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VOICE OVER:

Welcome to ASA Central Line, the official podcast series of the American Society of Anesthesiologists, edited by Dr. Adam Striker.

Welcome to ASA’s Central Line, the official podcast series of the American Society of Anesthesiologists, edited by Dr. Adam Striker.

DR. STRIKER:

Welcome to Central Line. I'm your editor and host, Dr. Adam Striker. Today, I'm joined by two esteemed anesthesiologists. Dr. Jeffrey Feldman is a professor of clinical anesthesiology at Children's Hospital of Philadelphia and UPenn's Perelman School of Medicine. And Dr. David Hovord is assistant professor of clinical anesthesiology at the University of Michigan. They're with me today to discuss the topic of low flow anesthesia. And so welcome to the show, both of you.

Before we get started, just a quick note for our listeners. This episode is sponsored by GE Healthcare. I have not been compensated for this discussion, nor have my guests. And we have independently developed this discussion. But we do appreciate the sponsorship from GE to help make our podcast happen.

With that, I'll start off the discussion by asking both of you to introduce yourselves just a little bit and tell our listeners a little about yourselves and describe your relationship with the companies you work with and and how that's relevant to our discussion with low flow anesthesia today.

DR. JEFFREY FELDMAN:

So thanks again for the opportunity to participate this evening. So I've spent time with low flow anesthesia probably since my training in the 80s, and it stems from having a background in engineering and training at the University of Florida, where we had an engineering group. But so over the years it's been a topic of interest. I've had an opportunity to work with Drager in a role as a consulting medical director in the past and
currently doing some consulting with GE, but, you know, have written about low flow anesthesia for a while now. What's nice is that now with the focus on sustainability, there's a renewed interest in the topic. And so it gives us a great opportunity to to dig into the details and really focus on how the technology that we have, the Circle system, which has been around for many decades, is finally being used to effect, which is to to reduce fresh gas flows and conserve anesthetics.

DR. STRIKER:

Dr. Hovord?

DR. DAVID HOVORD:

I'm also glad to, to be invited to, to join in with this discussion. And as you mentioned, I work at the University of Michigan. I'm in charge of our equipment and supplies. And as part of that, I run our green anesthesia initiative. So we're super focused right now on figuring out how to reduce the carbon footprint of the anesthesia agents that we give. And one of the ways that we're focusing on doing that is with low flow anesthesia.

Now, you might be able to tell already that I grew up in the UK and actually did most of my training there, and a couple of years before I left, which was I came to Michigan about ten years ago, we had this new device called an End-title Control installed on our anesthesia machines. And when I came to Michigan, we had the same anesthesia machines but couldn't find the setting anywhere. And I spent a long time playing with the machines, trying to find it, and come to find out that End-title Control has only recently been introduced in the US market by GE because of delays in FDA approval. So I've worked with GE, I'm doing some consulting work for GE, and we've also installed End-title Control at the University of Michigan. But I think this topic, as Jeff says, is really important now as we're all starting to think about sustainability and the impact of our daily activities on the planet.

DR. STRIKER:

Let's start with the basics for our listeners. Dr. Hovord, can you share what a working definition is of low flow just so everybody is on the same page with their understanding - - what it is, what it isn't?

DR. HOVORD:

Yeah. So you know, if you think about the currently available flows on an anesthesia machine, you can range from 15l, which is most people would consider high flow, all the
way down to a closed system where you're just replacing oxygen consumption, which could be as low as 150 CCS a minute. And that's a 100 fold difference between the two. So most people, I think, would probably agree that the definition of low flow sits somewhere between the two, probably towards the lower end and around one liter a minute right now would probably be the universally agreed definition. At the University of Michigan, we would consider low flow or the low flow we aim at with our technological solutions to be 500 CCS a minute. Previous studies have put that as ultra low flow. I'm not sure that the tag really, really helps. I think the key is to learn how to go with lower flows safely and figure out where that is for you or your institution, depending on the technology that you have available to you. Probably the best kind of low flow is something that's lower than you're doing at the moment. But I think one liter a minute is a good place to aim at if you're starting this journey.

