

PENNSYLVANIA society of ANESTHESIOLOGISTS

SUMMER 2021 NEWSLETTER

SENTINEL

Shailesh D. Patel, MD, FASA, MHA
PSA PRESIDENT

President's Message

"Michigan House OKs bill lifting supervisory rules for nurse anesthetists" is only one of many similar headlines from around the country. To ensure that Pennsylvania does not follow suit, we need your help. The PSA is an organization committed to advocating for our patients, our members, and our profession. But the PSA cannot be the sole voice for our patients, members, and profession; we need our members to use their voices to advocate and become involved in the political process.

The importance of PSA member involvement in advocacy and the political process cannot be understated. Participation in grassroots advocacy by PSA members is imperative to protect patient safety here in Pennsylvania. Your involvement in advocacy and the political process is now more important than ever. If you are unsure why now is the time to get involved, below are a few reasons.

- Department of Health Hospital Regulations: The Pennsylvania Department of Health continues its efforts to revise the Hospital Regulations. The last draft of the regulation that the PSA could see would eliminate physician supervision over nurse anesthetists. The draft regulations would allow each private hospital to determine the level of CRNA supervision. These regulations are expected to be proposed in November 2021.
- Governor Wolf's Emergency Order: On May 7, 2020, Governor Tom Wolf issued an Emergency Order suspending the physician supervision requirement in the Commonwealth for the duration of the COVID-19 pandemic.
- CRNA Titling Legislation: CRNAs have again introduced legislation that would amend the Nursing Law and create the title of "Advanced Practiced Registered Nurse-Certified Registered Nurse Anesthetists" (APRN-CRNA). This is more aggressive language than has been introduced previously and would set the stage for Pennsylvania to join the APRN Compact down the road.

"we need our members to use their voices..."

How can PSA Members help? All PSA members have a great ability to affect change by doing one simple thing: forming a relationship with their State Representative and State Senator. This relationship is the best way to educate legislators about important issues such as patient safety. If you already have an established relationship with your legislators, great work! Consider having a

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President's Message

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meeting to bring your legislators up to speed about important updates affecting your profession and patients. If you have not established a relationship with your legislators, the PSA would highly encourages you to begin building that relationship.

Once you schedule a meeting with your legislator, be prepared to tell your story. Stories are incredibly effective at being easily understood and convincing to legislators. Your story should include the quality of medical education you received as well as the extensive experience and training you have gained during your time as a practicing anesthesiologist. Do not shy away from telling the more compelling parts of your story -- the parts of the story where you, as an anesthesiologist, are called into the operating room when there is an emergency that the CRNA cannot handle, and how your training, education, and experience enabled you to save the patient's life.

The investment to become involved in grassroots advocacy is your time and effort. That investment of time and effort can yield significant results. PSA is doing everything it can through its physician leadership, government relations firms, political action committee, and legal counsel. But we cannot do it without you. Your involvement in grassroots advocacy is imperative in the success of the PSA advocating for our patients, members, and profession.

If you need any help building a relationship with your legislator or are interested in becoming involved in grassroots advocacy, please reach out to Tyler from Milliron Goodman at Tyler@millirongoodman.com and he will be more than happy to assist.

EDITORIAL

Summer is here!

Richard O'Flynn, MD, FASA
Editor, The Sentinel

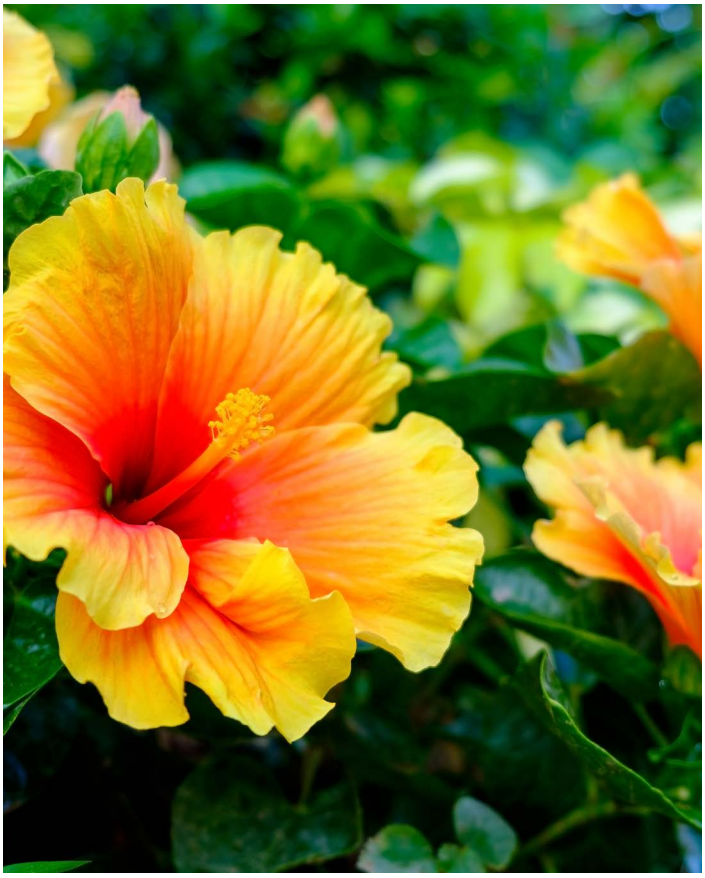
As we enter the summer vacation period, thoughts turn to time off from the usual grind of the daily operating room schedules, but we realize that staffing needs increase as others take time off.

Reflecting on the more numerous emails and phone calls for locum coverage, it has become obvious that there is a shortage of anesthesiologists in Pennsylvania and nationwide. Whether this is a seasonal event, related to Covid and early retirement, or the beginning of a more serious shortage remains to be seen.

We have seen this pattern in the past. There always seems to be an "in favor" specialty and an "out of favor" specialty. Some specialties, like orthopedics, ophthalmology, and radiology, always seem to be "in favor" but others, like pediatrics, family practice, and less so, anesthesiology, seem to go through staffing shortages. Let's hope that anesthesiology becomes and remains an "in favor" specialty because when there's a void, others see the opportunity to fill that need.This edition of the Sentinel is packed with interesting articles from a look back on the history of labor analgesia to the role of opioids in anesthesia care. The report from the PSA attorney highlights an important legal case working its way through the courts concerning malpractice defense. There is also an interesting article about noise pollution in the operating room and how it affects everyone in the room.

As always, comments and articles are welcome. Correspondence can be sent to:

PSASentinelEditor@gmail.com. We would also like to welcome Joan Oguntimein, MD as the Assistant Editor of the Sentinel.



LEGAL UPDATE

Dentist Anesthesiologist Antitrust and Constitutional Claims Dismissed

Charles I. Artz, Esq.
PSA General Counsel

A new federal court decision dismissing two dentists' constitutional and antitrust claims involving their use of the phrase "Dentist Anesthesiologist" is instructive in PSA's ongoing efforts to maintain supervision, direction and management over CRNAs.

