



Esophageal Atresia

Wake Forest University Baptist Medical Center

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Good morning. Today, I'm Dr. Charles Turner, head of pediatric surgery at the Brenner Children's Hospital. Today Dr. John Petty, who is a pediatric surgeon here as well, is going to perform a repair of a tracheoesophageal fistula in a very small baby or a "neonate," as we call them. And I'm going to introduce you to Dr. John Petty, and he will talk to you about the patient. John.

Thanks, Dr. Turner. Our patient today is a little baby girl who was born prematurely. She was born at about 30 weeks of her post-conceptual age, and a full term is 40 or so. So she was very small, and we initially managed her with a drain in her stomach so that he could get larger to undergo the operation that she's going to have done today.

The problem she has is with her esophagus, which is normally a straight tube from the mouth all the way down to the stomach, but hers is disconnected, so there are two ends that are not talking to each other, and that lower end is actually connected to her airway. We'll look at our X-ray over here. This is an X-ray of our baby that was done just day before yesterday, and there are a couple things that are noteworthy here. One is that she has this gastroscopy.

That's the tube we put in her stomach so that air that she was breathing in that went down the lower part of the esophagus can fill up the stomach and it can get bigger and bigger and fill up with air and cause the baby to get distended and have trouble even ventilating. So when she was very, very small, within her first day or so of life, we put that little tube in her stomach, and we'll probably see that on the patient today.

The other thing is that this is a tube that's going in through her mouth, and it's in the upper part of her esophagus, which reaches down to about here, and that just comes to a dead end. So this tube is draining saliva and other secretions out of her upper esophageal pouch. So the operation that we'll be doing today is dividing the lower part of the esophagus from the trachea, the airway, and connecting that end to this upper end here so that, then, the esophagus, again, becomes one long tube from the mouth all the way down to stomach. That will allow our baby to feed.

Right now she's only been getting her nutrition true IVs. She has not been able to feed because it's been unsafe to feed her. We can't feed her through the mouth because it would not be able to go anywhere. And we can't feed her through the tube in her stomach because there's a chance that it could go backwards and up into her lungs because there's an abnormal connection there. So that's the nature of our operation.

So this is another X-ray where we actually put a little dilator into our baby's mouth and shot an X-ray with us. What this allows us to do is to try to get a sense of how long the esophagus is up here. Here is her jawbone and

her skull, and these are her neck bones, her collarbones here. And we're trying to figure out, because we can't tell until we really get in there, how long this is.

If this pouch is very far away, it's a long distance to try to get that hooked up. So this is just a way to try to tell ahead of time what we might be up against. So this dilator comes down to about here. The lower end of the esophagus comes off the trachea right about here where it splits into the airway that goes to the right and into the left lung. So we think that our lower part comes to about here and our upper comes to about here, so my hope is that we'll be able to get those together without too much difficulty today.

Again, this is the gastroscopy tube. That's the little tube that we put into her stomach when she was just in her first day or so of life so that her stomach wouldn't get real full of gas and that she'd be able to ventilate and be able to grow well. The baby is no longer on the ventilator, but she was initially on the ventilator when she was born, because, again, she was very premature. She was only about 1.3 kilograms when she was born, and today she's 2.6 or 2.7, so she has just about doubled in size since she was born, and that will make our operation technically easier to conduct because there's a lot of things that we have to take care of while we're in there.

We hope that this will be a single type of connection. There are multiple connections that can happen between the lower esophagus and the trachea or the windpipe, and there are multiple connections that can be had between the upper esophagus and the windpipe as well, even though the esophagus comes to an end. So we'll have to find those out. There's no indication that there are other connections at the present time.

That's right. So Dr. Turner, while we're operating is going to be giving descriptions about what we're doing and what we're seeing, and we'll try to keep it interesting for everybody. It's a small field, and we'll do our best to let everyone have a look as we're doing the operation. Thanks.

