

# Academy NEWSLETTER

THE AMERICAN ACADEMY OF CARDIOVASCULAR PERFUSION 515A EAST MAIN STREET ANNVILLE, PA 17003 (717) 867-1485 PHONE OR FAX OFFICEAACP@AOL.COM HTTP://WWW.THEAACP.COM

SPRING 2018

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# **2018 Annual Meeting**



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# **Welcome to New Members**

The American Academy of Cardiovascular Perfusion would like to welcome the following individuals whom were voted into membership at the Closing Business Meeting of our annual meeting in New Orleans.

### Fellows

Isaac Chinnappan Ann Guercio Robert Grimmett Craig McRobb Killian Patton-Rivera

#### Members

Jennifer Arriola Desiree Bonadonna Patrick Caracci Chloe Choi Kathryn Gray DeAngelis Edward Delaney Julie Fenske **Rio Foster** Matthew Hillier John Ingram Lauren Jones Suzanne Keuler Kacper Kucharski Ashleigh LeBlanc Adrienne Nightingale Susan Schneider Krista Sieling **Trevor Swyers** Emily Thunstrom **Barry Towers** Shigang Wang Marguerite Wellstein

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Bharat Datt, Msc,CCP,CPC,FPP

**Chief Pediatric Perfusionist** 

Arnold Palmer Hospital for Children

# GET RID OF THAT 1/2 " VENOUS LINE! IT'S SO 1960'S.

The current use of a half inch venous line is widespread in the US and is based on a cardiopulmonary bypass (CPB) book (1) by Galetti in 1962. With our current understanding of fluid dynamics (Figure 1) we can ascertain that

- A. The half inch venous line is too large an internal diameter for venous drainage. Hence the chattering and partial clamping observed in the operating room.
- B. Adequate venous drainage can be achieved by shortening unnecessary length from the cannula to the top of the venous reservoir. Any additional drainage need can be

provided by a venous reservoir (Figure 2) whose architecture boosts gravity drainage and/or vacuum assisted venous drainage (VAVD).

Ni and colleagues (2) described an ideal cross-sectional area for a ve-

$$Q = \frac{\pi r^4 \Delta P}{8 \eta l}$$

Q = Flow (venous drainage) r = radius (tubing diameter

 $\Delta P$ 

 height differential (tall/short surgeon)
n = viscosity

I = length

Figure 1. POSEUILLE'S LAW

## LOW RESISTANCE TO VENOUS FLOW



Figure 2. THE FUSION VENOUS RESERVOIR AIDS GRAVITY VENOUS DRAINAGE (courtesy Medtronic)



nous line to be 1 cm2 and were able to generate arterial flows up-to 6 L/min with a 3/8<sup>th</sup> venous line draining by gravity. The ID (internal diameter) of a 3/8<sup>th</sup> inch line is 0.95 cm2. The infinitesimal difference between the above two numbers described (Figure 3) can be achieved by focusing on shortening length of the venous line. At our institution a 3/8<sup>th</sup> venous line is used up-to 110 kg's with gravity drainage. VAVD can be used, but unnecessary use should be avoided as it increases complexity, undetected air embolism (3) and risk of accidents. Finally, appropriate cannulation is key. The principles we are describing do not apply to minimally invasive surgery.

Transformational change at any institution is hard and traditionally easier to achieve in pediatric (4) institutions. The pace of change should be tailored to one's individual team dynamics and communication is the key. Safety should be paramount and key clinical team players should be presented available data, focusing on the goals of reducing unnecessary homologous blood transfusions.

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The full manuscript of this article has been submitted to the journal Perfusion for possible publication.

Author/yr.	Venous tubing length (ft)	Tubing diameter (inch)	Drainage flows (lpm)	Pressure difference (mmgh)	Oxygenator	Venous Cannulation
F De Somer 2011	6.674	3/8	5	68	Not mentioned	Not mentioned
F De Somer 2011	6.674	1/2	5	16	Not mentioned	Not mentioned
Ni et al 2000	6.674	3/8	5	37	Dideco 703	2 stage 36 X 51 Fr or DLP bicaval
Ni et al 2000	6.674	1/2	7	51	Dideco 703	2 stage 36 X 51 Fr or DLP bicaval
Datt et al (in press)	4	3/8	5.5	Not measured	Medtronic Fusion	DLP metal tip 24 Fr, 28 Fr bicaval

