

PENNSYLVANIA society of ANESTHESIOLOGISTS

SPRING 2022 *NEWSLETTER*

SENTINEL

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

President's Message

Welcome to Spring 2022! While the weather brings about more outdoor events and socializing becomes the norm again, we encourage you to register for the **1st ANNUAL PSA SCIENTIFIC MEETING** being held at **the Union League in Lafayette Hill, PA.** We have an exciting agenda planned, including a full day of CMEs and dinner with the past president of ASRA, included in the Saturday conference fee, and a full day of CMEs. NASA experts, Medical Director of CMS, and Chiefs of Department of Anesthesiology from outstanding programs will be there to present interesting, engaging, and relevant topics that will not only capture your attention but *also* fulfill PA licensing criteria. Take a break from life, bring your family, and enjoy one of the most expansive and well-known golfing resorts, discounted for attendees. On Sunday, get your hands dirty and learn point of care ultrasound techniques and fascinating regional anesthetic blocks from instructors from throughout the Commonwealth. I am encouraging you to SIGN UP TODAY at https://www.psanes.org/meetings.html in order to secure your seats in this LIMITED space conference. Need a room? No problem! Blocks of rooms have been reserved for attendees and their families at a discounted rate.

Once you sign up, if you have any requests, please email Cyndi Powers at cpowers@pamedsoc.org, so we can help make this experience the best and long lasting for years to come.

Politically, **Pennsylvania** is in the midst of preparing for a very busy election year. This election cycle, Pennsylvanians will have the ability to select a new governor, a decision that will be with Pennsylvania for the next four years.

Currently, Pennsylvania's Governor is Tom Wolf, a Democrat, and the General Assembly, both House and Senate, are controlled by Republican majorities. This election year will decide what party is able to control the House and the Senate, as well as the Governor's office.

In addition, all 203 State House seats and 24 of the 50 State Senate seats will also be up for election. These offices are vitally important to our patients and profession because these are the officials who will write the laws that directly affect our patients and profession.

As we continue to move through 2022, I hope that you will keep in mind the important upcoming elections and the effects they could have on our patients and profession.

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"It's time to sign up for our exciting 2022 Annual Scientific Meeting"

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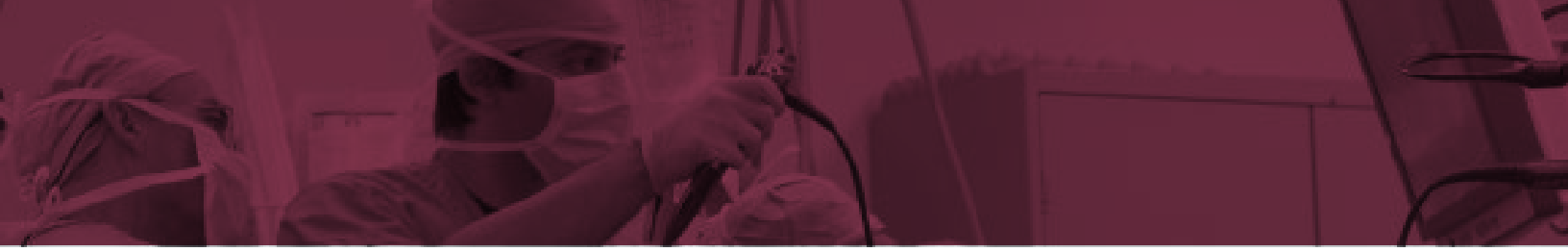

President's Message

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Below are some relevant dates regarding the upcoming elections.

- **May 17, 2022- Pennsylvania Primary Election**
- October 24, 2022- Last day to register before the November election
- November 1, 2022- Last day to apply for mail-in or civilian absentee ballot
- **November 8, 2022- Pennsylvania General Election**

Z-PAC, the political action committee of the Pennsylvania Society of Anesthesiologists, is your voice in Harrisburg.

The PAC supports candidates for office who champion safe anesthesia care.

Please consider supporting Z-PAC with a financial contribution. Not everyone can take the time to visit and educate their elected leaders but through the PAC the unified voice of Pennsylvania anesthesiologists is heard throughout the Capitol.

EDITORIAL NOTE

Editor's Note

Richard O'Flynn, MD, FASA

Editor, The Sentinel

As we go to press, the primary election is 4 weeks away and the candidates should be known when this arrives in your mailbox. This election year, the entire Pennsylvania House of Representatives is up for reelection, and the seats of half of the state senators, the governor and lieutenant governor are up for election. Our legislative council, Andy Goodman, reports on this in more detail. Given the significance of the upcoming election, it is very important that everyone gets out to vote in the general election in November.

With summer right around the corner, I'm sure that most groups struggle with staffing issues more so now than at other times of the year. Staffing shortages seem to be a recurring event. Even with the number of anesthesia residency programs and CRNA training programs in the state, it seems that Pennsylvania is not the desired workplace of many of our trainees. A possible solution to the provider shortage is in the works and hopefully this will help to alleviate the problem.

This June, PSA is reinstituting a long-ago tradition of the annual educational meeting. Originally scheduled for 2020, the inaugural event is finally ready to go after a long COVID caused delay. The meeting is set for the new Union League at Liberty Hill resort. There is an impressive lineup of speakers and a point of care ultrasound training program during the two-day event. PSA President Doctor Patel has more to say about this in his president's report.

In this edition, there's a very interesting article about inhalational agents and their effect on the ozone layer and greenhouse gas generation. Just a small change in anesthesia practice and a decrease in fresh gas flow can result in a significant decrease in greenhouse gas generation. Probably the worst inhalational agent to use is nitrous oxide followed by desflurane. This is a good wakeup call article no matter which side of the global warming theory you believe.