The baby has a complicated problem called "esophageal atresia" with tracheal esophageal fistula, which has to do with development of both the swallowing tube of the esophagus and the trachea, the windpipe, to where the esophagus isn't connected to itself. It's actually in two separate areas. In one of those, the lower part is connected to the windpipe.

And so the operation today was to disconnect that abnormal connection between the esophagus and the trachea and then to reconnect the esophagus to itself so it's one long tube from the mouth all the way to the stomach. The esophagus is a fairly central structure and you want to do this operation on the side opposite the aorta. Babies with this problem can have an aorta on the wrong side of the body, so you would hate to make an incision and find that in the way. So this baby has had an echocardiogram ahead of time that shows us that the aorta is on the patient's left side. Here you go.

So this is our incision through the skin, and this is the fat. And this muscle is the latissimus dorsi here. So I'll have you put your sponge on there, keep some traction toward the floor and just stay right under beneath that.

So we're going to do a muscle-sparing thoracotomy. We're going to move the muscles out of the way rather than divide them. We think it's easier on the baby for recovery, and maybe even down the road. So we're going to open up our posterior auscultatory triangle, so here's our trapezius going this way. I'm sorry. This is our latissimus dorsi going here, our trapezius here, and our scapula here. So this triangle here is what we're going to open up and we're going to go across here. So Bovie to Dr. Dorton [PH] and (INAUDIBLE) to me. So we're going to go alongside parallel to this fiber up here. That's good. Uh-huh, I see.

Orientation was it's over his shoulder.

We're going to go under the scapula here. We're going to try to identify our fourth intercostal space. There's one.

He's feeling for the scapula right now. He's using a multiple-sparing procedure. In days in the past we would have made this incision 20 years ago and cut the muscles, the latissimus dorsi and the serratus anterior muscles, which are those muscles on the chest wall. Children could have had a problem with their scapular afterwards if certain nerves were cut during that cutting of the muscle, but now he's elevated the latissimus dorsi, which is where the pickup is, that little holding device in his hands, and he's pushing that to the top of the screen. That's the muscle he's going behind rather than cutting it, and often you can do this case without having to cut that muscle. Sometimes you do to cut the muscle to get enough exposure.

In surgery the important thing is to be able to see what you're doing obviously, and we call that "exposure." Now he's counted the ribs that's going to -- so he can identify which rib he's going on top of. This is probably the fifth rib that he's on right now, and just above the fifth is the fourth, and just between those is a space or the interspace between the two ribs.

He's probably going to go through that fourth space, the space between the fourth and the fifth ribs. This operation, although it's in inside the rib cage, it's hopefully behind that lining of the chest called the "pleura," so that pleura will be stripped off the inside -- that lining will be stripped off the inside of the chest so that the envelope that holds the lung will not be opened, and the lung can be pushed out of the way, and then he can do the operation on the esophagus and the trachea behind the pleura, as both of those are behind the pleura, behind that lining of the chest wall.

So he's presently just trying to get inside now. John, did you ever think about using that light that Tom uses that clips on.

You know, I've tried that before.

I don't like it.

I find it makes my loops want to fall off my face.

Okay.

Other than that, I love it. That's probably our pleura right there. The pleura is your way.

The choice of staying outside the pleura; that is, pushing the pleura off the chest wall is kind of a choice. Most people do it that way, but it's been shown actually that you can go right through the pleura into the chest cavity and do the operation just as safe.

That's good.

Now you can see he's pulling the ribs apart, and the lining of the pleura is right in front of you, and the lung is just on the other side, and he's going to take these little cotton-tip applicators and push the pleura away from the lining of the chest wall, push the lining away from the chest wall itself so that the lung stays in that envelope of pleura and allows him to stay behind that envelope.

The point of that all is that if, after this procedure were done, if there were a leak from where the esophagus were put together, it would be contained behind the lining of the chest wall rather than within the actual cavity of the chest itself, inside the lung, and that's the way it's always -- that's always been the reason for this. Again, that was a very good study showing that that going right through the chest really didn't offer that much more of a problem. But going in front is the hard part because that's where most of adherent.