DR. FELDMAN:

Another little footnote to. David's discussion of the definition. You know, we were involved in launching a course on low flow last year through the APSF that's available now on the website as well. When we thought about the definition of the course, we recognized that people tend to focus on individual numbers, but the reality is to safely and effectively deliver anesthetics and oxygen, that number may change at different times in the anesthetic. For example, during induction, one liter per minute may be too low to achieve a safe and effective anesthetic. Nonetheless, there is a reduced flow below minute ventilation that will be more environmentally responsible. And so as you think about your practice throughout the continuum of induction emergence, there are different settings for low flow that would be good choices but may not be a particular number. And learning how to do that is part of the art.

DR. STRIKER:

Do you mind telling us a little bit about the history of low flow? How far back does this go and how has it evolved over time, the concept?

DR. FELDMAN:

It's interesting that it goes back almost 100 years now to the work of Ralph Waters. He was the first to really didn't introduce CO2 absorption per se, but he built on work that had been done in the lab to make it a clinical tool for conserving anesthetics. And so he really built the first rebreathing system, the to and fro canister around CO2 absorbent, which allowed him to reduce the amount of flow and anesthetic that he introduced to achieve a safe anesthetic. And his accomplishments are really pretty remarkable because he didn't have an oxygen monitor, he didn't have an anesthetic monitor, yet he
was able to accomplish this for thousands of patients. In the 30s, he published a report of some thousands of patients that he had done using this technique.

And it is interesting, too, that the motivation was a little different back then. There were no scavenging systems, so they wanted to reduce pollution, but it was pollution in the operating room and exposure to the personnel and the operating room. Fast forward today, we have scavenging systems, but pollution is still, still a concern and now it's around the environment. So we've known how to do this for over a hundred years now and it goes beyond the 17 year cycle you talk about from publication to practice, but fortunately we're there now with some really nice technology to support the low flow practice.

DR. STRIKER:

Well, Dr. Horvord, Dr. Feldman just mentioned environment. You mentioned that earlier as well. In addition, what are some other benefits both to patients and the clinicians as it pertains to low flow anesthesia?

DR. HOVORD:

For patients, simply the lower the flow you use, the less heat you lose the gas that comes out of the pipeline or the cylinder is cold and dry. So you lose humidity and you lose heat. So I think they are the two direct benefits to patients. Clearly moving from 600 or 500 CCS a minute probably won't have a big difference in those for the patients. But certainly if you're in the maintenance phase, at least moderately high flows reducing that will certainly have benefits.

One of the questions that we get asked a lot as we're introducing our green anesthesia program in Michigan is, you know, we're doing this for patients or the planet, and it's very difficult to separate the two, really. We're all products of our environment. Patients live on the planet and are affected by the environment that they live in. So there are indirect environmental benefits to patients, whether that is today or whether it's in 20 years time. Guess who really knows.

In terms of benefits for the clinician? Low flow anesthesia is— I think this is one of the reasons that Jeff was kind of alluding to, se've known how to do this for a long time and why don't we do it? I think it's the first thing to go. Doing low flow anesthesia is slightly more complex. It requires you to be more vigilant. It requires you to have a plan to think about what point you're going to reduce the flows and how you're going to do that in a step wise process. However, one of the benefits to reducing flows is that you can
probably use more modern, more expensive anesthesia agents as long as it's not a desflurane. And so I think that's probably the major benefit to the to the clinicians.

Health systems -- they are all pushing for environmental targets to be met. And there's a financial benefit, too, to the health system. If you reduce anesthesia, gas consumption, it may not seem like a lot in the grand scheme of things, but that does exist.

DR. STRIKER:

Spending just a little another minute or two on the environment. Dr. Feldman I think everybody understands that polluting the environment is bad and the more we can minimize that is good. But is there are there more specifics we need to be aware of as it pertains to the environment? And also, as Dr. Hovord just mentioned health systems are a little more engaged. How has that evolved over time? Maybe some specifics about the advantages for the environment and then the desire for health systems to affect that impact and how that's changed?

