TROUBLES WITH TINY TUBES? TRY DOPES

When a child being ventilated has problems, this mnemonic may help

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Facing highly stressful situations can tax our mental resources and critical thinking abilities. Mnemonics help us remain focused on tried-and-true processes of problem-solving. The sudden and rapid deterioration of a child being ventilated (via mask or endotracheal tube) is a time-critical event that demands immediate action. This is when we should remember the mnemonic *DOPES.*

DOPES is a way to troubleshoot and quickly determine the cause of oxygenation emergencies in patients with artificial airways. It is not just for tubes or trachs but also for backup and alternative airways (such as a King Airway, LMA, or i-gel).

The letters stand for:

- *Displaced* or *dislodged* device (tube or mask);
- *Oxygen* flow or *obstruction* of the airway, physically or positionally;
- *Pneumothorax*;
- *Equipment* (tubing, connections, valves) or *errors* (user);
- *Stacked* breaths or *stomach* (abdominal compartment).

Displaced and Dislodged Devices

There is a reason the DOPES mnemonic begins with *D*: If the tube is displaced or dislodged (i.e., no longer in the right spot), bad things, like serious neurological complications or even death, tend to happen quickly. Therefore, before any other intervention, verify the airway device is in the right place!

Remember, breath sounds are not a reliable way to confirm tube or trach placement, especially in smaller patients. "I swear I heard breath sounds!" should not be an excuse used in court or to your colleagues, a family, or your own conscience.

The standard of care when assessing airway device placement, initially and for subsequent verification, is end-tidal CO_2 (colorimetric or capnographic) verification. And that holds true for any tube, trach, or alternative airway. When using colorimetric (color-changing) CO_2 detectors, many of us were taught mantras such as "Gold is good" or "Yellow is mellow," along with the

converse that "Blue is bad." Either way, if the detector turns blue or purple, your patient is likely to turn (or, worse, stay) that same color. That is never a good sign with a critical patient.

Some anesthesia providers in the United Kingdom have developed a brilliant variation on this theme when it comes to capnography. They will tell you, "No trace, wrong place!" The natural expansion of that thinking is, "Good trace, right place!"

When you are checking for end-tidal CO_2, whether by color changes or wave shape (see below), you want to take control of the situation. You want to be "hands on" in your approach. And that means your hands should be on the resuscitation bag.

Obstruction or Oxygen

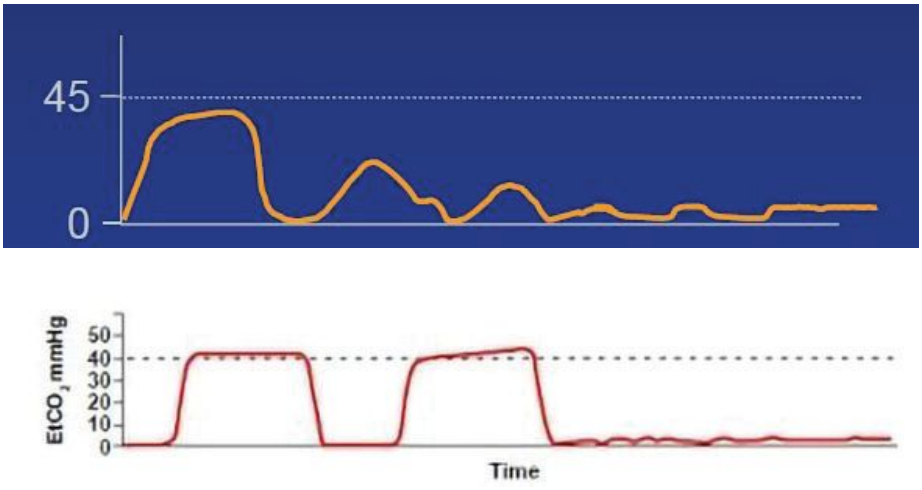
Air must be able to go in before it can come back out—that seems simple enough. If you have the resuscitation bag in hand, you will quickly know if the air is going in. Whether in a hospital or on a transport, don't rely on a machine. Check it with your own hands. Something as simple (and common) as a kinked tube can cause an obstruction. If you feel resistance when bagging or if you can't easily pass a suction catheter all the way down the endotracheal tube or trach, then an obstruction may be the problem, and a tube/trach change in the near future is a real possibility.

As for as the other *O, oxygen,* this part of the DOPES mnemonic should be self-explanatory. If the oxygen is disconnected, empty, or for some other reason not flowing properly, ventilated patients tend to not do well.

Pneumothorax

If you hit the *P* level in the mnemonic, it's time to assess for a pneumothorax: essentially air where there shouldn't be air and interfering with getting air where there should be air.

Now, while your run-of-the-mill small pneumothorax is bad, it probably won't kill you in the next few minutes. However, what about having the "mother of all pneumos," i.e., a tension pneumothorax? This can quickly result in not just respiratory failure



Top: "never in the right place" capnograph; bottom: "right place, then wrong place" capnograph

but death. So if a tension pneumothorax is the suspected culprit, needle decompression or a finger thoracostomy is the next step. If performed properly (and that's another lesson altogether), this will allow the trapped air to get out and may keep the patient alive until a chest tube or pigtail catheter can be placed.

The *P* should also remind us to consider the perils of pediatric physiology leading to poor placement and precarious positioning. When working with our little ones, make sure the tube is not down too far, i.e., in a main stem bronchus. Right main stem intubation is one of the most common pediatric ETT poor placements. Be honest, it's easy to get excited when you visualize the 1-year-old's vocal cords! And once they're seen, what's next? Shove that little endotracheal tube down there like it's going out of style.