I'll take the Bovie, yeah. If you can kind of just hold it that way. Little fibers left. Bovie. Okay.

He's got the rib spreader in now that holds the ribs apart, and he'll slowly advance that as he gets the pleura away from the chest wall. He will slowly advance that rib spreader a little at a time to spread the ribs. If he tried to do it all at once that would tear the pleura as well as break a rib maybe, so you have to go about this very gently and meticulously and slowly.

Come in there. Shadow in. Really engage. Good. Cut it.

He's continuing to push the pleura off the chest wall, and he's going to get back behind the pleura, lifting the pleura and the lung up so that he can find the esophagus, so he can find the trachea, he can find where the esophagus goes into the trachea, where the esophagus comes down from the neck and ends, and he will be looking at it through this hole, I mean this opening right here, but he's got to get the lung out of the way. The lung is enveloped by the pleura, and so he's going to pushing the lung and the pleura out off the chest wall so that he can then see where the esophagus and the trachea are.

There's a vein back in the back called azygos vein, and he'll be finding that in a minute and probably divide that so he can push the pleura further, because azygos veins go through the pleura into the superior vena cava just before the top part of the heart. You divide that vein and you can push, then, the pleura further away from you. And those metal things are the retractors. He has one in separating the ribs. He's got another one that's pushing the muscles out of the way. And then he has a little square window, and he'll work on through that.

There's the azygos vein right there.

So there two areas here on the lung.

He's got the dark area here. Here, that purple to the left and the pink to the right are lung, and then the blue thing right above his index finger right there at the bottom of the screen is the azygos vein. At some point in time, he may choose to divide that. He's using a retractor, just coming in holding the lung back.

I bet that's our right main bronchus here. So let's take a sponge.

Beautiful picture.

I'm going to have you come in underneath.

He's trying to get the retraction, trying to get the exposure right.

Just a little hemostat.

The rib spreader's here. He's slowly advancing the rib spreader so he gets just a little better vision.

She's essentially one lung.

So he's have a little better view, trying to catch up with that. He's got a sponge in there right now. He'll take that out in a minute as he moves ahead. What he's doing right now is trying to make sure that the child can tolerate the lung being compressed, because you have to have the lung compressed in order to get behind it and to see the esophagus and to work on the esophagus and all that. And while you're doing that, you're compressing the upper lung, which is the right lung, and the down lung that you're having to use to ventilate the patient, so you're pretty much on one lung ventilation, and you have to make sure that the child can tolerate that. On occasion, you have to come back later when the child is a little bit bigger if they can't tolerate one-lung ventilation.

He's getting under the azygos vein now with the right angle clamp, and he's eventually going to come out on the other side, and he's going to ligate it or tie it and divide it so he can push away the pleura even further.

Touch the nerve. Touch in between there.

See the vagus nerve in there. He'll stitch around that, put a ligature around the vagus nerve. The chest wall is to the left, and the heart is to the right. You can see one of the branches of the azygos vein coming off the chest wall here at the intercostal vein there.

Bring it over to your side as far as you can.

This is on the heart side, medial. And then that white line going behind azygos vein is the vagus nerve, which runs right along the esophagus and helps you find the esophagus as you're looking for that distal portion of that bottom part of the esophagus, which is harder to find sometimes. He's going to divide the azygos vein now. All right. Now he's got those sutures.

Easy. Easy. Easy. We'll cut there.

The anterior aspect on the bottom portion of the esophagus.

That looks like esophagus there. You can see the azygos vein tied on the bottom part of the screen just in front of that sponge. Now he's pushing off the pleura so that he can find that bottom esophagus, which is right there. See that? That's the vagus nerve right there, that little white line.

We need to come out. I guess we'll try to get the nerve over toward you. Okay.

That looks like you got esophageal tissue right there, doesn't it?

Yeah, I think certainly down below here.

Yeah.

That's probably where our fistula is. We're going to try to get our vagus nerve off of that. So this is, I believe, our esophagus distally right here on my -- or this is the Vagus nerve I've grabbed next to it to try to get it away, so we preserve that.