DR. FELDMAN:

So in terms of the impact on the environment, I mean, we know that the inhaled anesthetics are many orders of magnitudes more impactful in the atmosphere than carbon dioxide is. One of the arguments sometimes is that, well, you know, compared to cars and buses and autos, it's a small fraction. And and certainly there's some truth to that argument. But when you look at the impact in a health system, that's a different story. And some significant percentage of the total health system impact seven, eight, 10%, something like that was just from anesthetics alone. So in the overall scheme of a health system's impact on the environment, certainly the inhaled anesthetics play a role.

And then clearly the health systems are are thinking about this. And it is interesting in this country that it's not an economic driver as much as recognizing that the health systems have a big impact on the environment and trying to play a more responsible role.

The other comment I would make in terms of the individual provider and their role in this is that I think most people in this country recycle -- cans, paper, things like that on a regular basis. And if any one of us stopped recycling tomorrow, well, maybe it wouldn't matter so much in the scheme of the environment. But if all of us stopped recycling tomorrow, now you're talking about an impact on the environment. So, you know, I think as we think about our individual role in in environmental responsibility, you know, it's the collective efforts of large groups of people over time that really have an impact. And I think that's where we have an opportunity in anesthesia, you know, that any individual
anesthesia provider, you know, in the course of their career, they're going to do tens of thousands of anesthetics. And does it matter in any one anesthetic? Probably not so much. But when you multiply it over their whole career and then you multiply it by the number of anesthesia professionals, now you're talking about a substantive impact, not different from the other things we do to try to protect the environment in our lives as individuals.

DR. STRIKER:

Well, great. Well, have more questions for both of you. So if you don't mind staying with me just through a short patient safety break, that'd be great.

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DR. SCOTT WATKINS:

Hi, this is Dr. Scott Watkins with the ASA Patient Safety Editorial Board. Medication errors remain one of the greatest threats to patient safety in the operating room. Anesthesia providers often recognize drugs by the size, color or shape of the packaging and use standard colored labels to designate classes of drugs. For this reason, look alike, sound alike. Medications are one of the leading contributors to medication errors in the operating room. Strategies to prevent errors from look alike sound alike drugs include arranging drug trays so that look alike sound alike. Drugs are separated. Use of color coded labels with tall man lettering. Use of pre-filled medication Syringes. Using technology to scan barcodes and or vials. And using generic rather than brand names. Finally, no discussion of safe medication practice will be complete without a reminder to always observe the five rights, the right patient, the right drug, the right dose, the right time and the right route.

VOICE OVER:

For more information on patient safety, visit asahq.org/patientsafety22.

DR. STRIKER:

Well, Dr. Feldman, let's pick up where you left off. You're talking about how low flow anesthesia can infect not only the environment as a whole, but how the individual practitioners can contribute to that difference. Because I do want to ask about patient safety. And I think that when we discuss a lot of changes in practice as it pertains to anesthesiology, patient safety always comes first. We would all agree with that. But I
also feel that's kind of that last hurdle that oftentimes people can't get over when it
comes to their individual practice, when it comes to practice change. And many times
for good reason. Anesthesiologists are they're very good at individual patient safety
issues. And I think it's an important topic as we discuss these kinds of changes
from what we're all used to and specifically low flow anesthesia. So what are the safety
concerns and what strategies should our listeners be aware of?

DR. FELDMAN:

Yeah. So it's a great question and it's certainly a paramount consideration. It's one of
the reasons that the low flow course came out of the Patient Safety Foundation because
we wanted to play a role in promoting that practice, but at the same time ensuring that
it's done in a safe fashion. And so, you know, what are those safety barriers? So people
are concerned about inadequate oxygen supply to the patients, obviously a major safety
concern. People are concerned about inadequate anesthetic levels, which certainly a
major safety concern. You don't want to have a patient be aware or inadequately
anesthetized. And then another barrier relates to the Sevoflurane packaging. And we
can talk about that in a few moments if you like. But with regards to oxygen and
anesthetic concentrations, the wonderful thing now is that it's pretty standard on
anesthesia delivery systems to have an oxygen monitor. That's been true for decades.
And an anesthetic concentration monitor is also pretty much routine now. So you have
the ability to now practice in a more refined fashion, if you will, or certainly more
environmentally responsible fashion and use those monitors to help guide your practice.
So they're not just threshold monitors to make sure you're not below a certain safe
threshold, but they're actually your friends or your partners in practicing low flow
anesthesia safely and effectively. And, you know, as we've emphasized repeatedly in
the course that we put together, you never want to put any patient lower flows where
you're all at all uncomfortable doing so from a safety consideration. By the same token,
then you learn the techniques and you learn how to use the bedside monitors, it
becomes really a pretty comfortable practice and a very satisfying practice and also
ultimately a very safe practice.

