



Using Capnography and Recognizing Respiratory Compromise Could Save Patient Lives

Michael Wong:

Welcome to the health and safety podcasts. My name is Michael Wong. I am the founder and executive director of the Physician-Patient Alliance for Health & Safety.

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Today, we're talking about the need for clinicians to recognize the signs of respiratory compromise. So, I'm very pleased to have as our guest Jennifer Lightdale. Dr Lightdale is division chief, pediatric gastroenterology and chief quality officer at the Children's Medical Center at the University of Massachusetts Medical School.

Could you please give me a brief background about yourself, Dr. Lightdale.

Jenifer Lightdale:

Sure, thank you for asking me to do this type podcast. I am indeed a pediatric gastroenterologist, which I sometimes refer to myself as a plumber. As a pediatric GI, we do see a whole range of issues in kids - really from newborn up through college. Some of those conditions do mandate that we do endoscopy. So, as part of endoscopy, I really have become very interested in sedation and how we take care of patients, as we actually get them through the procedures. So, you know in terms of how you and I have intersected, I think when we think about respiratory compromise, that is the number one risk we deal with, when we sedate somebody for a procedure such as a endoscopy.

Wong:

Yes. Absolutely. Procedures are can be very risky. Patients and families think that they are risk free and in reality they may not be. So, that's why you and I spend quite a bit of time talking about and thinking about respiratory compromise.

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Last year, we spoke with Dr Jeffrey Vender about respiratory compromise. Dr Vender is chairman of anesthesiology at North Shore University Health System and he's also chairman of the clinical advisory committee to the Respiratory Compromise Institute. In that interview, although sepsis and respiratory compromise are clearly very different conditions, Dr Vender believes similar to the subsystem awareness campaign that greater awareness of respiratory compromise will lead to earlier diagnosis and interventions which may drastically improve patient outcomes.

What do you think of Dr Vender's opinion, Dr Lightdale?

Lightdale:

Yes. So, obviously I think respiratory compromise is indeed the harbinger that the patient is quickly physiologically de-compensating and actually a very similar model is occurring in sedation. Obviously with sedation, it is a manmade situation, where we're administering sedatives with the goal of putting the patient to sleep, so to speak, but the big risk is you could induce a level of consciousness where the patient now has respiratory compromise. And I think recognizing that respiratory compromise, or the risk of respiratory compromise, or as the respiratory compromise is beginning, the earlier you can recognize that that's happening, the more likely you are to reduce adverse events and certainly bad adverse events like patient death. So, Dr Vender's concept definitely holds up with what I do.

Wong:

I hear from a lot of families, unfortunately patients' families, who have experienced death or serious adverse events, like brain injury, following a procedure and that's how I've gotten involved with these families. But, there seems to be a lag between early adopters of new technology and broad acceptance and use.

What do you think can be done to overcome reluctance to use capnography and in general sort of continuous patient monitoring?

Lightdale:

So, I think we're at a point for most patients undergoing sedation that there is continuous monitoring going on, but the monitoring is really oxygenation using pulse oximetry. Capnography of course is a technology that allows us to measure ventilation to really measure gas being exchanged - CO₂ being blown off. And, I think there has been some reluctance to add capnography to a monitoring routine that's using pulse oximetry and observation. So, why do I think that is? It's certainly the concept of you're going to add something new and people have to learn something new - that's, I think, definitely been a barrier.

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And, I think, unfortunately another big barrier has been cost. As you bring in a new monitor, there are now additional hardware costs and even per patient cost. So, there's certainly some cost issues that have contributed.

Wong:

You're absolutely right. There's obviously technology and the cost of technology. And, then there's there's learning time or making sure that folks are kept up to date with the technology- how to use and how to interpret the way forms and that kind of thing- so, it's both a technological problem and both a human problem.

So let's talk about the meta-analysis that you did it. Why did you do that study and what did you find?

Lightdale:

We recently published a study that I did with a health economist. Rhodri Saunders is the first author on the study, where we looked at all studies, all randomized controlled trials, in particular that had been done comparing monitoring that involved capnography with the monitoring that doesn't use capnography yet. And, we looked to pool all the data from all the randomized controlled trials that we could find, because each study, in and of itself, was able to show some effect of capnography, but not the big one that everybody's looking for. So, what's the big one that everybody wants to know. Everybody - meaning people who are really setting standards and key opinion leaders who can make real changes in practice - want to know whether capnography indeed, if added to, routine patient monitoring for procedural sedation would actually reduce patient deaths. That unfortunate and rare situation, where a patient dies could that actually be avoided, if you use capnography.