But this esophagus, now that he's dissecting it and kind of cleaning up and getting a good picture, goes into the trachea. So he wants to find out where it goes into the trachea. He's going to go around it and lift it up and take it off the trachea and then close that little hole in the trachea. Then he'll have the distal end of it ready to put together to the proximal or the top part. The distal is away and proximal is up to the top.

Right there. There we go. Right angle. So this is our distal esophagus coming in here is membranous trachea.

That's a good shot there.

So we're going to divide the fistula here. It's a fairly big fistula. So this bit closed and we'll have it open here, but we're going to dissect a little bit more so it's easier to get in to do what we need to do.

So he's going to keep on cleaning that up, and then he'll come across it, leaving a small amount of esophagus to attach the trachea. And that's what he'll close. If you try to shave it off the trachea and then close that hole, you'll cause the trachea to be narrow. So there is a little bit of judgment in this as well.

That's all we dare get. Okay. Get that little bit. Pull away with that.

When you're not doing the operation, it seems like there's a lot of time spent preparing to do things. When you're doing the operation, you want to have it just right, and so you spend a lot of time preparing to do it. And watching one of these operations, the surgeon wants to get it just right, get it just set up perfect, and so it needs to be done.

This is from the other side now.

Pickup.

You going to have to have my side of the sutures going up.

So you can see he's up into the trachea. The trachea is just a little wider where that needle is.

Let me have a snap.

Sometimes when you're doing this case, your patient has a difficult time getting the ventilator because air comes down the trachea and down the esophagus, and so you have to kind of get in here in a hurry and then pull up on that esophagus so that no air can escape that way and it can all go into the lungs while he's ventilating.

Start your fistula right about there. Leave about a millimeter away from that suture, uh-huh. A little further away, uh-huh. That's a pretty good bite. Almost. A little more. Go ahead and get (INAUDIBLE) in there. Uh-huh, a little more.

Now he's dividing the fistula, and you will see that there will be some air bubbles. See just a small hole goes into the vagus and the trachea. He's going to sew back, pull a stitch there to help chose it.

We'll just do it in sequence. Snap.

There we go, pull all that out. Okay. See the air coming out of there? Every time they breathe a patient that air comes out.

Pull down on Mayo. Other stitch. And you don't want to cut anymore toward the floor.

He's going to go ahead and finish dividing this.

Come up parallel to the floor. Don't cut any deeper. There would be way to (INAUDIBLE) your tips. There you go. Not all the way. Okay. Other stitch. That's our fistula there. You can hear the air come whistling out of it.

Last time I talked about tracheoesophageal fist fistula, that's what you're looking at. It's where the esophagus goes into the trachea. It's a defect in the embryology of how the lung buds off the foregut. It's kind of a fascinating piece of embryology.

Before you do that I'm going to put one of these on the esophagus. Okay.

He's just going to put a suture through this bottom portion of the esophagus so that when he completely divides the esophagus this doesn't completely retract and go down where it's difficult to find.

I'll guess I'll need some more of these.

You never want to lose control of the situation.

Why don't you finish it off there.

Now he's going to finish dividing the fistula.

Just be careful with your vessel because it's going to (INAUDIBLE). Go ahead and finish it. Get all the way across, uh-huh. There you go.

The fistula is divided. Now he's just got to close where the fistula went into the trachea, and that's what he's doing here. You can see the azygos vein back here behind that, and he's protecting it with his pickups. He doesn't want inadvertently injure that. Now he'll start at some, point in time, start tying those down and making those knots and go ahead and closing the fistula.

So now often if a patient has had problems with loss of air down a fistula, they don't have that problem anymore, and ventilation actually becomes better for the patient for the rest of the case. Dr. Petty has real good technique. It's smooth and balanced, methodical, meticulous. It's really fun to watch him operate.

There it is. See the closure?

Those four little sutures are closing our fistula. So that's the membranous trachea, vagus nerve. Here's the end of our esophagus right here.