In **Seay v. Oklahoma Board of Dentistry**, 2021 WL 1394478 (W.D. Okla. 2021), the litigation dispute focused on specialty licenses in dentistry. Dr. Seay and Dr. Jacobs are "dentist anesthesiologists" who both hold advanced degrees. They are licensed as general dentists, although their practice is focused exclusively on providing anesthesia services. Oklahoma law prohibits those dentists from advertising to the public as specialists because the term "dentist anesthesiologist" is not recognized as a specialty and precludes them from obtaining a specialty license.

They filed suit against the Board for deprivation of their constitutional protected property and liberty interests without due process of law; equal protection violations; freedom of commercial speech; and restraint of trade in violation of the federal antitrust laws.

Fortunately, the federal court dismissed all of the claims. The federal court dismissed those claims because they were filed too late, i.e. Dr. Seay and Dr. Jacobs missed the statute of limitations and the claims were time-barred. The court did not address the merits.

This case demonstrates the length to which non-Anesthesiologists may go to secure a title and the ability to advertise that they are Anesthesiologists without legal support or medical training. It underscores the need for PSA to maintain its aggressive stance against use of the term Anesthesiologist by any other licensed practitioner.

PENNSYLVANIA SUPREME COURT AGREES TO HEAR IMPORTANT PROFESSIONAL LIABILITY DECISION INVOLVING ANESTHESIOLOGIST

The Pennsylvania Supreme Court has agreed to review the Pennsylvania Superior Court's decision in Lageman v. Zepp, 237 A.3d 1098 (Pa. Super 2020). The Supreme Court is not required to automatically hear any case and it is significant when it does.

In this case, Dr. Zepp, who is a PSA member, provided anesthesia to a patient with a bowel obstruction undergoing an exploratory laparotomy and lysis of adhesions. Under the guidance of ultrasound, Dr. Zepp inserted a needle into what he believed was the jugular vein to establish a central line. Dr. Zepp used manometry, which is the "gold standard" for confirming that the small catheter is located in the vein rather than the artery, with the expected result. Prior to administering any fluids, Dr. Zepp passed the ultrasound transducer over the catheter. It revealed that the patient had an unusual anatomical orientation whereby the carotid artery lay below the jugular vein and that the catheter was located in the carotid artery rather than in the jugular vein. Dr. Zepp immediately abandoned the procedure and called in a vascular surgeon for assistance. The bowel surgery was successful, but the patient sustained a stroke that left her paralyzed on the left side.

After a six-day trial, the jury found in favor of Dr. Zepp. The patient appealed, and the Superior Court overturned the jury's decision citing the trial judge's

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failure to give a jury instruction on res ipsa loquitur and the fact that the trial court allowed Dr. Zepp to perform a live central line placement demonstration on a training mannequin.

Res ipsa loquitur essentially means "the thing speaks for itself." The key to the res ipsa loquitur doctrine is that a sufficient fund of common knowledge exists within a jury of laypersons to justify raising an inference of negligence. A res ipsa loquitur jury instruction would have enabled the patient to establish the elements of negligence through circumstantial rather than direct evidence.

Generally, to invoking the doctrine of res ipsa loquitur a plaintiff must demonstrate:

- ***the event is of a kind which ordinarily does not occur in the absence of negligence;***
- other responsible causes, including the conduct of the plaintiff and third persons, are sufficiently eliminated by the evidence; and
- the indicated negligence is within the scope of the defendant's duty to the plaintiff.

Superior Court sent the case back for a new trial. Before a new trial could be held, Dr. Zepp filed an appeal to the Supreme Court. On March 31, 2021, the Supreme Court granted Dr. Zepp's request to hear the case. The issue to be decided is whether the Superior Court's opinion conflicted with prior Supreme Court decisions relating to the res ipsa loquitur doctrine.

Dr. Zepp's appeal claims that the trial court's refusal to give the res ipsa loquitur jury instruction is consistent with Pennsylvania law in medically complex cases. If Dr. Zepp's appeal is successful, the res ipsa loquitur jury instruction guidelines will be clarified in favor of Anesthesiologists and all physicians.

The rationale for the appeal is that medical procedures are so complex the jury is not sufficiently sophisticated to draw inferences from testimony during the trial and needs to hear the opinions of expert witnesses to accurately decide a case. Should the Supreme Court rule in Dr. Zepp's favor, the decision will uphold the longstanding principle that negligence in medically complex cases should be established through direct rather than circumstantial evidence.

When the Pennsylvania Supreme Court issues its ruling several months from now, we will provide an update.

ANESTHESIOLOGIST PERMITTED TO PURSUE LAWSUIT AGAINST ESTRANGED WIFE FOR HACKING PATIENT FILES UNDER FEDERAL COMPUTER FRAUD AND ABUSE ACT

In Stein v. Needle, 2021 WL 1178283 (D. Conn. 2021), the federal court in Connecticut dismissed a motion for summary judgment made by the estranged wife of an anesthesiologist. The anesthesiologist had a computer in his home which permitted remote access to his practice's computer system, including patient protected health information. The anesthesiologist had a separate subaccount with a private password that prohibited unauthorized access to the subaccount and to the software necessary to achieve remote access.

In the midst of a contentious divorce, the anesthesiologist's wife and a paralegal from her divorce attorney's law firm obtained the anesthesiologist's password, accessed his subaccount and then remotely accessed the practice's system. The paralegal downloaded the practice's files, including approximately 800 patient files, to an external flash drive. The files were then uploaded to the attorney's computer system and at one point transmitted via unsecured email.

The anesthesiologist and the anesthesiologist's practice separately brought claims against the wife and her attorneys for violation of Connecticut's computer crime law and the federal Computer Fraud and Abuse Act. The wife and her attorneys attempted to have the case dismissed on various grounds all of which, except for one, failed. The court held that the civil action against the wife and her lawyers could proceed and the case will be further litigated.

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The important compliance points to take away from this unique case are:

1. **Always password protect accounts and other software** designed to access patient files including remote access software.

2. **Keep passwords secret.** Although the anesthesiologist acted correctly in creating a separate subaccount and password protecting it, he clearly did not sufficiently secure his password.

3. Relationships, even with the most trusted individuals, can sour and end but Anesthesiologists' obligations to protect patient information do not.

4. Although HIPAA only applies to covered entities (such as hospitals, physicians, insurance companies, etc.), there are other avenues for prosecuting individuals who impermissibly access patient information causing physicians to incur damages related to mitigating such unauthorized access under federal and state law.

Z-PAC Update

The Retired Factor

Craig Muetterties, MD
Z-PAC Treasurer

It happened again this month. It's been happening with increasing frequency for the past several years. More and more of the Z-PAC donations received are from society members who are retired. Initially this looked good to me but on further inspection a more ominous pattern is revealed. Retired members are becoming a larger percentage of donors than young anesthesiologists.

One of my favorite retired members revealed to me several years ago that he had been retired for 34 years. I wondered at that time what would ever possess an anesthesiologist to retire in what I thought was mid career. This physician has been donating faithfully year after year for as long as I can see in the record book. His last check, that was sent to the Media post office box, indicated that he is 95 years old! This physician did not retire early in his career but has managed to stay interested in the profession long after he retired.