DR. STRIKER:

Well, let's go ahead and let's take the opportunity now to talk about the Sevoflurane
issue. I'm not sure all our listeners are familiar, but let's delve into it for a minute or two.

DR. FELDMAN:

So Sevoflurane, if you look at the package insert, the FDA required labeling, which was
last updated in 2002 or 2003. It has a minimum fresh gas flow recommendation for
sevoflurane. And the specific language is not less than one liter per minute for up to two mach hours and otherwise not less than two liters per minute. And my impression in talking to even a lot of the residents that rotate through where we are is that many practitioners really try to stick to that two liter per minute lower threshold when they're using sevoflurane, which is, you know, it's a reduced flow, but certainly not as low as you could get to be a little bit more environmentally conscious or effective with your flows. So this package insert becomes a barrier, but in fact it's really a medically obsolete recommendation. It goes back to compound A, which is produced when sevoflurane interacts with carbon dioxide absorbents. And so the FDA requirement was to try to protect patients from exposure to compound A. It turns out that Compound A is not indeed toxic in humans, even though there was some renal toxicity in animals. And furthermore, we've learned what carbon dioxide absorbent formulations produce Compound A and many that are commonly and routinely used have limited the amount of strong base and will not produce compound A. So not only don't you have to worry about it as a toxic item in your patients, but if you're using many of the modern absorbents which are commonly used, it's not even produced and you can really use any flow that you want very safely with sevofluorane. And that's indeed the recommendation from the APSF is that there isn't a lower limit of safe flow for sevoflurane use to any more today.

DR. STIKER:

Well, do you think the adoption of the newer CO2 absorbents was one of the key factors in perhaps adopting low flow anesthesia on a larger scale as we’re seeing it more now?

DR. FELDMAN:

I don't know if it was an important factor. Certainly if you look at the marketing of a lot of those absorbents, they are marketed as low flow absorbents or reduced flow absorbents. You know, that's often in the language, in the marketing language. And so it recognizes that change in formulation. And I do think it’s, it is a way to help people become comfortable using low flows once they understand that it's not going to produce compound A, they're using that particular absorbent. It removes another barrier and helps increase that comfort level. If you look at the definition of low flow anesthesia that we put together for the course, provider comfort is an element of that definition. So we really never want people to operate at flows lower than than they're comfortable with.

DR. STIKER:
Well, Dr. Hovord, the hospitals and clinicians know they have a flow rate issue. How do you monitor and quantify this problem within your own organization or your health system?

DR. HOVORD:

That's a really good question. I mean, no one comes into work thinking, you know, I'm gonna, I'm gonna I'm going to use all the flows today, You know, I'm gonna see how high I can push it. And think that probably most individual clinicians, you know, don't think that they have a flow rate issue. But think when you look at the data and think this comes to the second part of your question about how you figure this this out really think you have to get the data. And what we've done at the University of Michigan is create a whole series of dashboards. And it's specific to to anesthesia flow. And we've divided that into flows during induction and flows during the maintenance phase. Just to reiterate, you know, the point that Jeff made earlier about low flow, depending on the phase you're in. And we do focus a lot on flow during the maintenance phase. That's the time that we spend the longest time in. But actually, if you start your anesthesia off by pre oxygenating at 15l a minute and then you leave it up there for ten, 20 minutes afterwards with a sevofluorine at 2 to 3%, it will it will make going low flows in maintenance phase largely pointless. So I think that's one of the things that we've impressed on clinicians is that is to look at the manufacturer guidelines for the correct flow for Preoxygenation and the machines that we have at the University of Michigan, it's eight liters a minute. So we've done small things to try and help providers do the right thing by making sure that the machines turn on to eight liters a minute, which is exactly where they should be to achieve decent preoxygenation. And then what we do is we collect data on flow rates during these various phases and we email monthly feedback to clinicians along with a whole bunch of quality indicators. And we do that via the mpog collaborative, which is a data collection club which collects data from hospitals and provides dashboards on on a whole range of quality indicators and low flow anesthesia and environmentally friendly anesthesia is one of them. For the maintenance phase. What we've done is we've introduced End-tidal Control software, which is I think only available with GE in the US at the moment. There are other manufacturers in other countries which have similar technology and software. But what that does is allow the clinician to set the desired end tidal agent and end tidal oxygen concentration. And the machine then achieves that with the lowest possible flow rate that it can. And you can set the default minimum flow rate that you like. And at the end we set that at 500 cc's a minute. We're also encouraging providers to use sevoflurane, just to echo Jeff's point about there being no lower limit with Sevoflurane, and we consider that to be a safe practice. And I think it is a shame that this compound A story has persisted for so long because I think it really has limited the adoption of Sevoflurane and Sevo is the most environmentally friendly anesthesia agent in terms of its CO2 emissions, but also the
fact that it doesn't have any impact on the ozone layer, unlike Isoflurane, which because it has a chlorine atom in it, interacts with ozone and contributes to the hole in the ozone layer and the breakdown of ozone. So I think there's two reasons really there to for us to think about sevoflurane and be confident that we can use it at low flows.

One thing I think that is important to note and again to echo Jeff, we don't encourage providers to go to 500 cc's a minute if they don't have the End-tidal control software on their anesthesia machine. Not all of the machines have it yet. We're still in the process of rolling it out and provider comfort is really important and especially the educational level of the provider. So if you've got a new resident, it's not an additional stressor that you really want to put on a very junior resident at that point. So it's very important that safety does come first and that providers do what they're comfortable doing. And one of the ways in which you can become more comfortable with low flow anesthesia is to learn more about it.

DR. STIKER:

What do you think the current behavior is stemming from when it comes to using higher flows routinely? Is it just that current anesthesiologists learn that in their training and haven't been able to break the habit? Or is it this worry because they don't maybe know all the details and they don't want to worry about it, so they're just going to so they don't have to think about it, use higher flows. I'm just curious to hear what you both think about why as that behavior persists of using more flow than is necessary, why that is.

DR. HOVORD:

Yeah, I mean, it's a good question and I think it comes to the root of why what what our motivations are to do anything really. I think they're probably the direct issue is that the majority of patients, when you wake them up, whether they've had a low flow anesthetic or a medium or a moderate or a high flow anesthetic, they kind of look the same. And, you know, the patients don't wake up any better if they've had a low flow anesthetic. I mean that's a sweeping generalization. But I think there's a perceived lack of benefit to the patient. And, you know, there are two concrete benefits that we can pin down quite comfortably in terms of humidity and heating and then this massive indirect benefit to the environment. But I think providers see it as adding complexity to their anesthetic. I think it's probably the first thing that goes when providers are worrying about one aspect of an anesthesia being complex or having a particularly complex series of patients, and there's an education gap as well. And like all of these things, I think one of the other similar kind of fields would be with training for monitoring or neuromuscular monitoring under anesthesia. Everyone kind of knows it's important. We sort of know how to do it. But doing it every day requires habit forming and it requires reinforcement and it
requires a lot of education to the providers that you're working with daily and with the lack of perceived immediate benefit to the patient. I think that's one of the barriers, the barriers that we're trying to overcome.

DR. STIKER:

Dr. Feldman, what about you?