Doctor Answine describes a recent event in the trauma bay and how a protocol limited his choice for patient care. His research following the event provides a very thoughtful review of the literature regarding what may be the optimal induction agent for use during intubation of the trauma patient. Also, in this edition are the usual legal review by attorney Artz of a current case involving an anesthesia group, the report of our District Director Doctor Erin Sullivan, and an equipment review by Doctor Cherian.

As always, your feedback, comments, or suggestions are welcome. Comments may be sent to PSA Sentineleditor@gmail.com

Know your Equipment: Measuring Cardiac Output

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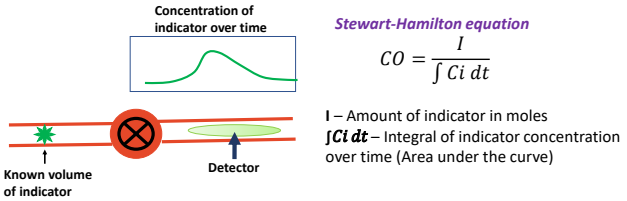
Cardiac output (CO) is the volume of blood ejected by each ventricle per minute and is mathematically, the product of stroke volume (SV) and heart rate (HR). The factors that can modify the CO are the heart rate, the cardiac rhythm, the preload, the contractility, and the afterload of the ventricles and their proclivity to ischemia. CO provides a measure of systemic oxygen delivery and global tissue perfusion.

Adolph Fick (1829–1901), in 1870, was the first to describe the method to estimate the cardiac output. [1] He suggested that if the amount of a marker taken up by an organ is known, then the blood flow to the organ can be calculated by measuring the concentration of the marker in the arterial supply and the venous drainage of that organ. Applying this principle, if the oxygen consumption (VO^2) of a person is measured by a spirometer using a closed rebreathing circuit with a CO^2 absorber, and the oxygen content of the arterial (Ca) and the mixed venous blood (Cv) is measured, then the CO can be calculated.
VO2 = (CO x Ca) – (CO x Cv); CO = VO2 / (Ca – Cv)
E.g. Cardiac Output = (250 ml O2/minute) / (200 ml O2/L – 150 ml O2/L) = 5 L/minute

Measuring the oxygen consumption in a clinical situation is not practical. However, CO can be measured using other techniques, namely the indicator dilution method, arterial pulse waveform analysis, ultrasonography, and the bioimpedance method.

Indicator dilution technique:
An indicator is injected into a vein and is then sampled over time, in either the pulmonary artery or a systemic artery. The concentration of the indicator will display a rapid rise followed by a logarithmic decay. The volume of blood the indicator gets diluted in determines the rate of decay. The Stewart Hamilton equation states that if a known amount of a substance is injected upstream, the change in its concentration downstream is related to the flow. *(Figure 1)*

Figure 1: An indicator is injected upstream and measured by a detector downstream. The integral of its concentration over time can be used to measure the cardiac output using the Stewart-Hamilton equation



The flow (volume over time) in this situation is the cardiac output. The indicators used could be thermodilution of a cold or warm thermal bolus, or lithium.

The pulmonary artery catheter (PAC) was initially developed to measure the pressure in the various chambers of the heart and was later modified by Jeremy Swan and William Ganz to measure the central filling pressures and the CO.

The PAC is a multi-channel catheter, about 110 cm long, that is inserted through the internal jugular or the subclavian vein into the right atrium. It is then gently

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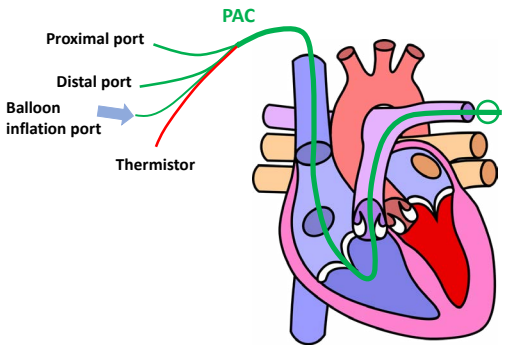
'floated', aided by an inflatable balloon at the tip, through the right ventricle into the pulmonary artery. *(Figure2)*

Figure 2: The Pulmonary artery catheter (PAC) is a multi-lumen catheter, which is gently 'floated' through the right ventricle into the pulmonary artery.



The passage of the PAC can be guided by transducing the channel that opens at the tip of the PAC and observing the pressure waves at the different locations. The aim is to sit the tip of the catheter in the middle branch of the left or right pulmonary artery to measure the pressure in the pulmonary artery. In that position, if the terminal balloon is inflated, the flow through that arteriole is blocked and the tip is 'wedged' and displays the blood pressure distal to it. This pulmonary artery wedge pressure correlates to the left ventricular end-diastolic pressure or the preload. One of the channels of the PAC opens into the right atrium and reflects the central venous pressure. A rapid response thermistor, to measure the temperature of the blood, is located at the tip of the catheter.

The PAC is the gold standard of CO measurement against which other methods are compared. A 10 ml bolus of cold (~0 °C) saline or isotonic dextrose solution is injected into the right atrium, and the temperature of the blood in the pulmonary artery is measured continuously by the thermistor. After the initial decrease in temperature, there is a slow return to the baseline temperature. The rate of return depends on the flow of blood that dilutes the bolus of cold saline. The area under the 'temperature' curve represents the change in temperature over time which is inversely proportional to the CO.

A continuous CO monitoring PAC uses the same thermodilution principle, but instead of a bolus of cold injectate, an electric filament located along the proximal part of the catheter emits pulses of thermal energy and the change in the blood temperature is recorded by the thermistor at the tip of the PAC. Another advance in PAC construction is the incorporation of a tiny light source near the catheter tip which can measure the oxygen saturation of the surrounding blood using reflectance oximetry. When the catheter is in the appropriate position, it measures mixed venous oxygen saturation (SvO^2).