Luckily patients don't often die during a procedural sedation, so it's actually quite a rare occurrence and it's so rare that it's quite difficult to do a big enough study to actually capture that effect happening - so you would need have a lot of patients in the study in order to answer that question and we calculated it was more than 26,000 patients that would be needed in the study - actually, I think, it's in each arm of the study, so an enormous randomized control trial you have to do, if you really want to prove that capnography prevents patient death.

But, there is a technique you can use, where you pool the data across lots of studies and try to see if that gives you enough study power to answer your question. And, we did find some answers. It still doesn't quite show us that it avoids facing death - it still wasn't big enough, in terms of what we found, but we do see very consistently that capnography detects respiratory compromise and avoids - both significant and less severe oxygen desaturation - so it certainly is useful for avoiding de-saturation, whether it's minor or major.

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Wong:

As you mention, having enough power to the study could possibly mean that you'd have two groups of patients and run into the moral dilemma of monitoring some, but not monitoring others and allowing the others to perhaps suffer an adverse event or even death, because they weren't monitored, so that could create that moral conundrum when you do that.

Lightdale:

That certainly could be. The other thing that's fascinating about sedation research is - you cannot and you should not tell the providers not to intervene, if they're worried for the patient - so, inevitably if the patient is experiencing respiratory compromise and now is going on to become more unstable from a cardio-respiratory standpoint - appropriately, clinicians now intervene so they literally rescue the patient before the outcome of interest occurs, which is totally appropriate, we want them to do, but it really is quite hard to find that outcome of interest. In fact you don't find it as you just pointed out.

Wong:

I guess maybe the goal really should be - have you been able to reduce the severity of the adverse events that have occurred. I often hear from hospital executives that say "Oh I don't have a problem with respiratory compromise, insufficiency and death. An event has never occurred on my watch." Then, I sort of ask them, "So how much narcan do you guys use at your facility?" They'll obviously know that answer and that seems to indicate some kind of issue may be occurring at their facility in terms of making sure that their patients are safe, while opioids being administered.

Lightdale:

Right, that's exactly correct, and actually the correlate in our study was we looked at how often bag mask ventilation needed to be used. So, it wasn't the administration of narcan, but we were looking to see whether there was ventilatory assistance using a bag mask approach. And, we found that use of capnography was associated with significantly decreased use of bag mask ventilation. So, you aren't needing to rescue the patients as often, because you're picking up that respiratory compromise sooner and you're intervening much sooner probably by just either titrating your medication or asking the patient to take a deep breath at a critical moment.

Wong:

Yet, when I think about, the adoption of pulse oximetry there hasn't been a study that's shown that pulse oximetry would reduce patient deaths. So, then is it just a matter of time before capnography is more broadly used in adopted?

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Lightdale:

I think so. It is always an issue of supply and demand in terms of dictating the cost - again one of the big barriers - and I think the more that capnography is simply built into a monitor and it's very easy it, it'll be something people more use. Frankly, as you have new generations of physicians coming along and they have become educated and expect to use are looking after measures of ventilation rather than just measures of oxygenation, I think you'll have some change. But, it is a thing that people still are reluctant to realize how lucky they are every time they perform a procedure and it goes very smoothly or they rescue the patient at an early moment. Could they have rescued them even earlier probably and convincing of them of that is actually quite difficult.

Wong:

Now you mentioned earlier that you're a pediatric plumber. And obviously there's a lot of procedures where you're dealing with pediatric patients - they may find the procedure uncomfortable or are anxious about the procedures - which seems to be or is perceived by patients and their families as something routine and not having any possible adverse events. Why should we not just consider it a minor surgery and not be concerned with it?

Lightdale:

I think it's pretty clear that there are risks involved in administering - I'm always very clear with my patients that those are the risks. I'm most concerned because, frankly, from a frequency standpoint, they are more likely to encounter some issues related to respiratory compromise. Also, the stress on the body that can cause them to experience a complication. So, I certainly want the patients to understand that there are risks involved with sedating a child. A child is often not interested in having the procedure done, so we are certainly looking to achieve control over them from a willingness to undergo the procedure perspective quickly and we wind up using bigger doses than people expect. Children actually metabolize some of these medications a lot faster, so we have to be prepared that we may need to give them more sedative than we would expect. We're always having to walk that fine line of giving enough sedative to help the child to go through the procedure safely, but not so much sedative so that we now create complications.