Figure 3 – TABLE DEMONSTRATING VENOUS DRAINAGE GENERATED THROUGH A 3/8" LINE



### Halle Swann and Jared Arensdorf

University of Nebraska Medical Center

Omaha, NE

# Improving Hemolysis Levels Associated with Cardiotomy Suction

Cardiotomy suction remains the primary source of hemolysis in cardiopulmonary bypass and is largely due to the air to blood interface present [1,2]. Previous literature suggests avoiding excessive air aspiration is key in reducing hemolysis [3]. This research aims to decrease hemolysis by eliminating the air to blood interface through implementing the Venturi effect to create powerful suction. The major advantage of Venturi suction is that shed blood is introduced to saline filling tubing as opposed to air filled tubing.

We designed the three test conditions of vacuum suction, Venturi suction and Paradigm suction which incorporated the Venturi injector along with weighted sucker tips and shortened sucker tubing lengths. Samples were taken from each group postsuction, centrifuged and tested for plasma free hemoglobin (PFH) as a marker of hemolysis.

The vacuum suctioned blood showed PFH levels significantly increased from baseline (p=0.0039). Neither the Venturi nor Paradigm groups showed PFH levels significantly increased from baseline (p= 0.0625 and p= 0.125 respectively). There was a significant difference in PFH levels between the three conditions (p< 0.0001). The vacuum condition showed significantly higher levels of PFH compared to both the Venturi and Paradigm conditions (p's< 0.001). There was no significant difference in the PFH levels between the Venturi and Paradigm groups (p= 1.00).

We confirm that vacuum suction causes excessive hemolysis. We conclude that a Venturi powered suction system does not cause hemolysis and can be employed to reduce the damaging effects of vacuum suction on blood. Further research on the implementation of a Venturi injector is warranted.



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The full manuscript of this article has been submitted to the journal Perfusion for possible publication.



### Perfusion

### Research

# Abstract of Research Presented at the Society of Thoracic Surgeons (STS) Annual Meeting

Presented January 26, 2016 | Adult Cardiac Session: General

### The Unintended Consequences of Over Reducing Cardiopulmonary Bypass Circuit Prime Volume

### CLINICAL OUTCOMES AND ECONOMIC IMPACT

Contrary to the current trend of reducing prime volume in the heart lung machine to avoid blood transfusions during cardiac surgery, reducing the volume too much (<500 mL) can actually increase transfusions. When used efficiently, red blood cell transfusions may save lives, but these same transfusions are also associated with significant patient complications.

This research is based on data in SCOPE, the SpecialtyCare Operative Procedural Registry®, the largest cardiovascular perfusion database of its kind in North America.

### Impact on Patient Care

- Reduce patient exposure to complications associated with blood transfusions, such as acute kidney injury and pneumonia
- Alarms previously removed to reduce volume can be replaced, improving patient safety and outcomes

### Economic impact

- Cost of blood preparation and administration reduced
- Cost related to complications from blood use and the resulting increase in length of stay reduced

Across SpecialtyCare customers, the financial savings was \$3.4 million in actual blood acquisition costs. The related costs associated with patient morbidities are estimated to be between \$8-12 million.



### **RESEARCH ABSTRACT**

### Authors

B. C. Sun, T. A. Dickinson<sup>2</sup>, D. S. Likosky<sup>3</sup>, D. Wells<sup>2</sup>, S. Weinstein<sup>2</sup>, <sup>1</sup>Minneapolis Heart Institute, MN, <sup>2</sup>SpecialtyCare, Nashville, TN, <sup>3</sup>University of Michigan Health System, Ann Arbor

### **Commercial Relationships**

D. S. Likosky: Consultant/Advisory Board, AmSECT; Research Grant, Agency for Healthcare Research and Quality, National Institutes of Health; S. Weinstein: Employment, SpecialtyCare; D. Wells: Consultant/Advisory Board, SpecialtyCare; Employment, SpecialtyCare; Ownership Interest, SpecialtyCare

### Purpose

The Society of Thoracic Surgeons blood conservation guidelines recommend minimizing cardiopulmonary bypass (CPB) circuit prime volume (PV) as an integral, evidence-based (Class I, Level A) blood conservation strategy. We used a large, multi-institutional database to evaluate the effectiveness of restricting CPB prime volume on intraoperative red blood cell (RBC) transfusion.