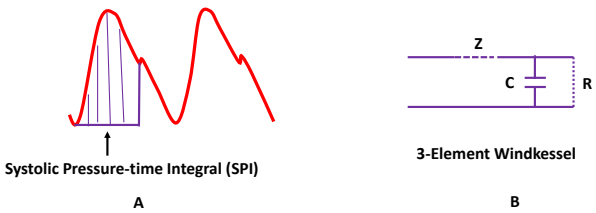
Arterial Pressure Waveform Analysis:

'Windkessel' effect: When the left ventricle (LV) contracts it ejects a stroke volume (≈70ml) under (systolic) pressure (≈120mmHg). The elastic wall of the aorta distends to accommodate the stroke volume and subsequently recoils to push this volume forward at (diastolic) pressure (≈80mmHg). Otto Frank, the German physiologist who first described this phenomenon, wherein a cyclical ventricular contraction generates a constant flow through the blood vessels, called it the 'Windkessel' effect. The fire engines of those times used an air chamber (Windkessel chamber) that converted the sinusoidal pressure generated by the rotatory pump into a constant water stream.

Mathematical analysis:

The general principle of the arterial pressure waveform analysis is that the Systolic Pressure-time Integral (SPI) or the area under the systolic part of the arterial curve is directly proportional to the stroke volume and inversely proportional to the total arterial compliance. The estimate of aortic compliance is based on the three-element Windkessel model, which includes the compliance of the great arteries (C), the resistance of the vascular system, principally in the arterioles (R), and the aortic impedance (Z) due to the elastic, reflective pressure wave. *(Figure 3)*

Figure 3: The Systolic Pressure-time Integral (**SPI**) or the area under the systolic part of the arterial curve (**A**), is directly proportional to the stroke volume and inversely to the arterial compliance. The estimate of aortic compliance is modeled on the three-element Windkessel (**B**). [Z- impedance, C- capacitor, R- resistor]



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Therefore, to measure the CO from the arterial pressure waveform, the arterial compliance should be known. This can either be estimated based on the patient's biometric values such as gender, age, height and weight (uncalibrated technique), or by calculating it by first measuring the CO using the Fick's principle (calibrated technique). [3]

- Flo-Trac / Vigileo: The Flo-Trac sensor is attached to a standard arterial line. The monitor analyzes the arterial waveform and calculates the CO by incorporating the value of aortic compliance based on the population demographics (e.g. age, weight, height and gender). A newer model (Clear-Sight®) generates the arterial waveform by using a finger cuff and vascular unloading technique.

- Pulse index Continuous Cardiac Output (PiCCO): This system uses a transpulmonary thermodilution method to calibrate its algorithm. It requires a standard central line and a thermistor-tipped arterial cannula which is placed within the femoral or the brachial artery. Cold saline is injected into the central line and the temperature change is measured at the arterial cannula. The CO is measured using the Stewart Hamilton equation. This information is then used to calibrate the program that analyzes the pulse pressure waveform.

- Lithium Dilution Cardiac Output (LiDCO): This system uses a lithium dilution method to calibrate its algorithm and requires only a standard arterial cannulation. Lithium chloride is injected into a central or even a peripheral vein and the change in concentration is measured by an electrode sampling at the arterial cannula site.

Ultrasonography:

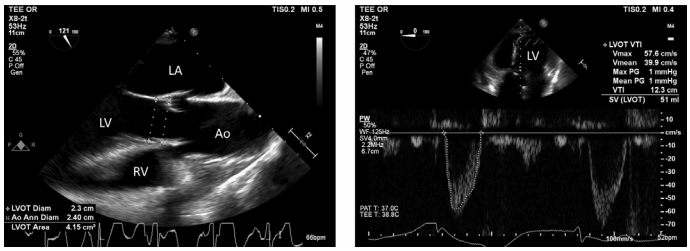
Although ultrasound are sound waves greater than 20,000 hertz (Hz), the frequency used for medical imaging is 2-20 MHz. The speed of ultrasound through tissue is 1540 m/s. Echocardiography uses ultrasound to delineate the structure and function of the heart and the ultrasound probe can be placed either on the chest wall, known as the trans-thoracic echocardiography (TTE), or inserted into the esophagus, the trans-esophageal echocardiography (TEE).

Doppler principle: When an ultrasound wave strikes a moving object some of it gets reflected with a change in its frequency. The reflected waves are at a higher frequency if the object is moving toward the probe and lower if it is moving away. The shift in frequency is proportional to the velocity of the moving object. The frequency of the reflected wave can be detected by the ultrasound probe and using the Doppler frequency shift equation, the velocity of the reflector can be calculated.

Frequency (received) = (2 x Frequency (transmitted) x Velocity of reflector x Cosθ)/ (Speed of sound in tissue)

The basic premise of using ultrasonography to calculate the CO is to measure the cross-sectional area of the left ventricular outflow tract (LVOT) and the velocity of blood expelled through it using the Doppler principle. *(Figure 4)*

Figure 4: Trans-esophageal Echocardiographic (TEE) views showing (**A**) the diameter at the left ventricular outlet tract, and (**B**) measuring the Velocity Time integral (VTI) using the pulsed-wave Doppler and calculating the storke volume (SV).



A B

The diameter of the LVOT, about 1cm from the aortic valve, is measured by specific orientation of the ultrasound probe, namely the mid-esophageal long axis (TEE) or the parasternal long axis (TTE) view. Assuming the LVOT to be circular, the area is calculated using the formula for area of a circle (A=πr2). Using a deep trans-gastric (TEE) or the apical five-chamber (TTE) view, a pulsed-wave Doppler is used to measure the velocity of the red cells at the LVOT. Care should be taken to measure it at the same location the LVOT diameter was measured. The area under the curve of this spectral Doppler profile is known as the velocity time integral (VTI). This depicts the distance a red cell travels per beat or the stroke distance, which when multiplied by the estimated cross-sectional area of the aorta, gives the stroke volume. As evident in Figure 4, most echocardiogram machines are programed to calculate the LVOT area and the stroke volume, and the accuracy of the measurement depends on the expertise of the proceduralists to attain the appropriate view.

