

Transcript Details

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Current & Emerging Tools for Pneumothorax Detection & Prevention

Announcer:

This is ReachMD, and you're listening to Vascular Viewpoints, sponsored by Becton Dickinson, advancing the world of health. Here's your host, Dr. Jennifer Caudle.

Dr. Caudle:

In the practice of vascular access procedures, pneumothorax is a rare but life-threatening complication for our patients. Diagnostic tools, such as chest x-rays and ultrasounds, have been instrumental in detecting and even preventing this type of injury, but when time is of the essence, are they actually being used? And is one approach better than the other?

This is Vascular Viewpoints on ReachMD, and I'm your host, Dr. Jennifer Caudle, and joining me to help address these and other questions is Dr. Rachel Liu, Director of Point-of-Care Ultrasound Education at Yale School of Medicine. Dr. Liu, welcome to the program.

Dr. Liu:

Thanks very much for having me.

Dr. Caudle:

To start us off, can you give us a better sense of pneumothorax as a risk factor in this field and the types of procedures where it can occur?

Dr. Liu:

Sure. I'll start with the last one first, and that's the type of procedure where it can occur, and it's related to anything that can puncture the chest wall. So, for our common procedures, that would be something like central line placement in the internal jugular vein or subclavian vein, nerve blocks that are in the chest wall region; we've seen it happen with acupuncture; but overall, the risk of pneumothorax is relatively low. It has been reported maybe as high as 13–15% in previous literature but overall relatively low.

Dr. Caudle:

Now, let's talk about how proper tip location of the catheter is assessed starting with traditional chest x-rays. What is the typical protocol for using this technology in line placements?

Dr. Liu:

Usually, once I've done a central line, then I might obtain a portable chest x-ray, and these can be limited depending on patient position or body habitus, and I'm usually trying to pull up the x-ray myself so that I can approximate where the tip is if I can see it. If there is a question about malplacement or the study is really limited, then we might have to send the patient to the radiology suite for a two-view chest x-ray.

Dr. Caudle:

How often in your experience does this confirmation and prevention protocol actually get utilized in ICUs or in other inpatient care settings? Are there some practice gaps with this?

Dr. Liu:

Right now, at least in my institution, the chest x-ray is still the standard for line confirmation, and so everyone getting a central line at least in the chest wall region would be receiving a chest x-ray. Sometimes there is some delay with this, and so, if we want to use a

central line right away, since the reason for placing a central line in the first place is because the patient is critically ill, we might use ultrasound first and kind of confirm with the x-ray or wait for the read later on.

Dr. Caudle:

Let's now turn to ultrasound and other technologies being utilized for tip confirmation as well. What can you tell us about these technologies and their role in detecting or preventing pneumothorax?

Dr. Liu:

Ultrasound, we've been using it for procedural guidance at least in the United States since the 1980s, and it really has become crucial for us in mitigating complications of procedures, including central line. How we do this is, when we're placing the central line, it's under ultrasound guidance, so we're visualizing the vessel at all time points of needle insertion, and what that lets me do is I can really see when the needle tip has entered the vein, and I can stop there and go no further. Then I can complete the rest of the central line placement being sure that the needle tip has not punctured the posterior wall of the vessel, which itself would lead to complications like massive hematomas or even arterial puncture. Once I'm done with the central line and I'm happy that it's gone smoothly, I can do a quick echo view to confirm that the saline flush has entered the right atrium and right ventricle like a flush should, and I can also confirm that my lung still has bilateral pleural sliding, indicating that there is normal lung movement and no pneumothorax after the central line.

Dr. Caudle:

For those of you who are just tuning in, you're listening to Vascular Viewpoints on ReachMD. I am your host, Dr. Jennifer Caudle, and with me is Dr. Rachel Liu. We're focusing on current and emerging diagnostic tools in the detection and prevention of pneumothorax.

So, with this emergence of ultrasound in pneumothorax detection, does it change anything in our approach to line procedures compared to traditional chest x-rays?

Dr. Liu:

I think we could start getting to the stage where we could start using ultrasound as a standard for line confirmation instead of needing to rely on chest x-ray or portable chest x-ray so much for line confirmation.

Dr. Caudle:

So, Dr. Liu, what's the recent literature saying with regards to the differences between the utility of chest x-ray and ultrasound in detecting pneumothorax?

Dr. Liu:

Well, our earlier literature confirmed the use of ultrasound being a way of improving safety in terms of better overall success rates for the central line, better overall first-time success passes when placing a central line, and then decreasing those complications that we talked about, including pneumothorax, arterial puncture, hematoma, etc. And so, now that we've gone beyond that point, recent studies have shown noninferiority of ultrasound when confirming a central line to chest x-ray, which means that replacing potentially chest x-ray for confirmation can be done safely with ultrasound, and so, in the future it might mean that the standard of care becomes ultrasound guidance post placement of a central line instead of chest x-ray. Then what that would mean is that the confirmation process would happen a lot quicker and that we could use the central line almost immediately after placing the central line.

Dr. Caudle:

And practically speaking, what's the difference between these respective tip confirmation approaches for central line placements? Is anything made easier or harder based on what's utilized?

Dr. Liu:

What's made easier when using ultrasound is that you truly can visualize the needle tip upon entry in real time at all stages of the process, and that can't really happen with chest x-ray because you're not using chest x-ray in a real-time fashion. Ultrasound also allows us to track anatomic variants which may have been anticipated but largely would not have been anticipated, so by using ultrasound to guide the track of needle as well as follow the track of the vessel is really quite useful to us. What also makes it easier is that there are certain conditions like body habitus, cardiac arrest, significant vascular clamping from that person being hypotensive that doesn't really allow us to palpate a vessel, and so visualizing it on ultrasound also makes it easier. A harder process though is that ultrasound is very operator-dependent, so it does require some training in order to be using it properly for procedural guidance, and if someone is used to placing central lines who never received ultrasound training, they might find it a little bit of a different shift in mindset.

Dr. Caudle:

Thank you for that. And lastly, Dr. Liu, let's compare cost, both financial and labor-oriented, between those approaches to tip confirmation. How do ultrasounds and chest x-rays compare on that front? And do the respective advantages of each approach outweigh these cost differentials?

Dr. Liu:

So a chest x-ray might cost anywhere between \$200 to \$400. Probably, the kind of x-ray that we are getting to confirm a central line is a one-view chest x-ray, which probably would fall on to the lower side of that, maybe about \$200, understanding that the practice and billing variations are kind of regional-dependent, so I might be over- or underestimating here, but I'm going to compare that to ultrasound-guided central line. That also has some billing variability dependent on where in the country you are, but say for the Medicare population, the Medicare cost for a line that's placed under ultrasound is about \$73, so I guess I can say \$73 compared to \$200 there would be a difference there. Often times the ultrasound for central line confirmation might get kind of rolled into another sort of ultrasound that was performed, like an echocardiogram that was performed to figure out why that patient was so critically ill in the first place, and so there might not be direct charges from that, but it would be less labor as the person who placed the central line is also the one doing the confirmation, so there wouldn't be a need for wheeling that patient to radiology suite or having radiology techs wheel a portable chest x-ray into the room to obtain that confirmatory x-ray.

Dr. Caudle:

Well, with those comparisons in mind, I'd like to thank my guest, Dr. Rachel Liu, for joining me to examine the use of chest x-rays versus ultrasound in detecting and preventing pneumothorax. Dr. Liu, it was great having you on the program.

Dr. Liu:

Thanks very much for having me.

Announcer:

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