I am in the twilight of my personal career. I still greatly enjoy what I do, and am challenged by all of the new things that I constantly have to learn. My plans for retirement will include the example of those retired members who have remained faithful in contributing to the stability of patient safety and anesthesiology.

I have recently been fascinated by a project that interviews Holocaust survivors who are at extremes of age. Apparently, they were asked approximately 1500 questions that were submitted by children inquiring about their experiences. These questions have been stored in a computer which displays an animated three-dimensional image of the survivor. The object of this project is to ensure that the legacy of what has occurred will not be lost on the youth of today. It is a wonderful idea. History tells us that when a society lives in a time of peace and prosperity it can fall victim to apathy. The hope is that by keeping this memory alive that complacency will be avoided. Young physicians today are practicing in an environment where they are separated from the business of anesthesiology. Their paychecks, medical benefits and contributions to their retirement are coming from sources that are frequently alien to them.

This was not true for older anesthesiologists and I can well remember the days when all in my practice understood finances and the importance of ensuring that the practice of anesthesiology wasn't legislated out of existence. I ultimately became the third member of my group to become president of the PSA. My group actively supported me. Ours wasn't a militant group but it understood the importance of being active in patient care advocacy. Young physicians could learn an important lesson from their elders.

It is my hope that in the future young members of the society will become an increasing percentage of active participants in advocacy.

You can start today. Find out how you can personally interact with the legislators by visiting our website at www.psanes.org. You can also make a first step in your journey by becoming a regular contributor to Z-PAC.

You can contribute online at our website

Personal checks can be sent to:

Z-PAC
P.O. Box 325
Media, PA 19063

LEGISLATIVE UPDATE

Milliron & Goodman
GOVERNMENT RELATIONS LLC

It is budget season once again in Harrisburg. As we continue to move towards June, the PSA wanted to update you about the different challenges we face this session.

The Pennsylvania General Assembly will soon begin the process of creating the Commonwealth's annual budget. As you can imagine this year may be a bit different, Pennsylvania received a large influx of COVID-19 relief funds and it is now the responsibility of the legislature and the Governor's office to decide how that money will be distributed. The PSA will continue to monitor the situation as it develops over the coming months.

CRNA titling legislation has been reintroduced this session. House Bill 931 and Senate Bill 416 vary from past versions of this legislation by seeking title recognition as "advanced practice registered nurse-certified registered nurse anesthetists" (APRN-CRNA). The inclusion of the APRN concerns the PSA as it sets the groundwork for Pennsylvania to join the APRN compact in the future.

In addition, the Pennsylvania Department of Health is continuing with their plans to revise the Hospital Regulations. These regulations have been delayed due to the COVID-19 pandemic but are expected to be revealed later this year. The PSA remains highly engaged on this issue and stands at the ready to work with the Department towards a solution that provides the best possible care for patients throughout the Commonwealth.

In an effort to protect patients and the physician supervision requirement, the PSA is working with Representative Mentzer and Senator Scavello to reintroduce our Administration of Anesthesia legislation. This legislation would protect patients across the Commonwealth by giving authority and jurisdiction over the practice of Anesthesia to the Board of Medicine. Currently, the Department of Health has authority and jurisdiction over the practice of Anesthesia. The PSA will continue advocate and update you as the session continues.

The PSA is also closely monitoring House Bill 681. This legislation would prohibit the enforcement of non-compete agreements for health care practitioners. Under this legislation a not to compete agreement may be enforceable if all of the following apply:

- **The health care practitioner's primary health care facility or office is located in a county of the sixth, seventh, or eighth class.**
- **The geographic restriction is less than a 45-mile radius from the primary health care facility or office of the health care practitioner.**
- **The length of the covenant not to compete is no more than two years.**
- **The restriction applies only to the primary health care facility or office of the health care practitioner.**

As you can see the PSA is facing many unique challenges this legislative session. The PSA cannot protect our patients by ourselves, we need your help. We need PSA members to contact their legislators and begin advocating for their patients and profession. If you would like to become involved in advocacy or have any questions, please feel free to contact Tyler at Milliron Goodman via email (Tyler@millirongoodman.com).

Changing a Mindset: Opioids as Analgesics, not Anesthetics

Joseph F. Answine, MD, FASA

Alternate District Director to the ASA

We, as anesthesiologists, know that providing anesthesia involves multiple molecules with multiple mechanisms of action at multiple sites throughout the nervous system. Whether temporarily scrambling lipids within the neuronal cell membrane, binding to neuronal surface proteins, potentiating GABA pre- and post-synaptically, reducing norepinephrine and/or serotonin release presynaptically, blocking NMDA receptors, stimulating opioid receptors, or a myriad of other mechanisms that we do not know exist as yet, we promote unconsciousness, immobility, amnesia, and a loss of pain perception. By doing one, some, or all of these, we induce and maintain anesthesia.

By using multiple molecules having different mechanisms of action, we achieve our "balanced anesthetic". I was taught that you require a hypnotic, such as thiopental or propofol, to achieve unconsciousness; a benzodiazepine, such as midazolam, to achieve amnesia; a paralytic, such as rocuronium, to achieve immobility; and a narcotic, such as fentanyl, to achieve analgesia. An inhaled agent assists with all of the above. A lack of any of these components unbalances the balanced anesthetic regimen. That was drilled into me over and over again. Don't unbalance the balance!

Following that mindset, if a patient becomes tachycardic and/or hypertensive while under anesthesia, they are "in pain". which requires an opioid to be administered. However, if pain is a perceived response by the brain to stimulation of an A-delta or C afferent nerve, and until then, it is nothing more than a nociceptive signal trying to work its way to a cerebral cortex that is not accepting calls, we are actually giving an opioid when there is no pain. So, based on the procedure and the rest of the regimen employed, if the patient is unlikely to have significant pain in the immediate post-operative period, what are we actually treating with that opioid?

When an afferent nerve is stimulated, it sends signals to the dorsal horn of the spinal cord, then those electrical signals cross over and travel up the spinothalamic tract to the thalamus as the relay station. Then they go to the brain cortices for identification, the reticular activating system for wakefulness, the hypothalamus for the fight or flight response, and the limbic system for an emotion. While under anesthesia, with stimulation, each area is likely at a different anesthetic depth than the others; therefore, the somatosensory cortex may not identify the pain and the limbic system will not provide an emotion, but the reticular activating system may promote movement and the hypothalamus may stimulate a release of catecholamines leading to a change in the heart rate and blood pressure. Therefore, we could just treat those isolated responses. We could administer a paralytic for movement and antihypertensives for the catecholamine release. Not traditional, but balance will be restored.

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Changing a Mindset: Opioids as Analgesics, not Anesthetics

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What could be used for the fight or flight response? Other anesthetics, beta blockers, calcium channel blockers, other arterial or venous dilators, and alpha 2 agonists are great choices to avoid the necessity for an opioid. Each class has multiple molecules with differing durations of action at our disposal. We can give them at induction to blunt the hemodynamic response to intubation or incision, during the case with changes in surgical stimulation, or at emergence to avoid the hemodynamic change as patients awake.