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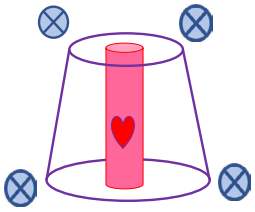
Bioimpedance & Bioreactance:
The human body is able to conduct electrical current because of the presence of charged ions within the body fluids. According to Ohm's law (I= V/R), the current passing through a substance is inversely proportional to the resistance it offers to the potential difference. This resistance is termed 'impedance' when it is an alternating current. Impedance can be defined as a combination of Ohmic resistance and reactance, or resistance to an alternating current, and is denoted as Z. The 'bio-impedance' varies between different tissues, e.g. blood (150 ohm/cm), plasma (63 ohm/cm), lungs (1275 ohm/cm) and fat (2500 ohm/cm). [4]

The basic principle of the bioimpedance cardiography is that the thorax is viewed as two concentric cylinders, a low impedance, inner one containing blood and a higher impedance, outer one constituting the lung and other body tissues. Since the volume of blood increases with each systole, the bioimpedance decreases during the ejection phase and returns to baseline (Zo) during diastole. Electrodes are applied at the base of the neck (thoracic inlet) and the costal margins (thoracic outlet), and a high-frequency, low-amplitude current (1.4-1.8 mA at 30-75 kHz) is transmitted between these electrodes and the change in their amplitude is measured. *(Figure 5)*

Figure 5: The bioimpedance model views the chest as two concentric cylinders, a low impedance, inner one containing blood, and a higher impedance, outer one constituting the lung and other thoracic tissues. The electrodes are applied at the base of the neck (thoracic inlet) and the costal margins (thoracic outlet), and a high-frequency (30-75 kHz), low-amplitude current (1.4-1.8 mA) is transmitted between them.



This information can be used to calculate the rate of the change of Z (ΔZ/Δt), which correlates to the flow of blood into the aorta, during systole.

The stroke volume is proportional to the product of ΔZ/Δt, the ventricular ejection time (VET), and the volume of electrically participating tissue (VEPT), which is essentially the thoracic volume. The VET is calculated from the R-R interval on the ECG and the VEPT is predicted from the height, weight, and gender of the subject.

$$SV = \Delta Z/\Delta t \times VET \times VEPT$$

Although this technique of measuring CO was originally used in astronauts in the 1960's, several modifications have been incorporated over the years. Two significant modifications are substitution of the cylindrical model of the chest to a truncated cone and use of the formula that accounts for deviation from ideal body weight in calculating the thoracic volume. The bioimpedance technique is unreliable during arrhythmias (VET is measured from the R-R interval), acute changes in tissue water (pulmonary oedema or pleural effusion would alter the bioimpedance), changes in temperature and humidity (impact on the electric conductivity between the electrodes and the skin), and mechanical factors such as noise from electrocautery, mechanical ventilation, and surgical manipulation.

Bioreactance is an improved technology which analyzes the relative phase shifts in the voltage of the alternating currents. According to bioreactance, the human thorax is considered an electric circuit with resistors (R) and capacitors (C), which together generate the two components of thoracic impedance (Zo), namely amplitude and phase (phi, o). The pulsatile ejection of blood from the heart modifies the value of R and of C, leading to instantaneous changes in the amplitude and the phase of Zo. Since phase shifts can occur only because of pulsatile flow, and the overwhelming component of thoracic pulsatility stems from the aorta, the bioreactance signal is strongly correlated with aortic flow. This is impacted less by movement artefact, patient body variance, and thoracic fluid, which would be relatively static.

The bioreactance device is made up of a high-frequency (75-kHz) sine wave generator and four dual-electrodes to establish electrical contact with the body. Each electrode sticker contains one electrode that transmits the high-frequency sine wave into the body, while the other electrode is used by the voltage input amplifier. The signal processing unit detects the relative phase shift (Δo of the input signal. The peak rate of change in phase ($\Delta\phi/dt$) is proportional to the peak aortic flow.

$$SV = K \times VET \times \Delta\phi / dt$$

K is a constant of proportionality which is determined by bioreactance

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Monitoring the CO guides administration of fluids and vasopressors, especially in critically ill patients or during major abdominal surgery with large fluid shifts. It can be measured using invasive, minimally invasive and non-invasive techniques. This was an attempt to explain the physical principles used in each of the techniques and to give a better understanding of their strengths and limitations.

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May is Mental Health Awareness Month!

Make sure you take time to care for yourself. Get outdoors and get some sunlight! Here are some neat places to visit in our great Commonwealth!

Austin Dam Memorial Park
https://austindam.mailchimpsites.com/
Go hiking, camping, fishing, or picnicking and overlook the grassy meadow that memorializes the 2nd worst dam break in Pennsylvania history.

Ricketts Glen State National Park
https://www.dcnr.pa.gov/StateParks/FindAPark/RickettsGlenStatePark/Pages/default.aspx
With 11 trails and 22 waterfalls, Ricketts Glen is sure to double your pleasure and double your fun with all the scenic views it has to offer.

Blue Marsh Lake
https://visitpaamericana.com/partner/blue-marsh-lake-recreation-area/
Biking, walking, hiking, horseback riding, boating, fishing—take your pick of outdoor recreation. Blue Marsh Lake is a great spot for lovers of land and water alike.

Valley Forge State Park
https://www.nps.gov/vafo/index.htm
Take a trip back in time and visit this 3,500-acre park that was an encampment site of the Continental Army during the Revolutionary War. Enjoy the museum, monuments, and meadows while listening to the many bird species that abide there.