That's the esophagus right down there in the bottom of the screen he's putting pickups in.

We'll put one more tract suture on board or so.

Saline in and we'll see if we give the patient breath and see if we can see any bubbles coming up out of here.

Okay. No bubbles. Get suction.

Take a breath, take a breath, big breath. Go down to trachea and if that wasn't closed tightly there would be bubbles down there, so there weren't, so suck that out. That's good.

I'll take another PDS for Dr. Turner and the audience, we're going to put a little azygos vein over the little trachea fistula closure. That will be all right. Pull that azygos vein there between our esophagus and the trachea.

(INAUDIBLE).

What's that?

(INAUDIBLE). Yeah, you want to have a little cuff of stuff there. Okay. There you go. Now we're going to need Tim or Linda to give us a little downward pressure on the NG tube, and then we're going to kind of keep our eyes peeled and keep our proximal.

The anesthesiologist will push on the NG tube, nasogastric tube. Of course it doesn't go into the stomach. It goes into the top of the esophagus. And we'll see bulging down into the chest from the neck, and that will allow us to find out where it is and then dissect it further. So when they push the tube down from the top, you can feel it in the esophageal pouch; that is, the top part of the esophagus. It helps you locate it and then helps you dissect it away from the structures that are holding it.

We're going to need a 3.0 PDS here in a second.

And once you can feel it and see it, you dissect it. You can dissect it off the trachea. It doesn't have a common wall of the membranous portion of the trachea for a while, and you can dissect it off the vagus nerve, stay right on it so it doesn't interfere with the current laryngeal nerves high up in the neck. They're trying to determine if there's a proximal fistula at the time. At the time, although on pre-operative bronchoscopy, it was not noted to have a proximal fistula or a proximal hole between the trachea and the esophagus, but that can occur.

So the next step is to prepare that top portion of the esophagus to put together with the bottom part or anastomose the top part to the bottom part of the esophagus, put the esophagus back together as it should be. And up where that cotton ball is is where the proximal pouch is. You're looking up into the neck from the chest. The heart's to the right. The chest wall is to the left. And he's working on the esophagus as its coming down the neck. And you can see it's being pushed on right where that cotton ball, where that cotton swab is is where the proximal esophagus is. And he's going to make that presentable enough that it can be hooked up to the esophagus below.

Right angle. Take your Bovie. We're going to have to be up more.

Oh, yes, he has to work on it. He'll have to free it up out of the neck. It's stuck up to a lot of tissue up there, so he's just starting that process of freeing it up from the tissues that are attached to it as it comes down the neck, so he can pull it on into the chest.

We'll get a little traction suture on it here soon. The trachea has cartilage on the top part.

More forward thrust on the NG.

And those cartilages are like an omega.

Good.

And on the back there's no cartilage. There's just muscle. We talk about the membranous portion of the trachea, where this bottom esophagus came into was the membranous portion of this trachea. And he was careful when he closed it not to close that tight, you know. And up here, that proximal pouch is coming down and it's right next to the membranous portion, so he's got to dissect that proximal pouch off of that membranous portion of trachea. Now he's putting a stitch in that proximal pouch so he can use that as a handle to help him lift it up and get beside it and get behind it.

The trachea is right here. So there's the trachea right there. There's the pouch right there, so he's trying to get the pouch off the trachea. They share muscle wall, so you don't want to make a hole in the trachea, and you don't want to make a hole in the esophagus, so you've got to go right between them, and it's sometimes really tricky.

Touch there with the Bovie, yeah toward the esophagus, uh-huh, touch. Good.

And that being the trachea, the tube that's breathing the patient is back there too, so you can actually feel that in the trachea, and you don't want to be moving it, pushing it back and forth. So now they're working up here. So

this camera is not going to give us a good picture because it's going to be looking straight down, and he's up under the top portion of that, looking up into the chest now.

A little muscle down there, uh-huh. Go ahead and touch it, uh-huh. Good. Push down. Uh-huh. Take that. Let's work on your side a little bit more. Go ahead.