DR. FELDMAN:

Yeah, I think, you know, David makes a lot of great points. And just to add a couple of other considerations. So there's a great quote in a book by Ernst and Lowe on closed circuit anesthesia. It's kind of the Bible of closed circuit anesthesia. But in that book, they say something to the effect that if every anesthesia provider had to pay for anesthetic agents out of their own pocket, they would all use closed circuit anesthesia. And indeed, there are practices where providers do pay for their own anesthetics. And in point of fact, some of those places I've talked to use quite low flows as a result. So, so they, they have a personal motivation, but that's not typical in most practices. And I think, you know, part of it just comes down to people become or we all become victims of our training in a sense. And when you're using high flows, it is much easier to manage concentrations in the circuit. So if you think about it, there's really three concentrations of, say, anesthetic or oxygen in the circuit. There's what's delivered in the fresh gas flow, there's what the patient inspires, and there's what the patient expires. When your fresh gas flow is at minimum minute ventilation or above, that is there's no rebreathing, then you're delivered and you're inspired concentrations are the same. So what you dial on the vaporizer or what you dial in the flow meters is going to be reflected in the inspiratory limb in the circuit. As soon as you reduce your flows below minute ventilation, now there will be a difference between your delivered and your inspired that you then have to manage. And it becomes pretty intuitive after a while. But it it's not quite as straightforward as as using those high flows and I think that may be a factor as well.

DR. STIKER:

Yeah, certainly it makes perfect sense. You know, the other question I wanted to ask you both before we wrap up is you're both well versed in this topic. How do you both perceive the future of volatile anesthetics in the field of anesthesiology?

DR. HOVORD:
Future volatile anesthetics: we've at the University of Michigan have taken no position on the environmental benefits of volatile anesthesia versus Tiva. Total intravenous anesthesia certainly has environmental benefits in that it doesn't produce any direct, you know, CO2 emitting gases. I mean, it's very difficult to tease out, to be honest. What is the environmental cost of manufacturing, transporting, disposing of Propofol. But I think it's pretty clear that it probably is an order of magnitude better than doing the same for most of anesthesia gases. I don't think, though, that we can just ask clinicians to wholesale move to Teva. I think that volatile anesthesia is going to have a significant place in anesthesia practice going forward. It has for a long time, but I do think it's incumbent on us to use the least harmful version of it. And at Michigan, that is going to be sevoflurane with End-title control, with education around the maintenance phase and reducing the usage of that entirely. And I think that's probably going to be the future across the board really. I think that continuing to use the most polluting agents like Desflurane and nitrous oxide, I think that's going to be very difficult going forward. I think Scotland just made Desflurane illegal, which seems like a big step, but I suspect that no one in the UK is really using desflurane much anymore anyway. Which is why they took that step. I think tevos going to play a bigger role going forward. But I think that we will still see significant usage of anaesthesia going forward in the future.

DR. STIKER:

Dr. Feldman, you have anything to add to that?

DR. FELDMAN:

Yeah, I guess just a couple of quick thoughts. I mean, I certainly agree with David that both inhaled and intravenous anesthetics are going to be around for a while. I practiced pediatric anesthesia and, you know, inhalation anesthesia is certainly very embedded in pediatric practice for the foreseeable future. And I think the relative environmental impact of both of those techniques I think is still arguable. You know, there's this notion out there that maybe Teva is environmentally better, but when you look at the total life cycle of both, I think it's unclear. You know, the pharmaceutical agents are in our drinking water. What's the impact of that? You know, I just don't think we know. And ultimately, I think we want to be comparing a very effective, environmentally responsible practice using each of those agents to one another to see if if there really is a difference or not. And I'm not sure there is if we're if we're really practicing as responsibly and effectively as we can with each of them. And we're not doing that across the board yet.

DR. STIKER:
You know, this brings me to one other question. I don't use desflurane because, like you, Dr. Feldman, I do pediatric anesthesia and I just don't end up using desflurane much ever. But I am curious because I know it's because of the greenhouse gas potential, it has really fallen out of favor. It's an expensive drug. One question I've always had about the decrease in usage of Des is: we only have three currently used volatile agents right now. What are your thoughts on taking that that one tool away when we have such minimal amounts? And I'm not trying to defend Des in any way, but I am just curious to hear your thoughts on eliminating one volatile agent from our armamentarium. And I imagine there's probably anesthesiologists out there that that feel this way. So I think it's worthwhile to ask the question. Let's start with Dr. Hovord again.