Bushkill Falls
https://www.visitbushkillfalls.com/
Visit the Niagara of Pennsylvania. This Pocono Mountains hideaway boasts a series of eight waterfalls and a plethora of activities for a full day of exploration and enjoyment.

Presque Isle State Run Park
https://www.dcnr.pa.gov/StateParks/FindAPark/PresqueIsleStatePark/pages/default.aspx
This 3,112-acre state park in Erie offers numerous trails, colorful sea glass, and 11 miles of beach so that you can swim or sunbathe, bike or hike, and enjoy nature to your heart's desire.

Propofol for Trauma Patients and other Myths and Fairy Tales

Joseph Answine, MD, FASA
ALTERNATE DISTRICT DIRECTOR TO THE ASA

Recently, I was in the trauma bay of the academic institution where I commonly go to torture young residents and students. We were asked to intubate a trauma patient due to concern for airway compromise. The patient was hemodynamically stable and was without a significant risk for major blood loss. I asked for propofol and rocuronium but was told not to use propofol as per protocol. I understand that propofol could produce a reduction in myocardial contractility and systemic vascular resistance in an already hemodynamically unstable trauma patient. My problem is that I do not necessarily hate but aggressively dislike protocols generally. I recognize that protocols in medicine are thought to reduce variability in care and mistakes, but they also remove the use of thinking from the decision making process. I prefer guidelines and recommendations, which provide room for independent thought. I sensed at the time that my insistence on using propofol would create an immediate argument, emails, meetings, and an expansion of the Joe Answine incident report filing cabinet. So, I used etomidate which, at least in my hands, creates inferior intubating conditions due to unpredictable levels of hypnosis and amnesia as compared to propofol. I asked where the data came from to support the "protocol" and was told it was based on in-house observations by the trauma service. It seemed as if I was considered too slow of thought to use my clinical judgment to determine the best induction agent based on the clinical situation. I guess my big issue was that the trauma surgeons were peeing in my pond. So, it may be time to review the actual data.

If the patients are so hemodynamically unstable, why not intubate them without anesthetics? In a study from the British Medical Journal in 2001 entitled "Survival of trauma patients who have prehospital tracheal intubation without anaesthesia or muscle relaxants: observational study", only 0.2% or 1 in 486 of the patients survived when intubated without anesthetics. Your first thought should be that if they were too sick to have anesthetics then they were likely going to die anyway. True, however the lack of induction medications surely did not improve survival, and it likely created suboptimal intubating conditions.

If propofol is not used, then the likely choices would be etomidate, which was used in the above case, or ketamine. When looking at different physician specialists, propofol is the drug of choice for anesthesiologists, and etomidate for emergency room physicians in the trauma bay. Propofol, however, has many benefits when used in trauma patients. Anesthesiologists today are comfortable with its use. It has a rapid onset, profound amnesia, and a short and predictable duration of action. Furthermore, propofol decreases CMRO2, cerebral blood flow, and intracranial pressure (ICP) making it an ideal agent for hemodynamically stable brain injury patients.

Etomidate is known to have more stable hemodynamics, however it is not without its problems in this patient population. There has been an association between etomidate and the risk of hospital acquired pneumonia in both traumatic and non traumatic critically ill patients. An article in Intensive Care Medicine from 2012 entitled "Etomidate increases susceptibility to pneumonia in trauma patients" reports that the use of etomidate increased the risk of pneumonia, occurring in 51.6% of those individuals receiving the drug which was significantly higher than those not receiving it. This was thought to occur due to etomidate's effect on endogenous corticosteroid production. With the number one complication in trauma patients being infection, whether wound infection, pneumonia, or UTI, this would be a major deterrent for its use. Other articles in critically ill patients describe a similar concern with etomidate's inhibition of 11-beta-hydroxylase and associated reduction in cortisol production and secretion.

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Propofol for Trauma Patients and other Myths and Fairy Tales

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Ketamine has an advantage of increasing cardiovascular stimulation through centrally mediated increased sympathetic tone and increased release of catecholamines, therefore, it can maintain adequate blood pressure in the hypovolemic patient. However, ketamine is also a myocardial depressant, and hypotension can occur in patients who are catecholamine depleted. Ketamine is useful in reactive airway disease by reducing bronchospasm associated with intubation. There is conflicting data with the use of ketamine in traumatic brain injury. There have been concerns for increased ICP with its use. However, some studies show no increase in ICP, and ketamine may demonstrate neuroprotective properties. Furthermore, ketamine may avoid hypotension which has been associated with poor outcomes in traumatic brain injury.

When looking at data comparing the three induction agents in trauma patients, the majority show that propofol use is associated with equal or less mortality when compared to ketamine and etomidate. In an article from Critical Care Explorations in 2021 entitled "Propofol, Ketamine, and Etomidate as Induction Agents for Intubation and Outcomes in Critically Ill Patients: A Retrospective Cohort Study", propofol was associated with more ICU free days and lower mortality when compared to the other agents. In an article from 2015 from the European Journal of Trauma and Emergency Surgery entitled "Use of propofol as an induction agent in the acutely injured patient", propofol did not produce hypotension as the dose was adjusted based on hemodynamics. In another article from 2021 in the Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine entitled "Ketamine versus propofol for rapid sequence induction in trauma patients: a retrospective study", there was no difference in 30-day mortality, hospital or ICU length of stay, or duration of mechanical ventilation between the two agents. In an article from Anesthesia for Trauma (2014) entitled "Choice of General Anesthetics for Trauma Patients", the authors write of the concern for hemodynamic changes with propofol. As per the article:

> Our institutional practice is to use reduced doses of propofol in patients with the potential for hemodynamic instability (0.5–1 mg/kg or lower) with adjunctive use of intermittently dosed phenylephrine (100 mcg intravenous boluses) to maintain mean arterial pressure in hypovolemic patients. A ketamine/propofol admixture (ketamine 0.75 mg/kg; propofol 1.5 mg/kg) has been studied and found to improve post induction mean arterial pressure in the non trauma patient compared to propofol (2 mg/kg) alone.