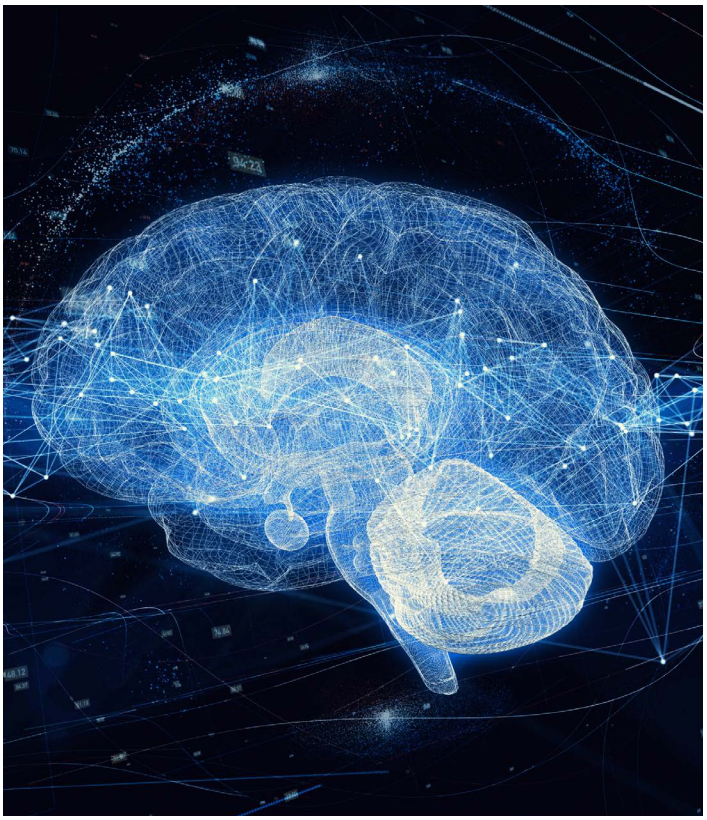
Why avoid opioids if we can? Because we are all "painfully" aware of opioid-induced adverse events in the postoperative period and the lingering risk of opioid addiction. I am a firm believer that opioids delay perioperative recovery and provide substantial risk to patients, especially those with significant comorbidities such as pulmonary disease and morbid obesity. And, yes, I know nonopioids have side effects as well but not with the same risks as opioids.

We have alternatives to treat postoperative pain although you have to be more creative. A bunch of opioids can be administered or one could give NSAIDs, steroids, acetaminophen, gabapentinoids, low dose ketamine, magnesium, alpha 2 agonists, or local anesthetics via many routes, and in the future, maybe even cannabinoids. But I know it is a lot of extra work when you can give opioids and take the patient to the recovery room with the endotracheal tube in, on BIPAP, or with a supraglottic device assisting with airway patency. Then, you go about your day and it is someone else's problem.

What about remifentanil or opioids "up front" not necessarily affecting wakefulness at the end? Acute tolerance or opioid-induced hyperalgesia is a real phenomenon, especially with high dose intraoperative remifentanil. Which opioids and how much is needed to create this acute tolerance requiring higher amounts of opioids postoperatively and significantly more pain is not well known, so any opioid used and in any amount is a proverbial crapshoot.

It does not mean opioids cannot play a part after major surgery. Large incisions for spine or open abdominal procedures for example, especially if regional techniques are contraindicated, will likely require an opioid as part of the pain management regimen. But in this case, the opioid is used as an analgesic and not as an "anesthetic".

The problem I contend does lie within the brain but not of our patients but within us as anesthesiologists. We are creatures of habit and it has served us well. A major rewiring of our anesthesia belief system does not come without some anxiety. How could our mentors be wrong? Well, they were not wrong for the time. It is just that our knowledge has advanced and newer studies demonstrate that we can comfortably move on.



Noise Pollution – Can you hear me now?

By Benjamin L Park, DO

PGY 1 Resident Physician

The operating room suite is a very active place, with lots of things happening. A patient's life may be saved in one room, while a patient in the next room may be receiving a "new" joint to improve their quality of life. A patient in yet another room may be undergoing an elective cosmetic procedure. With all this activity, the operating room can become quite busy and quite loud. This noise can be necessary in some instances, but often it is a distraction from patient care. OR noise can thereby be described as noise pollution, an unwanted or disturbing sound.

Sound is measured in decibels (dB) and equates to 1/10th of a bel (B). The bel was initially used as a measurement of transmission loss of power in telephony. The bel was named for Alexander Bell. When considering sound, it is important to understand what some normal ranges are. Normal human conversation occurs around 60dB and loud conversation occurs around 70dB. Hearing damage occurs when sound is above 85dB for a period of time or at 120dB instantly. Cars and motorcycles average around 90-95dB.

Measured operating room noise levels are quite variable. Interestingly, in one study involving sound in the operating room, there was no time that levels were below 45dB, even in an unoccupied operating room [Mohammed 2020]. Interestingly, that is above the levels that the World Health Organization (WHO) recommends for hospitals. The WHO recommends a noise level limit of 35dB during most daytime hours and 40dB at night. This is because most patients have less ability to cope with stress. However, it seems contradictory that the evening noise limit is higher than the daytime level, considering most hospitals are more active during the day.

When evaluating noise levels, orthopedic surgery has one of the highest noise levels. The peak noise level is above 100dB as often as 40% of the time [Joint Commission]. Other situations with higher-than-average noise levels include traumas, neurosurgery, and obstetrics. When anesthesia residents were studied at Vanderbilt, they found a 17% reduction in the ability to detect a change in saturation between 99% and 98% on pulse oximetry. The same study also demonstrated more "distractibility" during induction than emergence and maintenance [Stevenson 2013]. This correlates to clinical practice because induction and emergence are often some of the nosiest and most active times in the operating room.

In addition to hearing loss and distractions, high noise levels have been associated with other health effects. There is an association between noise pollution and cardiovascular disease (CVD). Some animal studies demonstrate this in different ways. Monkeys exposed to 85dB over 9 months developed high blood pressures and mice developed impaired endothelial vasodilatation [Munzel. 2018]. Many of the studies linking noise pollution to CVD are associated with nighttime noise levels, but more data is suggesting that noise exposure at any time causes increased stress responses and thereby increases CVD risk.

With all that is known about noise pollution in the operating room, why does it occur and what can be done about it? Unfortunately, in most instances, not much can be done to mitigate the noise levels in the operating room. As anesthesia providers, we cannot control the noise caused by surgical equipment or the noise caused by dropped equipment. We cannot control pagers and phones from making noise. We cannot affect the ambient noise levels from case carts moving and other necessary noises from the operating room.

There are a few small but significant things that we can do to help decrease the noise level in the operating room. First, and most importantly, we can communicate with our colleagues if personal conversation is causing a distraction. Unnecessary conversation and multiple loud conversations are very common and likely to cause noise distractions in the operating room. In addition, we can communicate with our operating room colleagues as to when a time or event needs our attention. This will eliminate excess noises and distractions because our colleagues will be mindful to help eliminate them for us. The times that we need help to minimize distractions are often during induction and extubation. We may also need help during active parts of a surgery. Secondly, the

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Noise Pollution – Can you hear me now?