DR. HOVORD:

Yeah. So, you know, I was pretty much responsible along with our leadership team, for removing Desflurane from the formerly at the University of Michigan. So just so you know where I stand. I don't think you can really justify the use of it as a curiosity. I don't think there's any place for it in widespread practice. I don't think it adds any particular benefits that you can't get from Sevoflurane. It's expensive. It's highly polluting. I think we calculated that if you run one desflurane OR you can run 30 ORs on sevoflurane at the same flow rate for the same CO2 emissions, You just can't you just can't justify its use. Am I sad to see it go? Yeah. And you know, this is the flip side of this. In 2012, I was made the liaison, or 2014, I think the liaison to Bariatrics at U of M, and the guideline that I proudly kind of wrote included the use of Desflurane because it was such a great drug for those patients and that surgery. So yeah, I do have a, you know, a tinge of sadness to see it go. But I think it's it's had its day and I kind of feel the same way about nitrous oxide as well, in that although they are there are definitely areas of use, and pediatrics is one of them, where nitrous oxide is still going to be used for a long time yet, that we need to certainly work towards eliminating the infrastructure that leaks so badly. So the nitrous oxide pipelines that leak about 90% of what you put into them. And I think if we can do those few things, then we can make a massive impact on the CO2 emissions that we are responsible for in our daily lives. And, you know, people ask, does that make any difference? Well, it's just what we have control of as anesthesia providers and clinicians. You know, we do this every day. It's something that's in our power to change. So why not change it?

DR. STIKER:

Dr. Feldman?

DR. FELDMAN:
I agree 100% with David on Desflurane and nitrous oxide. Both. You know, desflurane I haven't personally used in many years. We took the vaporizers off our machines at my facility about 5 or 6 years ago, left a couple in the work room and no one ever came to get them. So, so it's disappeared from our practice and we certainly don't miss it. Um, and then nitrous oxide is another interesting one. We've, you know, it's a pediatric hospital, large number of pediatric cases. We started a QI project to minimize, if not eliminate, nitrous oxide use in our practice. And over the last two years, we went from over 80% use of nitrous oxide during inhaled inductions to closer to 10% now. And I personally don't have used it during inhalation inductions for several years now. And I think given the properties of Sevoflurane, nitrous oxide adds little to nothing. That's a little bit of a personal opinion. It needs to be documented by some some research. But certainly that's been our experience at my institution that we can get by without it.

DR. STIKER:

Well, before we go, Dr. Feldman, do you want to just let our listeners know where, if they want to learn more about this topic or change their practice, where is a good resource that they can go to?

DR. FELDMAN:

Yeah. Thank you. I would really love to provide that direction. So, you know, I chair the Committee on Technology for the Patient Safety Foundation, and we launched a course it'll be a year ago in October. We launched it at the last ASA on low flow. And there's a landing page on the APSF website that contains a link to the course as well as supplemental information. That's apsf.org/ifa. Low flow anesthesia. The course is hosted on the ASA Learning Management System. It's available to any anesthesia professional that wants to take it free of charge. It generates CME and MoCA safety credits for physicians and similar credits for CRNAs. The reality is it's a difficult topic to teach in a few words. The course uses guided simulation, so it's a different approach than reading a textbook. It's interactive. There's eight modules. Each one is designed to be about a 15 minute interaction, so you can go into one, come back to another one at some other time, go back and refresh yourself. You know, we try to make it a pretty comfortable learning environment. And, you know, thankfully we’ve had over 400 people complete the course since last October. So I think we’re having some impact with it. And I do think it's an effective way to learn and we provided a lot of resources associated with that course. So I would encourage everyone to take a look at it.

DR. STIKER:
Great. Well, thank you both, Dr. Hovorrd, Feldman, for joining us for this fascinating conversation.

DR. HOVORD:

Thanks, Adam.

DR. FELDMAN:

Thanks, Adam. Really appreciate it.

DR. STIKER:

Oh, yeah. My pleasure. And to our listeners, thanks for joining us on this episode of Central Line. If you like the podcast, if you find it interesting, if you feel like you learned something, please let a friend know. Let a colleague know. Leave a review on your favorite podcast platform and tune in to us again next time. Take care.

(SOUNDBITE OF MUSIC)

VOICE OVER:

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