In a review article from 2011 in Emergency Trauma Reports entitled "Rapid Sequence Induction in Trauma", the authors' quote may sum it up best:

> Although there may be a plethora of retrospective studies and systematic analyses, there are few randomized controlled studies with solid evidence to support one technique over another. Hence, RSI and endotracheal intubation in trauma continues to be a procedure based on experience with agents and combinations selected based on premorbid conditions, critical status of the airway, hemodynamic status of patient, and associated injuries.

One last point is on the concern for the use of vasopressors to assist with hemodynamic stability in trauma patients. Vasopressors may be needed regardless of the induction agent used. From Anesthesia Experts (2021) in an article entitled "Vasopressors in Trauma: A Never Event?":

> Vasopressor use in severely injured trauma patients is discouraged due to concerns that vasoconstriction will worsen organ perfusion and result in increased mortality and organ failure in hypotensive trauma patients. Hypotensive resuscitation is advocated based on limited data that lower systolic blood pressure and mean arterial pressure will result in improved mortality.

They advocate for a "nuanced" approach to vasopressor administration in the resuscitation of traumatic shock. In an article from 2017 in the British Medical Journal entitled "Early vasopressor use following traumatic injury: a systematic review", the authors conclude that there is not sufficient data to support or refute their use.

In closing, the data currently available support the utilization of the expertise of the anesthesiologist and not a protocol to decide the appropriate induction agent for trauma patients.

The American Society of Anesthesiologists Responds to the Federal No Surprises Act"; Preserve Safe VA Care.

Erin A. Sullivan, MD, FASA

DISTRICT IX DIRECTOR, ASA BOARD OF DIRECTORS

I hope that everyone is enjoying the spring weather and takes time to step back, even for just a moment, to recharge and refresh from the exhausting pandemic that seems to have no end. Your ASA has been working tirelessly throughout the pandemic to support our members and to keep the advocacy torch burning brightly. Here are a few highlights about some of the most concerning issues that impact our membership.

The Federal "No Surprises Act"

On December 22, 2021, the American Society of Anesthesiologists joined the American College of Emergency Physicians and the American College of Radiology in filing a lawsuit against the federal government in federal district court in Chicago charging that the interim final rule (IFR) on surprise medical billing goes against the language of the No Surprises Act and will ultimately harm patients and access to care.

The No Surprises Act, passed in December 2020, was designed to protect patients from surprise out-of-network bills. Although the law intended to resolve payment disputes through an impartial arbitration system, the interim final rule released by the Departments of Health and Human Services, Labor, and Treasury creates a system that empowers profit-seeking insurance companies to strong-arm local community physician practices, narrow their provider networks and reduce access to care.

The recent rule ignores the law's intent to create a fair independent dispute resolution (IDR) process, according to ASA, ACEP and ACR. In the law that was passed, the arbiter is directed to consider all information submitted by the physician and insurer, including the median in-network rate, complexity of the case, previously contracted rates and market power of the physician and insurance company, among other things.

The law states that the qualified payment amount (QPA) could be one of many equally weighted factors considered in payment disputes. However, the departments made the QPA — an unverified rate set by insurers — the primary factor in the IDR process. This sets an artificially low benchmark payment, for all care – whether in network or not, which may not support wider access to care – particularly in underserved areas.

"We strongly support the patient protections in this law. However, instead of expanding in-network access for patients, what this rule does is exactly what we explained to Congress and the rule-making agencies would happen: insurance companies will use their overwhelming market power and these flawed rules to push more physicians out of network and fatten their bottom line," said ASA President Randall M. Clark, M.D., FASA. "If these rules are not overturned or corrected, insurance companies will use strong-arm tactics to abuse these laws as we have already seen in North Carolina, ultimately compromising timely access to care, potentially causing severe disruption and the wholesale loss of care for patients in areas that really need it."

"It is deeply troubling that the administration would upend the deliberately balanced mechanism to resolve billing disputes established by Congress as part of the No Surprises Act. We are left with a law that will tilt market forces in favor of insurers and they are already exploiting their newfound incentive to push emergency physicians out of network. Legal remedy is necessary so that the IFR does not undermine the entire dispute resolution process," said Gillian Schmitz, M.D., FACEP,

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The American Society of Anesthesiologists Responds to the Federal No Surprises Act"; Preserve Safe VA Care.

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president of ACEP.

"Many practices are reeling from the pandemic's economic impact. Imaging costs are down in recent years, including 2020. Now, insurers are using the new law to increase their profits by artificially cutting reimbursement to a point that many providers can't absorb and become unable to remain in their network," said Howard B. Fleishon, M.D., MMM, FACR, chair of the American College of Radiology Board of Chancellors. "Rural areas and underserved communities may be hit hardest by this insurer overreach that could result in longer wait times for care, delayed diagnosis, higher out of pocket costs to treat more advanced conditions, and even deaths as insurers use the new law to deny patients covered access to their chosen providers. With this harmful regulation due to take effect January 1, we have little choice but to protect patient access to care by taking legal action."

This lawsuit does not impact No Surprises Act protections to hold patients harmless during insurer-provider out-of-network payment disputes and will not increase patient out-of-pocket costs.

Maintain Safe VA Care

The American Society of Anesthesiologists is urging the new U.S. Department of Veterans Affairs (VA) leadership to reject a proposed new standard of care that would eliminate anesthesiologists from the surgical care of Veterans. The standard, if implemented, will place the health and lives of Veterans at risk.

In April 2020, Richard Stone, MD, former VHA Acting Under Secretary for Health, issued a memorandum ("Stone Memo") that put a process in place to change how anesthesia is delivered in the VA. Dr. Stone is seeking to shift VA from a physician-nurse Anesthesia Team model (physician anesthesiologist working with Certified Registered Nurse Anesthetists (CRNA)) to a CRNA, nurse-only model. The standard promoted by the Stone Memo lowers the standard of care for Veterans.