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anesthesia monitors can be set appropriately with alarm settings for our patient's vitals. This will decrease nuisance alarms and help prevent alarm fatigue and decrease noise. I believe sound-canceling material and quieter equipment is possible, but this is not feasible for most institutions and is unfortunately something we cannot easily change.

Working in the operating room involves a diverse team of people and communication with each group is important. As anesthesiologists, we are often team leaders or go-to people for the operating room. It is our duty to communicate our needs to the rest of the operating room team. Sometimes this is that we need assistance keeping noise levels down so that our concentration is not inadvertently divided. The more we can effectively communicate with our colleagues the better patient care we can provide.

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A Brief History of Local Anesthetics in Labor Analgesia

Harry Burke MD, Sarah J. Kroh MD, Nicholas Schott MD, Ryan C. Romeo MD

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Before local anesthetics became a mainstay in obstetric anesthesia, the concept of labor analgesia was controversial. On January 19th, 1847, a Scottish Obstetrician Dr. James Young Simpson first used diethyl ether to help a woman through labor. This was met with opposition even within the medical community. Many cited the Book of Genesis arguing that descendants of Eve were meant to suffer during labor. Other physicians of the day such as Charles Meigs, Baron Paul Dubois & Francis Ramsbotham opposed him. He would reply that it was God who "anesthetized" Adam with the birth of Eve. Despite much disapproval[1], the public began to be swayed when he provided anesthesia to Queen Victoria for the birth of Prince Leopold in 1853.

Image 1: This is a plaster cast of the head of the infant delivered that day. Due to the mother's deformed lower spine and pelvis, the birth canal was very narrow. Although the delivery was particularly difficult and undoubtedly would otherwise have caused severe agony, the mother had no recollection of pain after inhaling the ether. *Image and caption graciously provided by WLM of Anesthesiolgy, WLM ID: aijm*

It would take time for continued community acceptance and the development of neuraxial anesthetic methods. Women themselves played a crucial role in the advent of obstetric anesthesia, and as public opinion changed, they began to demand it from their physicians.

Using medications such as ether, chloroform, and opioids during labor has untoward side effects. The transition to neuraxial anesthesia with local anesthetics was crucial. While James Leonard Corning, an American physician based in New York, was the first to successfully describe the methods of performing a neuraxial anesthetic with cocaine in 1885, it was Bier who performed a spinal anesthetic for intraoperative pain control with the use of cocaine in 1898[2].

The advent of powerful local anesthetics such as amylocaine in the early 1900s prompted its use for spinal anesthesia for delivery. But it was not until the development of better surgical devices, catheters, and pumps decades later that the argument over general or neuraxial anesthesia truly began. By 1914, there were only 5 total peer-reviewed references to successful cesarean deliveries performed with spinal anesthesia.[3] By the middle of the 20th century, increasing evidence supported the safety and improved obstetric outcomes with local anesthesia vs. general anesthesia.

As time passed, several physicians had theorized about supplying continuous intrathecal or epidural infusions for improved pain control. In 1927, American physician Dr. George Pitkin developed a special syringe connected to a 22-gauge needle meant to deliver local anesthetics without multiple needle reinsertions.

Image 2: The Pitkin Syringe. The syringe could be refilled through a tube without disconnecting the syringe or reinserting the needle multiple times. *Image and caption graciously provided by WLM of Anesthesiolgy, WLM ID: akil, akim.*

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A Brief History of Local Anesthetics in Labor Analgesia

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In 1944, an Army anesthesiologist by the name of Captain Edward Tuohy used a directional 15-gauge needle to place a nylon catheter in the subarachnoid space for continuous dosing.[4] In 1951, Nanninga reported 1,265 cases of cesarean deliveries out of 13,153 total deliveries and declared spinal anesthesia to be the "method of choice" as it was associated with reduced maternal and fetal mortality.[5]

One other person critical for the widespread adoption of local anesthetics in obstetric anesthesia is the anesthesiologist Dr. Virginia Apgar. She noted differences in neonates whose mothers had been anesthetized with systemic anesthetics vs. neuraxial techniques. In 1953, she published a paper titled "A Proposal for a New Method of Evaluation of the Newborn Infant," which ultimately became the APGAR score.[6] Before this time, the effect of anesthesia and analgesia on the neonate had been largely ignored. Her work continued a trend favoring local anesthetics and neuraxial techniques over inhaled agents and opioids, given the improved mortality and morbidity of the parturient and neonate alike.

The work of neuraxial anesthesia was carried on by Dr. Gertie Marx through the late 1950s and early 1960s. Despite rising literature supporting local anesthetics safety in neuraxial techniques, many physicians feared that epidural use would prolong labor and greatly increase the rate of cesarean deliveries.[7] Through research and publishing, Dr. Marx showed that pain relief-without causing respiratory depression, aspiration, and increased risk of mortality associated with general anesthesia is not only possible but favored.

With improved patient safety, pain control, and the ability to have a significant other present for the delivery, local anesthetics and neuraxial anesthesia became the gold standard. By the end of the 1970s, the case fatality rate for general anesthesia was 2.[3] times that of neuraxial, and with improved methods, technique, and materials that rate had increased to 16.7 times that for neuraxial by 1990.[8] This reaffirmation of the method led to an overall decrease of anesthesia-related maternal mortality of 60% from 1979 to 2002.[9]

The evolution of anesthetic management in the parturient was not a simple one. It developed over almost two centuries, numerous countries, and countless patients - culminating through a critical blend of novel pharmacological compounds, scientific devices, and physician discoveries. Although childbirth will never be stress-free, it is because of the aforementioned that today's labor patients remain that much more comfortable and safer.

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Death and Depth at the Bedside

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Nine months into my intern year I lost my first patient to a PEA arrest. Out of all of my patients in the ICU, he was the only one who could talk. So naturally, I got to know him pretty well. The morning of his passing, I asked him if there was anything he was "dying" to eat. He had just been cleared for a diet and his aspiration risk was much weaker than his desire for food. It was an ironic question, in hindsight. He looked at me and said, "all I want is a lime slushie." My last words to him were, "you keep doing what you're doing and I won't leave work today without getting you that slushie."

Four hours and four broken ribs later, my patient was unconscious and I was thrusting my petite arms into his chest, trying to measure the recoil of my compressions, wondering if I was providing the depth that I needed to provide. I switched off with his nurse. She started to fatigue. Two more stepped in. I watched my fellow attempt to secure the airway. He failed. He tried again. He failed again.