Is it pretty freed up from the trachea up there, John?

I think so. We kind of had a little almost like a little common wall vet there, but I think we're separated up high.

Yeah, high as possible.

Yeah. You have the nerve hook?

There's the proximal pouch. See the little tube in the side of it. He's made an opening in that proximal pouch.

Pickup there. So this is our open proximal pouch here. We've got a stitch in each corner here and here.

There you go.

And then this is our distal bit here. Now we're going to do our anastomosis.

Our distal pouch is at the bottom of the screen, and the proximal pouch at the top of the screen.

Suction.

Yeah. Yeah, this particular shot is looking up toward the neck, and he's just putting a little hook in that proximal pouch. You can see that he's opening that hole which is into the proximal esophageal pouch, and he's going to put a stitch now in the posterior bottom wall of that. He's already put that stitch from the other side, from the inferior, so the pouch, the proximal pouch, the proximal pouch is at the top of the screen and the bottom esophagus is following those strings down to the left lower corner of your screen, and he's pre-placing a bunch of those so when he goes to pull them all up at the same time, it won't be too much stretch on one particular area of the esophagus. So he's putting these in.

That's in the bottom esophagus, the distal esophagus, if you will, and this is going to be in the proximal pouch or the proximal esophagus. We'll get the camera in there. Posterior wall. You'll note he made an incision on the top pouch cross ways not up and down. And when he puts all this together, then that will -- got a knot there. Got a knot. When he puts this all together, it will have kind of a diamond shape configuration, which will help hold it open.

One of the long-term problems with children with fistulas after they're repaired in the natural scar-forming process, they can get a narrowing of this area where the anastomosis is together. And that may require some dilatations, but that can be done.

This is my corner here between those last two.

So making it in a diamond-shaped anastomosis is a way to try to avoid that narrowing when the natural scarring takes effect. Now you're looking at over his shoulder, so that's -- the bottom esophagus is from his -- he's putting a stitch in the bottom esophageal segment, and he's going to sneak up there and go up under that retractor where the proximal pouch is. Now he's going to put that in the top of the esophagus right now. He lines all this up so you have the same orientation top and bottom.

And this suture material is absorbable material, so it will eventually -- the body will absorb this material after the esophagus heals together. What are you going to put, an eight-French feeding tube.

Yeah, a little five.

A five-French feeding tube?

Yeah.

So you can see that pretty well now. You see where the proximal esophagus is, and then you come down and see -- skin down. There you go. Skin -- go further down. Okay. You could see there is the distal esophagus there. And you can come up the strings and see where the proximal esophagus is. So they're all set up to kind of horseshoe that -- or parachute that down.

Now they have taken another tube and pushed -- and advanced it down the nose and down the esophagus and through that proximal pouch. You can see coming out of the proximal pouch. Now he's going to put it in the distal pouch and let that go on down to the --

Back up a little further.

Let it go on down to the --

A little more, uh-huh. A little more.

There you go.

That's probably good.

This tube is going to allow them to feed the child in the stomach or if the tube goes on into the smaller intestine, allow them to feed the child intraorally or within the intestines while the esophagus heals. They want the esophagus to heal seven to nine days so that it does not -- so that there's good healing before you start feeding the child. And before they start feeding the child, they'll get a barium swallow to make sure there's no strictures, no leaks.

And right now he's tying the back wall -- the back wall of the two ends. Once he gets the back wall together, holding the top and the bottom esophagus together, and before he closes the front wall, he'll put that tube on through the system and on down into the stomach. You can see the bottom of the esophagus has come up now. You can tell the top because that little new feeding tube is right at the top of the anastomosis.

But what you want to do at this particular stage when he's tying these down is to go ahead and tie at least three or four of those sutures so that they share the tension of that hook up or that anastomosis. If you try to tie one and then try to manipulate things, and all the tension holding those two ends holding those together are just on one stitch, and that's a little tenuous, so you want to try to sew together the entire back wall so that's sharing the tension between several of them. Now he's going to advance the feeding tube.

Pull that out of the way.