Despite strong objections from many stakeholders, including over 350 VA anesthesiologists who have three times formally invoked VA's "Stop the Line" patient safety whistleblower program, Dr. Stone's proposal remains pending within VA as part of VA's new Federal Supremacy Initiative. This is an initiative announced last November through an Interim Final Rule and requires VA to "standardize" care through new VA-only "national standards of practice" for all health professionals who work in VA facilities.

Under the Federal Supremacy Initiative, VA will supersede established state health care practice laws and regulations – the vast majority of which represent a higher standard of care. There is grave concern the standard under the Stone Memo will be made permanent through these national standards. Removing highly trained anesthesiologists from the care of Veterans unnecessarily puts the health and lives of more than 9 million Veterans at risk.

VA's longstanding policy for surgical anesthesia care provides for physician-delivered or physician-nurse team-based models of anesthesia care in VA facilities. This policy was recently reaffirmed after more than 6 years of research and study by VA from 2009-2017, including two comments periods. This generated a record 200,000 comments, including tens of thousands from Veterans and Veterans' families opposing the nurse-only model of care for anesthesia. VA's final rule permitted nurse practitioners, clinical nurse specialties, and nurse midwives to practice in the nurse-only model. Nurse anesthetists were explicitly excluded.

Please message your federal lawmakers today to urge them to contact VA Secretary McDonough and ask him to maintain VA's safety standard of physician anesthesiologists and nurse anesthetists working together in the team-based model of anesthesia care.

Key Points for your federal lawmakers:

- The standard promoted by the Stone Memo would place the VA well outside the norm of care models utilized by the nation's top quality health care systems, the care model for 96% of civilians in the United States. This includes the Mayo Clinic, Cleveland Clinic, MD Anderson, and the Johns Hopkins Medical Center – all of which use anesthesiologists personally performing anesthesia or leading teams of nurse anesthetists.

- The nurse anesthetist-only models of care are inappropriate for the older, sicker VA patients, and particularly so for Veterans suffering from medical

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- Prior to the issuance of the memorandum, neither Dr. Stone nor the Office of Nursing Services (ONS) collected workforce data to determine the need for the policy change. A system-wide cancellation of surgeries and other procedures requiring anesthesia resulted in overstaffing of both VA physician anesthesiologists and nurse anesthetists. There was and continues to be no anesthesia workforce shortage in VA.

Federal Legislative Conference 2022

ASA's Federal Legislative Conference is scheduled for May 9-11, 2022, at the Hyatt Regency on Capitol Hill, Washington D.C. It will be good to be back to an in-person meeting.

ASAPAC

I am honored to serve as a new member of the ASAPAC Executive Board and I pledge to represent our state component society well! ASAPAC provides non-partisan political support for ASA's advocacy efforts and allows our members to participate in the political process and protect patient safety and quality of care.

Political decisions directly impact our specialty, playing a key role in determining how much we are paid, the regulatory and legal environment in which we practice and the role of non-physician providers in our practices. The PAC provides ASA members access to legislators whether they are home in their local Congressional District or on Capitol Hill.

ASAPAC contributors recognize the challenges our profession faces—attacks on physician-led anesthesia, underfunded Medicare payments for anesthesia services and a burdensome regulatory and legal environment. They understand that political involvement is critical to meeting the challenges.

If you are currently contributing to ASAPAC, I wholeheartedly thank you. I strongly urge those who have not contributed in the past to do so now. We need every members' support to advance the practice and secure the future for all. It is very easy to contribute any amount. Go to https://asapac.asahq.org/home.aspx and click on the Contribute button. Member login is required.

Global Warming: The Latest Trend in "Blame Anesthesia"

Lucia Baglivio BSN, RN
Sarah Henke BSN, RN
Kara Keyes BSN, RN
Jason Pawlowski, DO

According to the World Health Organization[1] climate change is currently the greatest threat to public health. A greenhouse gas (GHG) is a gas in the earth's atmosphere that traps heat. The United States is the second largest emitter of GHGs in the world, behind China which releases almost twice the US amount. Ten percent of US greenhouse gas emissions come from healthcare alone.[2] If US healthcare were its own entity, it would rank 13th in the world for greenhouse emissions.[2] It is projected that if we allow warming to reach 2°C above pre-industrial times, some contend that we will experience devastating consequences to life as we know it, including extreme weather patterns and food and water shortages.[1] Climate experts support limiting warming to 1.5°C above pre-industrial temperatures to dampen the severity of these consequences. When conversing with others about climate change, the language takes a futuristic tone concerning life on earth for generations to come with some suggesting that climate change is of pressing concern today. At current rates of emission, it is projected that we will reach 1.5°C warming between now and 2050.[3]

To narrow the concern to anesthesia practice, the American Society of Anesthesiologists (ASA) reports that operating rooms generate 20-30% of total hospital waste.[4] In the US, 51% of operating room GHG emissions are due solely to anesthesia gas.[5] Carbon dioxide and methane are the GHG most of us are familiar with. Studies continue to prove that inhalational agents are anywhere from 200 to 2,000 times more potent heat trappers than CO^2, and in one year, anesthesia gases are responsible for the equivalent of 4.4 million tons of CO^2 emissions. This is equal to the carbon emissions of one million passenger cars.[6] A lack of awareness regarding the environmental impacts of anesthetic choices appears to be the greatest barrier to implementing sustainable practice.[7]

An important concept in climate science is called global warming potential (GWP). GWP was developed to allow comparisons of global warming impacts of different gases. This measurement is useful in comparing a certain gas to the GWP of CO^2 which is equal to 1. For example, sevoflurane has a GWP of 210, meaning it is 210 times more heat-trapping than CO^2.[6] Isoflurane and desflurane have a GWP of 510 and 1,620 respectively.[6] Isoflurane and nitrous oxide (N2O) both directly deplete the ozone layer, making the earth vulnerable to harmful radiation from the sun.[8]