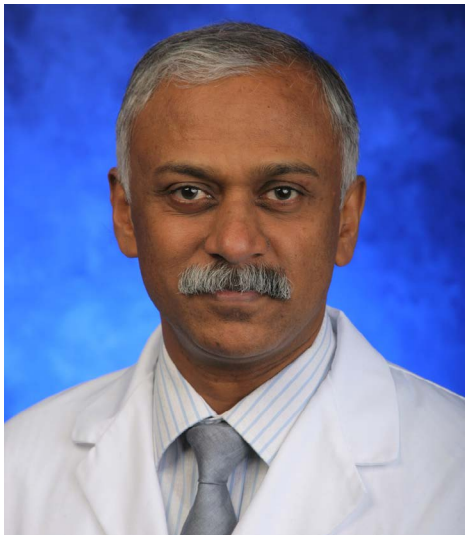
I took over compressions. Someone started to bag mask ventilate. There was a lot of noise. I tried not to think about the fact that this man was my dad's age. That he was fine this morning. He was doing so well. How did this happen? I avoided emotion by launching into logic. I thought through the H's. I thought through the T's. I mentally dug through his chart. Was there something I had missed that could have prevented this?

Multiple rounds of epinephrine, a half hour on the clock, and still no pulse later, my attending looked me in the eye and he said, "call the wife." He gave no further instructions. That's when it really hit me. My entire bachelor's degree worth of communication studies did not prepare me to communicate to this woman that her other half was dead. That we did not know why. That we were not going to bring him back. No algorithm or preparation shields you from that first shock. It's a mannequin in an ACLS course until it's someone's husband in a code.

After he was gone, I relayed my condolences to his widow. I told her that I was so sorry I didn't get his slushie to him in time. She gave me a hug, thanked me for being there, and told me that she had beat me to it earlier that afternoon before he coded. I thought, oh thank God. We sat there and we cried together.

It's easy during the difficult parts of training to forget the "why." Just when I start to forget, I am reminded again, by my patients and their families and their stories. I know this is the first of many for me. I know that sometimes even when we do it all right, it all goes wrong. While it is hard to be at peace with the outcome, I find peace in knowing that my first code taught me, both literally and figuratively, the value of delivering depth at the bedside.

Know Your Equipment: Waste Anesthesia Gas Disposal



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Introduction

Waste anesthetic gases (WAG) contaminate the air in the operating room. Historically, chronic exposure to these agents has been associated with adverse health effects. [1,2,3,4] However, these claims have not been substantiated with currently used anesthetic agents in concentrations found in an operating room with an effective scavenging system. Despite the controversy regarding these harmful effects, it seems prudent to remove these waste anesthetic gases from the room air. [1,4,5,6,7] The air exchanges by the air-conditioning unit and an effective scavenging system are the two methods used to control the air quality in the operating room. Anesthetic gases also have a significant effect on the environment. [8]

Current recommendations

The recommended exposure limit (REL) of WAG, in the workspace, is described as a time-weighted average (TWA), which is the average concentration reached over an 8h period. In 1977, the National Institute for Occupational Safety and Health (NIOSH) recommended a TWA of 25 parts per million (ppm) of N2O, 2 ppm of halogenated agents when used alone, and 0.5 ppm when used in combination with N2O. [1,4,6] However, these recommendations were based on levels that could be achieved at that time rather than on exposure that could produce adverse effects. [3, 4] Moreover, these RELs were for agents used at that time (chloroform, trichloroethylene, halothane, methoxyflurane, and enflurane) and do not include isoflurane, sevoflurane, and desflurane, which are currently the commonly used inhalational anesthetics. [1,4,5] The health authorities of different countries have suggested varied RELs. The British government, in 1995, suggested a REL of 100 ppm (TWA) for N2O, 50 ppm for enflurane and isoflurane, and 10 ppm for halothane. The Center for Disease Control (CDC) and the NIOSH in their joint publication recommend installation of ventilation and scavenging systems and monitoring the air sample for these gases. [9]

Chronic exposure to anesthetic agents

Various adverse effects have been historically attributed to chronic exposure to anesthetic agents. These include spontaneous abortion, infertility, birth defects, malignancy, alterations in immune response, hepatic, and hematological diseases. [2,3,4] Despite numerous animal and human volunteer studies and epidemiological data, there is no conclusive evidence to suggest a causative relationship between WAG and adverse reproductive health. [4,5,6,7]

Perhaps the first study that drew the attention of the scientific community to the risks associated with exposure to WAG came from Soviet Union in 1967. This study demonstrated fatigue, headache, and irritability among 198 men and 110 women anesthesiologists, exposed primarily to diethyl ether, N2O, and halothane. There were also 18 cases of spontaneous abortion in 31 pregnancies in this group of female anesthesiologists. [10]

The earlier studies that demonstrated a significant health risk were based on data from dental hygienists administering high concentrations (70%) of N2O to their patients, using unscavenged delivery systems in rooms without adequate air circulation. Meta-analysis of epidemiological studies on adverse effects of halogenated agents have shown that the incidence of infertility among female anesthesiologist is no greater than in other physicians, and the incidence

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of spontaneous abortion and congenital abnormality was unrelated to occupation of the mother, hours of exposure to operating room environment, or use of scavenging. [1, 6] The task force on waste anesthetic gases of the ASA occupational health committee, in their letter to the CDC, also state that a study, sponsored by the ASA, comparing mortality among anesthesiologists and internists, showed no difference in death rate due to cancer. However, the incidence of suicide, cerebrovascular, HIV, and drug related deaths were higher among the anesthesiologists, possibly related to lifestyle. [6] In their guidelines on management of waste anesthesia gases in the operating room, they recommend use of a scavenging system but not routine monitoring of gases levels.[11]

In studies on reproductive problems in women chronically exposed to anesthetic agents, factors such as mental and physical stress, need for constant alertness, irregular routine, inconvenient hours interfering with domestic life, exposure to transmissible infection, solvents, propellants, cleaning solutions, methyl-methacrylate, and radiation, could act as confounders. [6] It is also important to emphasize that most of these studies were performed before the scavenging systems were being used and with anesthetic agents that are no longer in use, except for N2O. [10] Therefore, the potential effects of chronic exposure to inhaled anesthetics regarding reproductive health might be even weaker.

In studies that have suggested that volunteers exposed to trace gas concentration show reduced alertness and impaired performance, the concentrations tested were significantly higher than that found in scavenged operating room. [11]

An important focus of recent studies is the potential of inhaled anesthetics to induce damage to chromosomes and DNA (genotoxicity and mutagenicity). [10] There have been studies that have shown chromosomal damage in subjects exposed to inhalational agents, while others have failed to do so. Oxidative stress causes damage to macromolecules, such as DNA, lipids, and proteins. There is evidence to suggest that prolonged exposure to high concentration of anesthetic gases may induce oxidative stress and damage the genome, while lower concentration does not. [8, 10]

N2O oxidizes the cobalt ion present in cobalamin (vitamin B12), leading to the inhibition of methionine synthetase with reduced production of methionine and tetrahydrofolate and its byproducts thymidine and nucleic acids (including DNA). This can lead to megaloblastic anemia, agranulocytosis, spinal cord subacute combined degeneration, and neurobehavioral disorders in individuals exposed for a long time to elevated concentrations of N2O. [12]

In summary, the conflicting data with regards to the health risks of exposure to inhaled anesthetics limits the ability to define safety levels or appropriate exposure policies. However, the need to use an effective scavenging system and adequate air handling of the operating room is unchallenged.

