Cath Lab Digest

A product, news & clinical update for the cardiac catheterization laboratory specialist

PERIPHERAL INTERVENTIONS

The Use of the Highlander™ 014 PTA Balloon Dilatation Catheter in the Treatment of Peripheral Artery Disease

CLD talks with Vishal Kapur, MD, FACC, FSCAI, RPVI.

What are some of the challenges of treating peripheral artery disease (PAD), particularly below the knee?

PAD is an underappreciated and underdiagnosed disease. It is considered as a coronary artery disease equivalent and hence warrants importance, especially in those patients who have critical limb ischemia (CLI). CLI patients have a significantly higher chance of amputation and of those patients who undergo amputation, half usually die within a year.

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Happy Cardiovascular Professionals Week!
February 11-17, 2024

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Do We Need to Withhold Jardiance (SGLT2 Inhibitors) or Ozempic (GLP-1 Agonists) Before Cardiac Cath?

Dr. Morton Kern with Drs. David Cohen, Kirk Garratt, Spencer King, Neal Kleiman, Srihari Naidu, Matthew Price, Steve Ramee, Chet Rihal, and Bonnie Weiner.

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Crossing Severely Stenotic and Tortuous Complex Lesions With Ease — Two New Devices Facilitate Successful Outcomes

Eric A. Secemsky, MD, MSc, RPVI; Killian J. McCarthy, MB BCh BAO

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PATIENT CARE

End-Tidal CO_2 Monitoring for Respiratory Adverse Events During Procedural Sedation: An Additional Layer of Safety

CLD talks with Arnold H. Seto, MD, MPA, FSCAI.

In today's cardiac catheterization laboratory environment, why is end-tidal CO_2 monitoring becoming more important?

End-tidal CO_2 ($EtCO_2$) measures the level of carbon dioxide that is released at the end of exhalation. Since the exhaled CO_2 is much higher than the level in ambient air, $EtCO_2$ is a sensitive marker of ventilatory effort, much more so than pulse oximetry, which might only decline several minutes after apnea occurs.[1]

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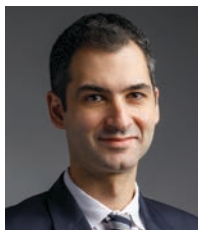
CALCIUM CORNER

A Physician's Perspective on New Permanent Reimbursement Pathways for Coronary Intravascular Lithotripsy

CLD talks with Yousif Ahmad, BMedSci, BMBS, MRCP, PhD, FSCAI, FACC.



How did the previous, temporary reimbursement pathways impact intravascular lithotripsy (IVL) utilization within your practice?

The previous IVL codes were temporary pathways as part of a breakthrough technology designation from Centers for Medicare and Medicaid (CMS). The two pathways were New Technology Add-on Payment (NTAP) or Transitional Pass-Through (TPT). These codes were helpful in that they allowed IVL technology to reach the market and allowed the cost of the device to be accounted for. You weren't losing money by using IVL, so the previous codes were very beneficial from that perspective.

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End-Tidal CO_2 Monitoring for Respiratory Adverse Events During Procedural Sedation: An Additional Layer of Safety

CLD talks with Arnold H. Seto, MD, MPA, FSCAI.

$EtCO_2$ can be measured mainstream (ie, through an endotracheal tube), sidestream (through specialized nasal cannula), or via Microstream™ capnography, which uses Molecular Correlation Spectroscopy™ (MCS) for better precision and can overcome some of the delays in signal that occur with sidestream monitoring.

At present, we are seeing significantly greater attention being paid to both quality concerns and complications of sedation, with accompanying regulation. Within the Veterans Affairs (VA) system, anesthesia has 'highly recommended' all moderate sedation procedures incorporate $EtCO_2$ monitoring. Historically, most cardiac catheterization labs have not had $EtCO_2$ or haven't felt the need to monitor $EtCO_2$. Improved equipment, including better sidestream and Microstream™ capnography monitoring of $EtCO_2$, has helped. We have an $EtCO_2$ system that is integrated into our hemodynamic system and it is more common now to find hemodynamic systems with the ability to integrate $EtCO_2$.

In the catheterization (cath) lab field generally, we are seeing more procedures moving out to ambulatory surgical centers (ASCs), especially in states like Arizona, Nevada, and Texas. In the ASC environment, you often don't have the protection of respiratory therapy or possibly anesthesia. As a result, strict attention to quality, monitoring, and safety is heightened in the ASC setting. Something can always go wrong in the cath lab. If a complication should occur, it is crucial to show that everything possible was done to help the patient and all capabilities were present, especially when working in a less traditional environment. This might mean a facility without cardiac surgery, or in the case of an ASC, in a cath lab without full hospital capabilities. Therefore, within an ASC, it is even more important to have $EtCO_2$ monitoring available.