Average atmospheric lifetimes of agents are well understood; most notably, N^2O remains in the atmosphere for 114 years. The atmospheric lifetimes of isoflurane, sevoflurane, and desflurane are 1.8, 3.2, and 8.9 years respectively.[6] GHG emissions associated with halogenated agents are profoundly increased when administered in conjunction with nitrous oxide, most notably with sevoflurane which causes a 900% increase in emissions due to its higher gas flow requirements.[9] Total intravenous anesthesia (TIVA) is always the most sustainable option even considering plastic and electricity use.[10] Several studies note that increased costs of TIVA are offset by shorter PACU stays and reduced costs of postoperative intervention experienced with TIVA versus an inhalational regimen.[11]

Decreasing fresh gas flows (FGF) in the OR is a relatively easy change with significant impact on the environmental burden of anesthesia. Unnecessarily high fresh gas flows lead to unnecessarily high emissions; the higher the flow, the more agent that is emitted into the atmosphere. Low flow anesthesia is environmentally conscious and safe.

A meta-analysis in 2020 reviewed the relationship between sevoflurane, nephrotoxicity, and fresh flow rates.[12] There is a variability in the occurrence of compound A mediated nephrotoxicity among distinct species, and it is specifically related to beta lyase activity which is an enzyme in renal tubular cells. The relevance of this enzyme is specific to rodents, and non-rodents do not have high activity of this enzyme.[12] Therefore, the nephrotoxicity of compound

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Global Warming: The Latest Trend in "Blame Anesthesia"

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A is not significant as evidenced by animal and human studies on prolonged exposure. Additionally, low FGF rates used with sevoflurane did not show decreased postoperative kidney function.[12] Based on these breakthrough findings, minimum FGF recommendation to suppress compound A levels is unnecessary.

Many European countries removed FGF recommendations for sevoflurane nearly 30 years ago, but US regulatory bodies still recognize FGF recommendations with sevoflurane use.[12] Not only have these recommendations increased meaningless hospital spending on anesthetic agents, but they have also escalated the unnecessary atmospheric release of an environmentally detrimental agent.[13] FDA (Food and Drug Administration) guidelines state that if the case is less than two hours and there is no presence of renal insufficiency, providers may use 1-2 L/min FGF with sevoflurane. Only if the case is over two hours and/or the patient has renal insufficiency should 2 L/min be used.[12] This should not be overlooked, as it is perhaps the simplest way for individuals to reduce emissions in half simply by reducing flows from 2 liters/min to 1 liter/min with sevoflurane during the maintenance phase of anesthesia during shorter cases.

As anesthesia providers, we have an extremely unique role in climate change and with relative ease can make a massive contribution to meeting limited warming goals. Four effortless ways to practice greener anesthesia: using the lowest flows possible, choosing sevoflurane over other inhalational agents due to its lowest GWP and atmospheric lifetime comparatively, reducing or removing desflurane and nitrous oxide from practice, and using more total intravenous anesthesia (TIVA). The Yale Gassing Greener App is available for both Apple and Android users for free through which providers can use the anesthesia carbon calculator feature which analyzes agent used, flows dialed in, and case length to receive information on the emissions garnered by said practice. The app offers suggestions on how to change practice to reduce harmful emissions. With adequate knowledge, practice change strategies, and collaborative effort to act, anesthesia providers have the potential to help decrease greenhouse gas emissions.

Four effortless ways to practice greener anesthesia include:

- **Using the lowest flows possible**
- **Choosing sevoflurane over other inhalational agents due to its lowest GWP and atmospheric lifetime**
- **Reducing or removing desflurane and nitrous oxide from practice**
- **Using more total intravenous anesthesia (TIVA)**

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LEGISLATIVE UPDATE

Milliron & Goodman LLC
GOVERNMENT RELATIONS

The PSA is continuing to work with the Pennsylvania Academy of Anesthesiologist Assistants (PAAA) to advocate for CAA licensure in Pennsylvania. The House Professional Licensure Committee recently announced that they will be held a hearing on House Bill 1956 which is the piece of legislation that would allow CAAs to practice here in Pennsylvania. The PSA had members there who testifyied and advocated. If you are interested in helping bring CAAs to Pennsylvania please feel free to contact Tyler@millirongoodman.com.

The General Assembly is once again readying itself for budget season, which will kick off in June. For the past 2 months, members of the House and Senate appropriations committee have met with members from the states' agencies to ascertain their current financial situations. Pennsylvania appears to be in a very good fiscal position as we head into budget. Currently, there is approximately $2.2 billion remaining in federal aid from the COVID-19 pandemic, $2.9 billion in the rainy-day fund, and we anticipate roughly a $2 billion surplus of revenue collected by the general fund. As the situation surrounding the state's budget continues to evolve, we will be sure to keep you updated.

Pennsylvania's General Assembly is also gearing up for a particularly important election cycle. This year all 203 members of the Pennsylvania House will be up for election or reelection (if they are challenged). In addition, of the 50 State Senate seats 24 are up for election or reelection this year. Pennsylvania's primary election date is May 17, 2022.

Outside of the General Assembly, Pennsylvania's race for governor is also heating up. Currently, Attorney Josh Shapiro is the only Democratic candidate. Meanwhile, the Republican field continues to be very crowded with notable names, including President Pro Tempore of the Senate Jake Corman, State Senator Doug Mastriano, and Delaware County Businessman Dave White.

As the elections for the General Assembly and governor begin to heat up, the PSA will be sure to keep our members updated.

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"It became at once apparent to all the world that surgical anesthesia had become a reality and that pain was no longer the master but the servant of the body."

—J. Collins Warren, MD

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