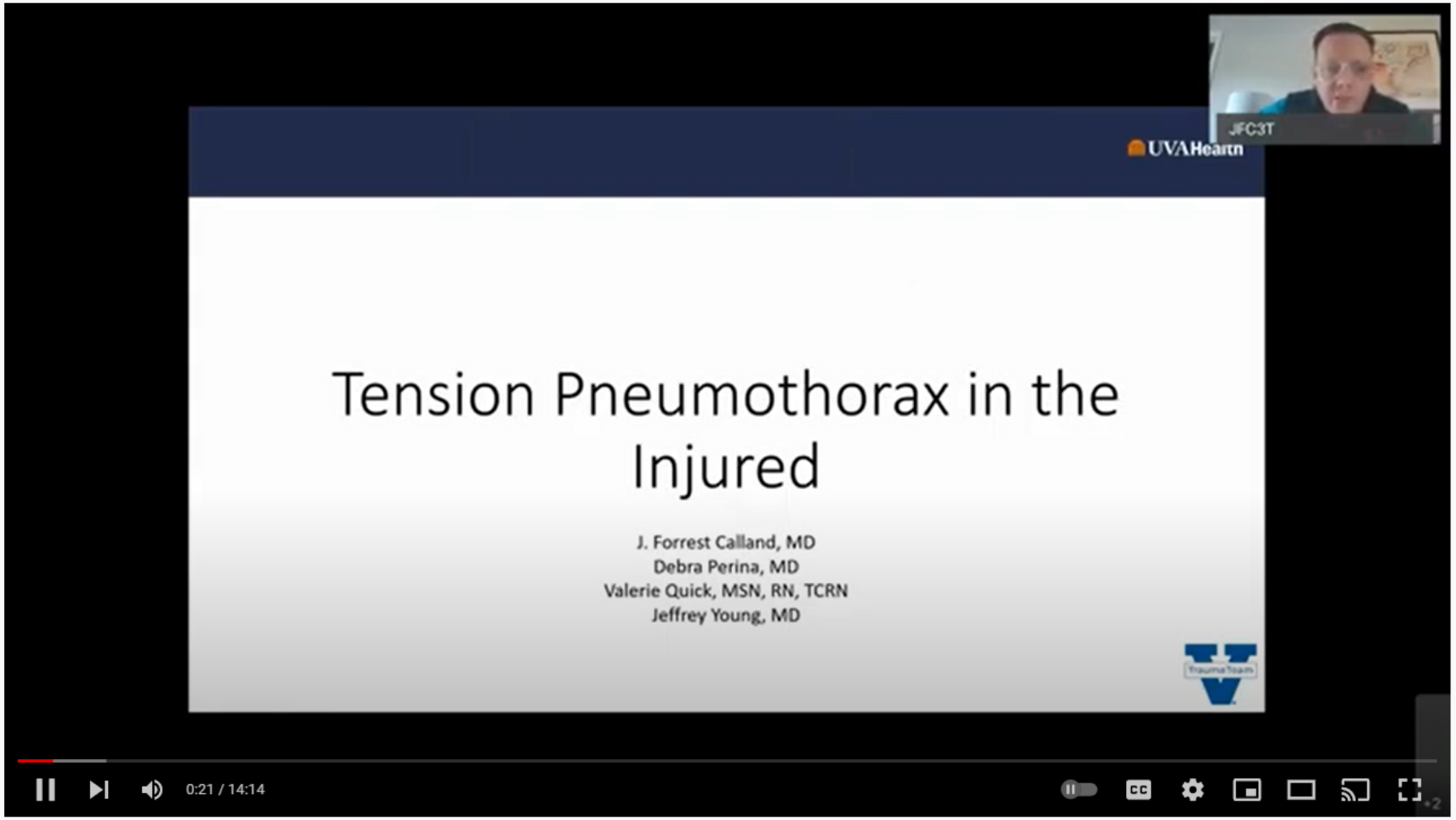
—Dr. Asher Brand and Dr. Jeff Young

TraumaTeam

YouTube Video

UVA Health

YouTube Search



UVA Health's Prehospital Needle Decompression Protocol

261 views • Jun 9, 2021

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