Has the cath lab patient population become more acute or sick in general?

We are seeing patients that are older and the procedures we do in these older patients can be more complex. In my environment, nurse managers and quality managers are taking a high interest in patient safety, which is an interest I also share. $EtCO_2$ monitor technology has overcome the initial phase where it was just an annoying alarm that no one knew what to do with. My present monitor instead shows me a ventilatory waveform and an $EtCO_2$ number, and my staff alert me when it flatlines or goes to '0'. $EtCO_2$ can help detect signs of respiratory compromise and when a patient is starting to decompensate, and certainly earlier than with pulse oximetry.[1] I do deep sedation procedures in my cath lab, including the use of propofol where $EtCO_2$ is a must. The $EtCO_2$ monitor draws your attention and alarms so that you do not have to rely on unreliable chest movement to indicate breathing.

The RespArray™ patient monitor (Medtronic) is safety made simple with an all-in-one monitor designed for procedural sedation, including in electrophysiology and cardiac catheterization laboratories.

Can you tell us more about your team and monitoring protocols around sedation?

Anesthesia is not involved for mono-sedation unless there is a complication. Nursing administers the medications under our orders and monitors the patient's airway. Everyone in the cath lab should be monitoring the patient's vital signs and $EtCO_2$. In addition to pulse oximetry, we also monitor the electrocardiogram and vital signs, which can all remain stable when the patient is oversedated. The first thing that will happen is that the patient will stop breathing. Everything can then go downhill very quickly. An $EtCO_2$ monitor allows for an early warning and increased reaction time. Like anything, the earlier you know about the problem, the faster and easier it is to resolve, and the easier it is to avoid a potentially catastrophic complication.

How and when are patients being assessed for risk prior to the procedure?

For all moderate sedation procedures, we ascertain the patient's Mallampati class. We are seeing more patients with obesity and sleep apnea, the condition most addressed with $EtCO_2$ monitoring. We make an assessment prior to the procedure of their weight, airway, and whether they are already on continuous positive airway pressure (CPAP) for sleep apnea. $EtCO_2$ gives us the confidence to take even these patients for moderate sedation, even without anesthesia backup, because we can watch and see when they have been oversedated. The good news is we don't tend to oversedate with most cath procedures, especially with the radial access revolution. While lower doses of sedation are typical, sometimes longer procedures will require increased sedation. We also will see unique patients that are hypersensitive, such as heart failure patients who tend to stack their doses because of the delay in onset of medication for the sedation. If someone gives an extra dose of sedation within 2 minutes of another dose because they didn't have the desired effect, then before you know it, the patient can become oversedated. The American Society of Anesthesiologists (ASA) scoring and the Mallampati classification don't necessarily reflect the patient's full risk of obstruction. The Mallampati classification may be more useful in determining risk, but there are certain younger or thinner patients whose airway can look unobstructed, but then they have a floppy tongue, relax, and needed CPAP anyway. Obtaining a history of any obstructive sleep apnea (OSA) is helpful. It would be useful to announce during the time-out session that the patient has sleep apnea and could benefit from a lower level of sedation. With radial artery access, using minimal sedation or anxiolysis is an option. I typically will give 1-1.5 mg of Versed and can be done with a diagnostic heart cath in 5-15 minutes, and then the patient goes home. In the cath lab, we have this bifurcation of low risk patients that are easy to treat in quick procedures, and then there are the complex percutaneous coronary intervention (PCI) and structural procedures, accompanied by a rise in the amount of patients with OSA.

How does the increase in structural heart procedures such as transcatheter aortic valve replacement (TAVR) affect the need for EtCO2 monitoring?

For TAVR, the field is increasingly moving to the use of moderate sedation and away from anesthesia, because anesthesia tends to add time to the procedure. As many as 80% of TAVRs have moved away from using transesophageal echocardiography (TEE),[2,3] which requires general anesthesia. More and more operators are doing TAVR in patients under moderate sedation.[3] Many hospitals are still doing monitored anesthesia care, which essentially is moderate sedation, only as given by the anesthesiologist, and it can be more powerful. The capability of monitoring EtCO2 is standard in all operating rooms and with the increase in structural heart procedures, you certainly want that capability in your cath lab as well. We even thought about having anesthesia gases piped in, because with the increase in electrophysiology ablation procedures, we want to make it easier for anesthesia to come to the cath lab. Instead of wheeling in a cart with their gases, anesthesiologists could just hook up to the lines. Increasingly, the cath lab is becoming more like an OR, and EtCO2 monitoring is definitely part of the OR.