He's just putting another stitch in the esophagus. The top is to the right and the bottom is to the left.

Take that stitch out. So here's the upper lip.

The proximal pouch, and these are stitches on the back row. He's got most of the sutures on the back wall done. He might choose to advance that feeding tube now.

You can see it's going to go.

These stitches on the back wall are tied so the knot is on the inside, which is helpful.

Pickup, and the air hook. Now we're going to have you gently advance that feeding tube.

Now they're going to maybe try to advance that NG tube and push it down into the distal, go on down into the stomach.

Keep going. Go. Go. Go.

So that tube will be into the stomach and maybe on into the duodenum, and you can feed the child through that while this is healing up here.

We're going to have you do -- that's fine. Picture it in your mind's eye.

Put a stitch through here. And a couple of things that tube helps is it helps sticking that needle in the back wall of the esophagus while you're doing that.

Follow the curve. Good. Inside.

And that nerve hook is a real nice thing to do to hold the esophagus out of the way.

Be sure you're all the way in before you hit that turn. Not so far back. There you go.

So now they're just sewing that front wall of anastomosis. Anastomosis meaning the hook up between those two. Stoma is a Latin word for mouth, so he's putting the two mouths together. That's where that word "anastomosis" comes from.

There you go. Good. Uh-huh, follow the curve. Don't come under the (INAUDIBLE).

By putting that stitch through they want to make sure they get all layers, all three layers of -- two layers of esophagus and muscle and mucosa as well.

So there it is, our tube going across that we just have to type the front wall of our sutures.

The sutures are all done.

The back wall reaches, so should the front wall. As he's putting those sutures down he kind of judges the tension on it very gently to make sure it's tight enough but not too tight. The tissue in babies is very fragile, and if you tie a suture too tightly it will just tear through. If you don't tie it tight enough, it won't hold the things together that you're trying to hold together, so it's very important to put just the right amount of tension.

This is a picture of the anastomosis, and it's a real like picture. The proximal pouch is on the top. The bottom pouch is on the bottom, and the sutures are holding the two together, so it's the real nice picture that the esophagus is going on down.

All righty.

(INAUDIBLE).

So there's our suture line there for the trachea. So it's migrated (INAUDIBLE) about a centimeter.

There you go.

As you can see. Good. See fistula closure there. I don't know if you can see that. I'll let you do it.

He will put a little tube in the chest, as I said, in case there were a leak from this anastomosis, it would come out that tube. You can see the other thing this tube does it allow any bloody fluid to come out that might otherwise gather behind the pleura. When he gets a swallow in seven to nine days and sees that there's no leak and everything goes down okay, he'll pull that little tube out, that little chest tube out.

After he puts that tube in, he's just going to get all the sponges out, let the lung re-expand, and close the ribs, approximate the ribs.

Yeah, that's great. We'll take the 501P whenever you have free second.

So he's about through.

Irrigate out and then we'll bring our chest tube in.

(INAUDIBLE).

Yeah, the (INAUDIBLE).

The tissue -- that azygos, the stump of the azygos vein over the tracheal closure so that that would separate the tracheal closure from the esophageal anastomosis and decrease the chance that there might be an infection between the suture lines and a recurrence of the opening between the esophagus and the trachea or recurrent fistula.

(INAUDIBLE).

Right up here.

One thing you have to keep in mind in all the operations that Children's Hospital such as Brenner's is that we have pediatric anesthesiologists and pediatric anesthesiologists and pediatric critical care, all pediatric sub-surgical specialists such as ENT and so forth that allow us to do these operations.

This is our esophageal suture line and this is our tube. We don't want our tube to be touching that.

Specialists who have the expertise and interest to devote their lives to this type of surgery, this type of anesthesia, and this type of critical care afterwards, at the point that probably is important as any point that we have made this morning. You can go ahead and turn it off.

(INAUDIBLE).