Wong:

So, why do you think it's difficult to predict how a particular patient will react to when they receive an opioid?

Lightdale:

That's a great question. I've been looking a lot at various sedatives recently over the last couple of years, because the FDA and the NIH and some scientists have really drawn our attention to

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the fact that sedatives are doing things that I don't think we haven't realized they were doing. So, they're actually maybe neurotoxicity involved with using a lot of sedatives. With opioids in particular, my own theory was I used to say people are wired differently. Now, I really realize that it's more about the fact that everybody has a different number of opioid receptors. They may be genetically programmed to upregulate or downregulate those receptors in different ways. And their sensitivity to opioids may really be determined in some genetic way that we don't fully understand or even congenital way. So something about them dictates how the opioids are going to work. Since we don't really know exactly how opioids work to begin with, it's really extraordinary that we are still able to use them on a regular basis to get what we want, which is the patient to be cooperative during the procedure.

Wong:

And, then, it sounds like it's exacerbated by the fact that you're dealing with children, versus an adult, where I guess most dosages for opioids and sedatives are based on adults and need to be adjusted to the pediatric patients.

Lightdale:

Exactly, exactly, we definitely have to be prepared to do weight based dosing, but again to titrate to effect.

Wong:

Which puts a premium then on making sure that the anesthesia provider really can recognize the onset of respiratory compromise and can then intervene as quickly and as early as possible during the procedure.

Lightdale:

Yes.

Wong:

So, is continuous patient monitoring like the last resort? I often think of it as the canary in the mine shaft used as an indicator of methane and carbon monoxide. Should all patients receiving sedation be monitored or just those that are undergoing moderate to deep sedation?

Lightdale:

So, I think an unequivocal "yes" - all patients receiving sedation should be monitored and all medical guidelines at this point are pretty clear that that is the case. So, there really are almost no levels of sedation, certainly in pediatrics, where you shouldn't monitor a patient. I worry that this guideline is not as easily recognized as applicable in some private office situations and

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some of those go beyond medicine. So, in particular, we do worry about sedation in dentist's office. It's really important that patients be thinking about their child receiving sedation in a dentist's office. At the very least, they themselves should be the continuous monitor of that of that child, even again if it's very light sedation. These are the types of situations out way beyond the walls of a hospital or even an ambulatory surgical center, it's really in a very small office where people may be getting sedation without that continuous monitoring.

Wong:

You're an absolute right. We've dealt with a number of children who have died just having their teeth extracted or undergoing what would normally be considered routine dental procedure and just because they're children, they probably were given more sedatives than an adult. And because the dentist was providing it and also doing the procedure at the same time, there wasn't a second pair of eyes on the child to make sure that he or she was safe.

Lightdale:

Yes and, again, I want to believe that all dentists are doing their best and practicing safe sedation, but what is interesting it's a different licensing board, it's different guidelines and so it's been harder to understand exactly what guidelines they're following.

Wong:

Absolutely So, really again it's that combination of - are you using the right technology and do you have enough personnel on hand to make sure that patients are safe and leave the facility, or in this case the dentist's office, safely?

Any last words of advice you would give to clinicians or hospital executives wanting improve opioid safety in their facility?

Lightdale:

The words of advice that I guess that I would give are around being open to these new technologies, capnography included, which may provide you with early warning. I'm a firm believer in the old aviation safety analogy for medicine. If you're flying an airplane, most of the time you get on at your point of departure and you land at your point of arrival - and there was no problem - but you would be open and I think all of us would be open to a new dial, a new technology in the cockpit that would help us to recognize the trouble is coming and to see that way before the trouble actually happens and give us a chance to avoid it. And, I would really encourage all clinicians and hospital executives to be open to the fact that what we in medicine have that possibility too. These new technologies are here and more are coming, and we should be open to exploring them and certainly to incorporating them in our guidelines when they've been proven to be helpful.

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Wong:

That's great recommendations and advice. So, thank you so much for joining me on this podcast and hopefully clinicians and hospital executives out there will listen to this and implement capnography in their own facilities or other patient monitoring devices that may yet be to be produced in and sold in the market. So thank you so much for joining me on podcast.

Lightdale:

Pleasure, thanks for inviting me.

Wong:

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