An end-tidal CO2 monitor allows for an early warning and increased reaction time. Like anything, the earlier you know about the problem, the faster and easier it is to resolve, and the easier it is to avoid a potentially catastrophic complication.

What do relevant guidelines have to say about continuous capnography monitoring?

The Society for Cardiovascular Angiography and Interventions (SCAI) has ASC guidelines[4] and EtCO2 monitoring is now part of SCAI guidelines for PCI without cardiac surgery support.[5] Guidelines address the overall support in the facility, but ultimately, in America, sedation is regulated locally by anesthesia departments. Recommendations tend to be similar to my anesthesia department in the VA nationally, where EtCO2 monitoring is highly recommended because it is part of the standard of care.[6] Anesthesia always monitors EtCO2 because pulse oximetry is just too crude and too slow to respond to oversedation. All anesthesia recommendations will have EtCO2 monitoring as a recommendation, at least for sedation procedures, which will guide an increased uptake of EtCO2 monitoring. No anesthesia departments have required it yet, to my knowledge. However, EtCO2 monitoring is highly recommended in the highly litigious healthcare environment in which we live, especially if you are already pushing the envelope in terms of the setting where these procedures are done. For example, my hospital doesn't have cardiac surgery backup. If you are working in an ASC, you can expect heightened scrutiny and should have everything necessary to defend against any complications that may occur.

What is important to communicate to staff about the use of EtCO2 monitoring in the cath lab?

You will need to inservice staff on the particular machine that you are bringing in for EtCO2 monitoring. The intensive care unit (ICU) historically does not measure EtCO2, so the general ICU level nurse that works in the cath lab may not be familiar with EtCO2 unless they were exposed to it previously. Staff should learn how to read the machine and how to understand that the flat line of the machine may indicate apnea as a warning sign to apnea. It still requires you to look at the patient and see if they are talking, or moving and breathing, because sometimes the sidestream monitor is not in line. It is not through the endotracheal tube. The patient can breathe around it, and so there is a delay between the tubing and the exhalation. That delay can reflect an apnea that is not present. It is instead a warning to look at the patient to make sure that they are still breathing or breathing adequately. It is also important to try to avoid using the extra-long tubing. If at all possible, the sensor should be placed close to the patient. It is important to know general airway management. Every nurse in the cath lab should know how to keep the airway open. The patient's jaw thrusts forward and needs to be held open. The vast majority of our patients are overweight or obese, and patients with sleep apnea are probably the key population where EtCO2 monitoring will be most helpful.

What should you do if a patient has chest rise, so they are ventilating, but the capnography monitor says that the patient is experiencing apnea, meaning there is likely some sort of airway obstruction?

Looking at the chest wall rise is important, but as you note, someone may move their chest wall while still being obstructed. In this case, capnography can be a better indicator of obstruction. The EtCO2 monitor measures these deep, forceful breaths that are very helpful in respiration. If there is a conflict between what you are seeing with the chest wall rise and the EtCO2 monitor, as an intervention, I suggest opening the airway prophylactically, if the patient is not awake, and seeing if the monitor improves. If you can wake the patient up and they start breathing and talking, then they have opened up their own airway. What you don't want to do is wait for 2 minutes, see the oxygen saturation drop, and then start to react, because then you have ignored the signal.

If a cath lab is interested in adding capnography monitoring to their procedures, what do you recommend?

Many of the cath lab hemodynamic monitoring systems have enabled incorporation of EtCO2 monitoring into the timed cath lab record. The first step is to ensure your system has the correct modules enabled and to find an EtCO2 monitor compatible with the system. Then add the disposable cannula to your supplies. Ensuring that EtCO2 is integrated into your usual monitoring system workflow will avoid headaches. Compared to other things in the cath lab, it really isn't expensive, and it will make your patients safer and your procedures smoother. ■

Scan for further reading suggestions regarding end-tidal CO2 monitoring and to read Dr. Seto's interview online:

This article is sponsored by Medtronic. Dr. Seto is a paid consultant for Medtronic.

Microstream™ capnography monitoring system should not be used as the sole basis for diagnosis or therapy and is intended only as an adjunct in patient assessment.

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