Especially with an intubated child, if there are no breath sounds on one side, pull the tube back a bit before you stick a needle in their chest. It is surprising how often a disaster can be averted just this way. Breath sounds and oxygen sats tend to come right back, and that's what we want.

Lastly, don't forget that kids have what we like to call "big head, little body" syndrome. Not only can the big head put an obstructive crimp in the neck in the supine position, the effects of even small movements of the head can have a significant impact on the placement of a tiny tube. Especially in little ones under age 2, placing a diaper or small towel roll under their shoulders can be invaluable in proper positioning.

Many of us were taught that if endotracheal tubes are placed too far down the airway, they tend to end up in the right main stem. While that is generally true, a left main stem placement is possible, especially in babies and little kids. More recently, in addition to breath sounds and x-rays, bedside ultrasound has become very useful in assisting with rapid diagnosis of tracheal vs. esophageal intubation as well as main stem intubation vs. pneumothorax.

Taping the Tube

As a reminder, more or less three times the size of the endotracheal tube is where it should be taped at the teeth or gums. For example: A 5.0-mm ETT should be taped at 15 cm, while a 6.0 ETT should be taped at 18 cm. In a patient with very diminished or no breath sounds on one side postintubation, slowly and gently withdraw the tube (especially if it is past the three-times-the-size-of-the-tube mark). Try the easy stuff first, but if that doesn't work, something really bad may be happening.

Equipment Failure or User Errors

At this point something's simply not working properly. So, if the patient is on a vent, take the vent out of the DOPES equation and bag the patient. If you have eliminated the *D, O,* and *P,* you can troubleshoot the vent while your patient is breathing with the help of a bag-valve mask. If the patient is being bagged but still having problems, consider the other equipment being used. Do you have the correct size bag and mask (especially crucial in babies and kids), and are they connected properly? Is your partner bagging at the appropriate rate and depth? The error may not be with the equipment but with the user.

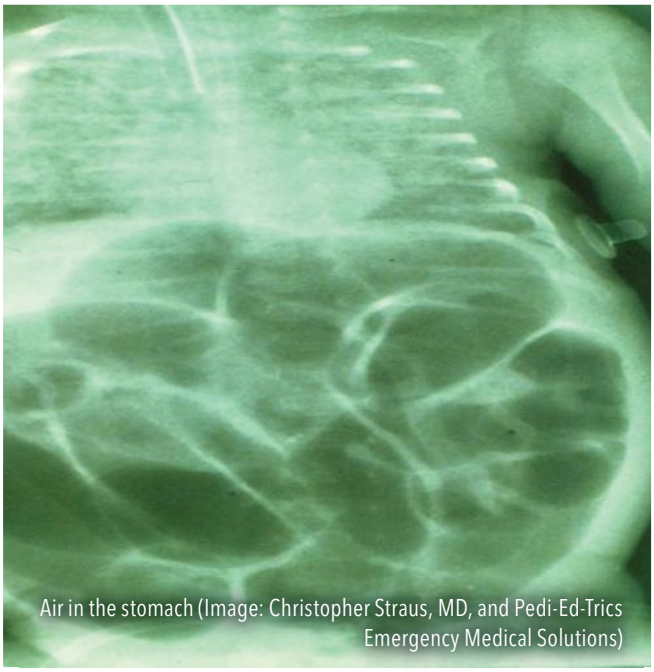
Back to basics: Airway and breathing come before vent, not only in the alphabet but in patient care as well.

Stacked Breaths or Stomach

For many years the mnemonic *DOPE* was used with great success. It has only recently been expanded to *DOPES* to reflect the potential problem of stacked breaths or stomach distention interfering with lung expansion. For example, in asthma one of the many problems we encounter is with exhalation. The difficulty may not necessarily be with getting the air in but getting it back out.

If a child or adult is sick enough to be intubated for their asthma, they are susceptible to a phenomenon referred to as *breath stacking.* This can occur when a breath being given starts before the person has had adequate time to exhale the previous breath, and it can be a real concern. So, especially with kids who might have a history of being wheezers or with other patients with chronic respiratory concerns, if they suddenly crash, and after troubleshooting with DOPE, simply taking them off the vent for a few seconds (or longer) will allow the patient additional time to exhale and can be a lifesaving intervention.

S is also the first letter in *stomach.* Especially with crying or overzealous bagging, it is incredibly easy for a little one's stomach to quickly fill with air. The distended belly can then push up on the diaphragm, leaving less and less room for the lungs to



Air in the stomach (Image: Christopher Straus, MD, and Pedi-Ed-Trics Emergency Medical Solutions)

expand. Placement of a nasogastric (NG) or orogastric (OG) tube can be yet another lifesaving intervention.

As a reminder, more or less two times the size of the endotracheal tube is also the suggested NG or OG tube size. For example: For a child with a 5.0-mm ETT, use a 10-Fr NG or OG tube. For a child with a 6.0 ETT, use a 12-Fr NG or OG tube. Two times the ETT equals your NG/OG tube (and suction catheter) size, while three times the ETT equals where to tape the ETT. How cool is that?

Conclusion

Practice makes perfect, and proper planning prevents poor pediatrics. Beyond recertifying in PALS, PEPP, EPC, or ENPC, regularly review to remember the key components of DOPE vs. DOPES. Adults typically arrest from bad habits and bad hearts. But when it comes to children, the origins of arrests tend to be respiratory, possibly respiratory, or probably respiratory. The moral of the story is simple: If something funky happens, remember the DOPES mnemonic to find and fix the cause!

RESOURCES

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