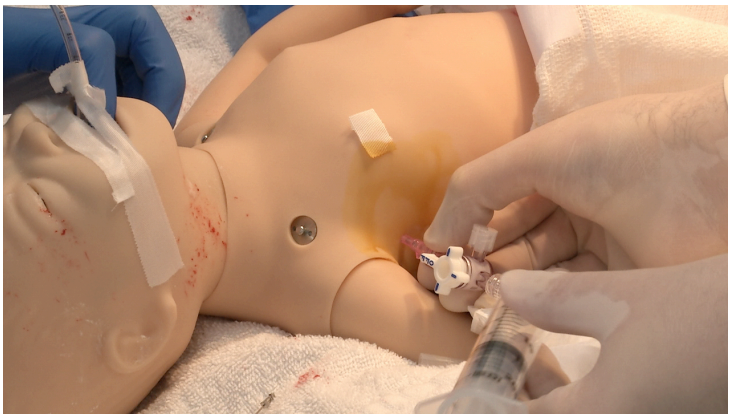
Newborn Resuscitation

Performing a Needle Thoracentesis

When a newborn's life is threatened by a tension pneumothorax, it is important to know how to perform a needle thoracentesis. The symptoms of a tension pneumothorax, which include decreased breath sounds and tracheal deviation, may be very hard to discern in the delivery room. To determine if these symptoms are present, first, verify that the endotracheal tube is inserted to the correct depth, which can be calculated in centimeters by adding 6 to the baby's estimated weight in kilograms; next, listen to both sides of the chest for asymmetric breath sounds; and, finally, using your laryngoscope, visually confirm that the endotracheal tube is passing through the glottis into the trachea. If you have gone through these steps, and if the baby still isn't responding to your positive pressure ventilation, chest compressions, and multiple resuscitation medication administrations, a needle thoracentesis may be necessary. It is imperative to work quickly and effectively as a team to help a baby in asystole return to spontaneous circulation as soon as possible. A baby with asystole (i.e. no detectable heart rate) for at least 10 minutes is highly unlikely to survive or, at least, to survive without severe disability.



To perform a needle thoracentesis, carefully follow these steps:

Preparing the Insertion Site

Place a square piece of 1 cm x 1 cm tape with a buddy tab over the baby's nipple. A buddy tab is made by folding the tape's edge over and onto itself.

This allows for quick tape removal after the procedure. Covering the baby's nipple with tape will keep you from accidentally injuring it when you insert the needle. The tape serves as an anatomic landmark to keep it from being obscured during draping or when betadine or chlorhexidine is applied. The very small nipples in premature infants are particularly difficult to visualize and are located close to where the needle will be inserted. If you injure a baby's nipple, this can result in breast malformation during puberty.

Apply betadine or chlorhexidine in an increasingly circular fashion, starting in the anterior axillary line at the level of the baby's nipple. This is the fourth or fifth intercostal space through which your needle will be placed. Betadine needs 60 seconds of contact time to sterilize the skin. Chlorhexidine needs 30 seconds of contact time and the Federal Drug Administration (FDA) cautions against using it with infants less than two months of age as it may injure the baby's skin. The risk of skin breakdown and burns from chlorhexidine is higher in babies less than 28 weeks, less than 1000 grams, and less than two weeks of age.

Once the chest area is sterilely prepped, it is time to put on sterile gloves. If they are available, use sterile towels to drape around the anticipated needle insertion site. Draping may be skipped if the needle thoracentesis must be done emergently to treat a tension pneumothorax that is causing cardiorespiratory collapse. In this dire situation, generously apply betadine or chlorhexidine to a wide area, and expeditiously proceed with inserting the needle.

Assembling the Needle Device

Now, assemble the needle device. If you use an 18- or 20-gauge angiocatheter, you will need additional supplies, namely, 4–6 inch (10–15 cm) long extension tubing, 4 x 4 gauze, and scissors. Set the angiocatheter on the side. Attach the extension tubing to a 3-way stopcock attached to either a 20- or 30-ml syringe to aspirate air. A plastic angiocatheter is preferred because it is more flexible and possibly less likely to cause internal injury than a steel butterfly needle.