Anesthetic gases and environment

Chemically, the inhalational anesthetic agents are closely related to the chloro-fluorocarbons (CFC) which play a significant role in ozone depletion. The ozone depletion potential (ODP) of anesthetic gases depends on its molecular weight, the proportion and type of halogen atoms, and its half-life in the atmosphere. [8] The half-life of the commonly used anesthetic gases in the atmosphere are: N2O-114 years, desflurane-10 years, halothane-7 years, sevoflurane-5 years, and isoflurane-3 years. The global warming potential (GWP) of halogenated anesthetics is reported to range from 1230 (isoflurane) to 3714 (desflurane) times the GWP of carbon dioxide (CO2). N2O captures the thermal radiation from the Earth's surface and contributes to global warming, creating the "greenhouse effect". The GWP of N2O is approximately 300 times that of CO2. [13] N2O, CO2 and methane are the most important greenhouse gases. N2O is also produced from nitrogen-based fertilizers, fossil fuels, as well as by microbial action in moist tropical forests. The N2O concentration is reported to be steadily increasing at a rate of 0.7 to 0.8 parts per billion (ppb) per year over the last decade. Ten percent of N2O is converted into nitrogen oxides (NO and NO2), both of which destroy ozone. The use of inhaled anesthetics for 1 h at 1 MAC and a FGF of 1 L/min has the CO2 equivalency as a car trip of 6.5 km for sevoflurane, 14 km for isoflurane, 95 km for nitrous oxide, and 320 km for desflurane.[13]

In their article 'Greening the operating room', the ASA task force on Environmental Sustainability Committee on Equipment and Facilities recommended reducing the use of high impact gases such as desflurane and N2O and implementing techniques to capture and reuse anesthetic gases. [14]

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Know Your Equipment: Waste Anesthesia Gas Disposal

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Mechanism of contamination

Although the exhaled anesthetic gases are expelled out of the expiratory port of the anesthetic circuit or the ventilator, there are many other routes by which the gases escape into the operating room. [9,12]

- The greatest advantage of using breathing circuits that adsorb CO2, such as the 'circle system', as compared to the open ones, as classified by Mapleson, is the ability of a low fresh gas flow to avoid rebreathing. However, to displace the large volume (8L) of air within the circle system with the anesthetic gas mixture, a high gas flow during initiation of anesthesia is needed to reduce the time constant for this process. The same principle applies during 'wake up' to wash away the anesthetic gases in the circuit. This high flow, especially during induction using a facemask, contributes to contamination of the room.
- The anesthetic gases could leak out of the breathing circuit from loose connections, disconnections, damaged corrugated tubes, and around uncuffed endotracheal tubes, laryngeal mask airways, or ill-fitting facemasks.
- During intubation, when the facemask is off the patient's face, it is important to turn off the fresh gas flow, as merely shutting off the vaporizer will not prevent the fresh gas from displacing the volatile anesthetic within the circuit into the atmosphere.
- Trace amounts of anesthetics continue to be exhaled by the patient even after recovery from the anesthetic. This can occur for couple of hours, depending on the anesthetic agent and the duration of anesthetic.
- Although the use of the keyed-filler has significantly reduced the spillage and escape of vapor during the filling of the vaporizer, the vapor of the anesthetic agent can escape the bottle during the time the bottle is uncapped to attach the keyed-filler adaptor.
- Another factor that affects the level of contamination is the potency or minimum alveolar concentration (MAC) of the agent, as a larger volume percent of a less potent anesthetic is needed to achieve the same depth of anesthesia. As an example, Desflurane, with a MAC of about 6 times compared to isoflurane, has been shown to cause more contamination. [8]

Inhaled anesthetics are also being used in dental offices, cardiac catheterization units, and interventional radiology and endoscopy suites, where the infrastructure to eliminate the WAG may be less than in an operating room.

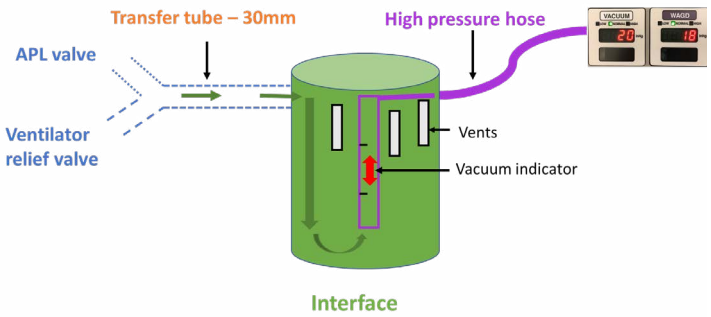
The scavenging system and the air exchanges achieved by the heating, ventilating, and air conditioning (HVAC) unit are the two ways that the WAG in the operating room can be removed. The construction of the operating room is such that the cooled, filtered air enters the room from the ceiling and exits through ports located on the wall near the floor. This ensures adequate movement and mixing of air. The recommended air exchanges in an operating room is a minimum of 15 air changes per hour, including 3 air changes of fresh air. Apart from the WAG exiting the expiratory port of the breathing circuit or the ventilator, the elimination of all other gas spillage into the operating room is achieved by the HVAC system.

Scavenging system

The gases expelled from the expiratory port of the breathing circuit or the ventilator can be collected and removed to a location outside the hospital building. Depending on how the vapor containing air is expelled, there are two types of 'scavenging' systems.

1. Active – A dedicated central vacuum system, is used to remove the gases that are collected.
2. Passive – The collected exhaled gases are channeled to the exterior passively.

Most modern surgical suites use an active system of WAGD. The scavenging system can essentially be divided into three sections.



1. Interface is the 'container' or space where the WAG is collected before being expelled out of the room
2. A connecting channel that brings WAG from the breathing circuit to the interface
3. A tube that channels the gases from the interface to the outside

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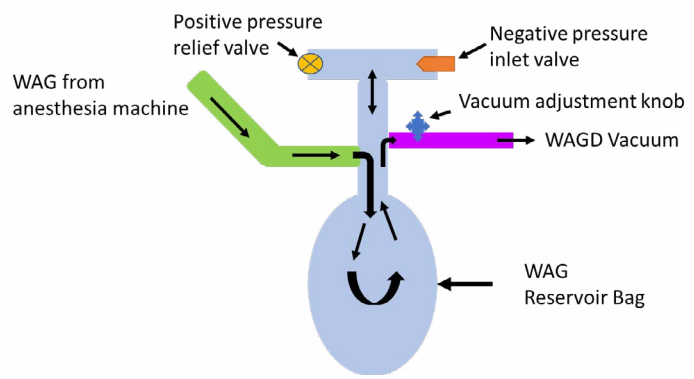
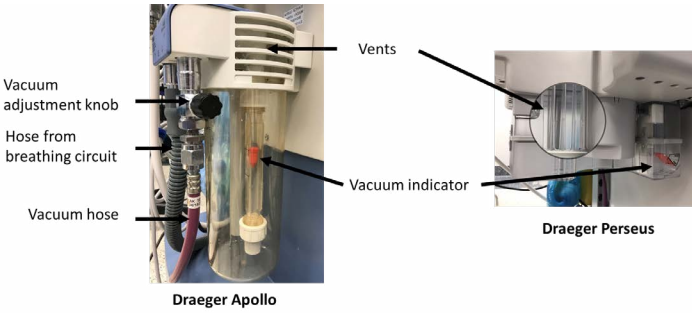
The interface can be a closed bag (4-5L) or a container that is open at one end. The idea of a closed bag is to contain the waste gases. However, if there was a failure with the vacuum system, the pressure within the bag would increase and it would be transmitted back to the breathing circuit. Alternatively, if the suction were too high and the bag is collapsed, the negative pressure in the system could be transmitted back to the breathing circuit. To prevent these pressure fluctuations from affecting the breathing circuit, the closed interface has a positive pressure relief valve and a negative pressure intake valve.