The child will go upstairs on the ventilator to the intensive care unit. And he will be on the ventilator, and that's important for the first couple of days because he probably will not take a deep breath well enough to ventilate well, and if he were to have all of a sudden the need to an endotracheal tube placement and that tube were accidentally placed down the esophagus or placed too hard into the trachea, it could cause damage to these places where he's been operated on. So keeping the trachea tube in there until he's a little more over the surgery and then pull with the expectation he will not need it.

We have 3.0, followed by 4.0 micro and 5.0 Monocryl, is that right?

That top part is a little bit (INAUDIBLE) than the lower part.

(INAUDIBLE). Give a nice sustained peep.

It will all pink up and fill that space again. John, move your head a little bit.

Oh, sorry.

You can see better and watch that live span.

Better window than a door, than a window.

That's purple right there, that's where the air is not in the lung quite yet.

All right. All the muscles have been preserved.

He'll take that retractor out and the muscle that was refracted today.

We're going to bring our muscle. Yes. What's that.

(INAUDIBLE).

The pal line, okay.

(INAUDIBLE).

Let me have that Blake drain as well. One on your side. I think I'm real happy with how things ended up.

I think it went really easy. I was impressed with how -- that you didn't have as much tension. I was thinking there would be more tension on the anastomosis than there apparently was.

Thankful for seeing how much space there was between them. I think you have to give the credit to the baby that her esophagus is strong enough to come together. But I was glad of that.

Sometime that bottom one is not as easy to get up, and the top one is easier to get down.

Right.

It seemed like it was just the opposite this time and didn't have any anesthetic problems. They ventilate the patient well during the entire case, even with that right lung down out of the way.

Yeah.

And I think that's a tribute to pediatric anesthesia.

Yeah, they did a nice job to kind of stay the course after the lung goes down to ride out the initial change. But one of the most challenges patient groups to care for in anesthesiology is the premature newborn. And these patients may have been delivered as early as 23 or 24 weeks of gestation. They may weigh just half kilo gram or maybe even slightly less. Many of their organ systems are not fully developed. They're incredibly sensitive to changes in temperature. They're unable to regulate their own temperature. Sometimes they're unable to regulate their glucose or body fuel metabolism, and they need incredible amounts of support. They're very unlikely to have lung maturity at that time. And these patients come to the operating room for a number of procedures.

Now how long will you expect to have this child ventilated post operatively?

Well that's a good question. You know, from her prematurity, she might take a little nose dive in terms of her respiratory status just given all that we've done today. So we'll leave her ventilated until she's back down to low oxygen settings and pressures and stuff. My guess would be two or three days. She's been off of supplemental oxygen for a while, and she's gotten to a good size, so hopefully it won't be very long.

Now when will you start feeding her through her transpyloric tube or the tube that she had now going into her stomach.

Yeah, or her gastroscopy.

Or her gastroscopy.

Probably a couple days if all starts out well with the ventilator and physiologic things afterwards. I would think we could do it right away.

(INAUDIBLE).

All right.

I think the exposure was good. You didn't have to cut any muscles or anything, and so that was good.

You know, I was uncertain about her scapula too. It didn't seem as hypoplastic as under x-ray. Knife down.

So now you're putting in the drain to keep juice from gathering up under the skin.

The subcutaneous space. Let's see. I guess we have to take that off. Charles, what did you see that we could have done better or differently, or what's your technique of what we did today?

I'm just learning how to do it better today. I sometimes take down the pleura with just a sponge, you know. But certainly you had beautiful exposure there. I don't think that could have been better. I use a little more sharp dissection than the sponges.

Than the Kittner or whatever?

The Kittners. But that's a matter of how you were trained and how you grew up in the surgical world.

And so you would have put the little patch over the fistula after the esophagus was closed?

Yeah. But I like the way you did it better because then you don't have to lift up the esophagus, and, you know, manipulate that after you put it together. So I think doing it beforehand is better.

Charles, thanks for coming to help do the gum.

Well part of the things surgeons like to do is watch surgeries.

Thank you for watching this OR Live webcast presentation from Wake Forest University Baptist Medical Center in Winston-Salem, North Carolina.