If you are using a 21- or 23-gauge butterfly catheter, it should already have the extension tubing attached to it. Set the butterfly needle and its extension tubing on the side, taking care to keep it sterile. To aspirate air, you will then attach a 3-way stopcock to either a 20- or 30-ml syringe. After

the butterfly needle is inserted, this syringe 3-way stopcock assembly is attached to the butterfly needle's extension tubing.

Inserting the Needle Device

Find the line where the baby's nipple, which should still be protected by the 1 cm x 1 cm square piece of tape, and the anterior axillary line meet. This is the fourth or fifth intercostal space where your angiocatheter or butterfly needle will be inserted into the baby's chest cavity.

Using sterile gloves, insert the angiocatheter (or butterfly needle) just over the rib and into the chest using a "Z" pattern. As soon as you enter the chest cavity, pull out, or retract, the angiocatheter needle in order to decrease the risk of injuring underlying structures such as the lung, heart, and blood vessels. The flexible plastic angiocatheter is now inside the chest cavity. This is an important advantage that the rigid steel butterfly needle does not have.

Now attach the assembled extension tubing, 3-way stopcock, and 30-ml syringe to the end of the angiocatheter. Aspirate air using a syringe. You will need to expel air through the side port if more than one syringe full of air is aspirated. Record the amount of air obtained, and stop when air is no longer being aspirated. The butterfly needle comes with its own extension tubing already attached. It simply needs the 30 ml syringe and 3-way stopcock attached to it in order to start aspirating air out of the chest. After the air is removed and the tension pneumothorax relieved, check the baby for improved color, heart rate, pulse oximetry, and activity.

Treating a Large Pneumothorax

If there is a large pneumothorax that is continuously leaking air into the chest, you will have to leave the angiocatheter or butterfly needle inside the chest until a chest thoracentesis can be done. To secure the angiocatheter, take 4 x 4 gauze pads and cut them to the middle. Slide these gauze pads around the angiocatheter and tape them in place. With the angiocatheter secured in place, another team member can continuously or intermittently remove air so as to prevent multiple repeat needle thoracentesis with its increased risk of injury.

If you should opt to use a butterfly needle instead, insert the butterfly catheter, using sterile gloves, just over the rib and into the chest using a "Z" pattern.

Now attach the assembled 3-way stopcock, and 30-ml syringe to the end of the butterfly needle tubing. Aspirate air using a syringe. If the amount of aspirated air exceeds one syringe, you will need to expel air through the side port. Record the amount of air obtained, stopping when air is no longer being aspirated. Check the baby for improved color, heart rate, pulse oximetry, and activity.

If there is a large pneumothorax continuously leaking air into the chest, you can leave the steel butterfly needle in place, securing the needle by either holding it or taping the butterfly needle's flanges to the chest wall until a chest tube thoracentesis can be done.

The steel butterfly needle requires less assembly but is harder to secure and may be more likely to injure internal structures such as lung, heart, and blood vessels. Choosing either a butterfly needle or an angiocatheter for needle thoracentesis is up to you, the person performing the needle thoracentesis.

Removing the Needle Device

When you are no longer aspirating air, quickly remove the butterfly needle or angiocatheter and dress with an adhesive bandage. The Z-track tissue insertion technique you used to insert the needle will ensure there isn't a direct route through the chest wall from the inside to the outside.

Do not forget to wipe off the betadine or chlorhexidine to prevent the baby's skin from drying and fissuring. This also prevents the baby's skin from absorbing iodine. High iodine concentrations from using betadine in babies may suppress their thyroid function due to the Wolff-Chaikoff effect. Chlorhexidine is also absorbed through the baby's skin but its effect is unknown.

Conclusion

By adhering to these important steps, you will be able to treat a newborn who is suffering from a pneumothorax. Keep in mind, a needle thoracentesis may be the last procedure you do for a newly born baby who is not responding to recommended resuscitation interventions and medications.