In an open interface, if the volume of WAG in the interface were less than what the vacuum system can expel, the air from the room would get sucked into the interface, and if it were more than what the vacuum system can handle, then the WAG could spill over into the room. Therefore, the pressure (high or low) within an 'open' interface is not transmitted to the breathing circuit or the patient, but there is a potential for contamination of the room. Most modern anesthesia machines have an open interface, that is attached to the side of the anesthesia workstation, and uses an active system, which is usually a dedicated vacuum system.



A short tube is used to transfer the WAG, exiting the expiratory port of the breathing circuit or the ventilator, to the interface. This tube should be wide enough to carry a high flow of gas and its connection to the interface should be accessible so that it can be disconnected in the event of malfunction of the scavenging system. The American Society of Testing and Materials (ASTM) specifies that the fittings at either end of this tubing should be 30mm in diameter, to avoid any chance of it being wrongly connected to the breathing circuit which has 15/22 mm connections. [1,4]

The tube that carries the WAG from the interface to the gas disposal system is a kink-resistant, color coded (purple) hose, with a quick coupler that connects it to the dedicated 'waste anesthesia gas disposal' (WAGD) wall port. The suction pressure of the WAGD is similar to the hospital vacuum at 18-20 inches of Hg and it can transport 30-50 L/min. A control knob at the junction of the vacuum hose with the interface is used to adjust the suction pressure to the appropriate level, as displayed by the indicator.

Limiting WAG

The ways to limit the level of WAG in the operating room are by limiting the use of inhaled anesthetics or ensuring effective removal.

- A closed circuit with low fresh gas flow can reduce the use of anesthetic gases.
- Avoid high impact inhaled anesthetics, such as Desflurane and Nitrous Oxide.
- Total intravenous anesthesia (TIVA) can eliminate the use of anesthetic gases.

There should also be an awareness of the effect of anesthetic gases on the environment. [8]

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Future direction

- CO_2 absorption using calcium hydroxide, as opposed to sodium hydroxide, minimizes compound A production, thus permitting use of sevoflurane with low fresh gas flow without the concern for compound A toxicity.
- Anesthesia Conserving Devices' (ACD): This device, 'AnaConDa', is essentially a combination of a small disposable anesthetic vaporizer and a heat and moisture exchange (HME) filter, which can be attached between the y-piece connector of the circle system and the endotracheal tube. It contains a carbon filter that adsorbs the exhaled anesthetic agent and release it back during the next inspiration, which is similar to what an HME filter does with moisture. [15] (https://www.sedanamedical.com/) This reflection reduces the total amount of anesthetic needed and also limits the WAG.
- As part of the disposal unit of the scavenging system, activated charcoal can be used to trap the halogenated WAG. Silica zeolite crystals (Deltazite®) can effectively adsorb isoflurane and can later be desorbed to yield liquid agent, which can potentially be reprocessed and reused. This is not currently approved by the FDA. [16] Cold trap condensation or cooling the gas below its dew point, is another way to capture the agent in liquid form.
- There are three ways to destroy N_2O, namely oxidation, reduction, or catalytic splitting. Oxidation produces NO, which also impacts the environment negatively. Reduction, on the other hand, removes oxygen to produce Nitrogen (N) plus an oxidized molecule. The catalytic splitting of N_2O generates N and O_2 and appears to be a logical method to reduce N_2O. [16]

Conclusion

Anesthetic gases have detrimental effects on humans and environment. Although the evidence on the adverse effect of WAG on humans is inconclusive, it seems prudent to use a functioning scavenging system and a HVAC system to limit its exposure. Efforts to curb the use of inhalational anesthetics by adopting low-flow anesthesia, TIVA, or anesthesia conserving devices and limiting the contamination of the atmosphere with use of WAG adsorption methods should be encouraged.

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IN MEMORIAM: Ronald S. Litman, DO

Ronald S. Litman, DO

The world and the extended pediatric anesthesiology community lost a cherished friend, mentor, and educator when Ron Litman passed away April 21, 2021 after a year-long struggle with AML. Ron was a long-time member of SPA and an inspirational pediatric anesthesiologist with a long and distinguished career first at the University of Rochester and for the last 20+ years at CHOP. For his entire career, Ron was a guiding light of clinical excellence, a dedicated mentor of all from undergraduate students to anesthesia trainees and faculty colleagues. His unending inquisitiveness and challenging of established dogma led him to innovative clinical research investigations, in which he collaborated with those from many fields outside pediatric anesthesiology (and outside CHOP), from adult pulmonologists at Johns Hopkins, to pediatric oncologists, otolaryngologists and sleep medicine specialists. His innovative findings have educated us all about everything from airway anatomy under anesthesia to pathophysiology of mediastinal masses and malignant hyperthermia. His interest in pharmacology and medication safety led him to leadership advisory roles at the FDA, culminating in his appointment as the Chair of the FDA Anesthetic and Analgesic Drug Products Advisory Committee and the medical directorship at the Institute for Safe Medication Practice. His interest in malignant hyperthermia led him to an enduring collaboration with Henry Rosenberg and a fundamental role in MHAUS and the MH help line.

He trained and inspired a generation of pediatric anesthesiologists. A voracious reader, both medical and non-medical, his love of learning and interest in medico-legal issues led him to study law as applied to medicine, receiving a Masters of Law at the University of Pennsylvania. Ron also devoted much time to volunteer pediatric surgical mission around the world. A premier educator/lecturer he was much sought-after speaker at meetings, both anesthesiology and other specialties. As was his custom, he made friends world-wide wherever he traveled and picked up mentees as he went. A pied piper of pediatric anesthesiology, but also Ron was a devoted father, husband, friend, tennis and squash player and filled his and our days with wisdom, laughter and love. May his memory be a blessing for us all.

Ron himself expressed his love and devotion to his life's work and colleagues best in an email he sent to inform the CHOP department of his diagnosis last July

—"Except for the obvious burden on my family, I don't really feel that sad about having such bad luck – I'm mostly thankful that I've had the incredible good luck to have a 30-year career where going to work every day is so much fun and fulfilling and impact so many children's lives throughout the years, and getting to work alongside so many wonderful colleagues. Very few people in the world get to have that kind of good luck, and with a little more, I'll be back in the OR in 2021."

NEW PSA MEMBERS!

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