### Methods

We reviewed 51,100 isolated coronary artery bypass grafting (CABG) procedures performed among 190 institutions between April 2012 and May 2015. We categorized net prime volume (NPV) as total prime volume minus autologous priming and evaluated three groups: <500 mL, 500-999 mL, and ≥1 L. The primary outcome was transfusion of at least one unit of intraoperative RBCs. Logistic regression was used to model the odds of transfusion. We report odds ratios for transfusion after adjusting for age, gender, acuity, re-operation, estimated blood volume (EBV), first hematocrit in the operating room, nadir hematocrit on CPB, and year. We tested for an interaction by gender.

#### Results

Nearly one-quarter of patients (n=11,351, 22.2%) received an intraoperative RBC transfusion. Relative to an NPV between 500-999 mL, patients exposed to NPV <500 mL had a 1.26-fold increased adjusted odds of transfusion, while those exposed to a net prime  $\geq$ 1 L had a 1.61-fold increased odds of transfusion. Women had similar average CPB NPV to men (864 mL vs 858 mL, *P* = .12), although a higher odds of transfusion (OR 5.26, *P* < .001). There was a statistical interaction by gender, *P* = .037. Relative to patients with NPV between 500-999 mL, men exposed to an NPV  $\geq$ 1 L had a 1.52-fold increased adjusted odds of transfusion and a 1.36-fold increase when exposed to net prime of <500 mL (both *P* < .001). Women had a 1.72-fold increased adjusted odds of transfusion when exposed to net prime of  $\geq$ 1 L (*P* < .001), but a non-significant 1.11-fold increase when exposed to net prime <500 mL (*P* = .12).

### Conclusions

Efforts to minimize CPB NPV below 500 mL do not protect patients from intraoperative RBC transfusion and may actually increase exposure. Perfusion net prime volume can impact both patient morbidity and the economic impact associated with blood utilization. Further studies on the influence of gender on blood transfusion are warranted.

#### ###

For related research, including the clinical and financial benefits of reducing intraoperative transfusions and best practices in patient blood management, visit our Blog and Resource Library at <u>www.specialtycare.net</u> or contact us at <u>info@specialtycare.net</u>.

# STUDENT PERFUSIONISTS ATTENDING THE ANNUAL MEETING IN NEW ORLEANS



### STUDENT PERFUSIONIST'S IMPRESSION OF THE ANNUAL MEETING

During the conference I really enjoyed getting to meet so many people within the profession, especially Upstate Alumni (I'm biased I know...) as well as the other student ambassadors. It was also very nice to get to see some of the perfusionists that I had rotations with previously. The FSC were great, but I felt a little unprepared for them since the topics of discussion were chosen on the spot, and I also didn't really know what chats I would get in to until the day or two before. I felt like I could've contributed to the conversation a little more if I was given a bit more time to review what we'd be talking about specifically. This is coming from a student perspective though, I know professionals probably don't need much time to recall circuit diagrams or protocols of their own department, etc. One of the panel discussions I really enjoyed was the chance to speak with the reps for the perfusion companies that supported the meeting. Hopefully there will be more collaboration opportunities like this in the future to spur new developments that create safer and better care for patients.

I also really enjoyed the food. Much better than the top ramen I've grown accustomed to as a student!



# **2019 Annual Academy Meeting**



Palm Coast, Florida February 6-9, 2019

# AACP 2018 Officers and Council

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Greg Smigla Chapel Hill, NC



### **Kyle Rider**

Vanderbilt University Medical Center

#### Nashville, Tennessee



Vasoplegic Syndrome and Treatments

Vasoplegic syndrome (VS) was first described in the 1950's, but up until the last few decades it has not received a significant amount of attention. The definition of VS remains up for debate: as it is characterized as significant arterial hypotension, low systemic vascular resistance, normal or elevated cardiac output, and increased requirements for intravenous volume resuscitation and vasopressor therapy. То date there are still no true quantifiable values to aid in the diagnosis of VS. (1) Along with a vague definition, the mechanism of VS is largely unknown but is suggested as being multifactorial in nature. Studies currently suggest that hemodilution, baroreceptor reflexes, complement activation and an inflammatory response that results in the release of nitric oxide and subsequent vasodilation can all be attributed to causing this phenomenon. (2)

What is for certain is that the use of cardiopulmonary bypass (CPB) can attenuate all of these mechanisms. VS occurs in up to 25% of all surgery with the use of CPB, and is associated with an increase in morbidity and mortality. Of these cases, 5% are found to be unresponsive to conventional vasopressor therapy (3). The use of CPB can cause an immunologic response secondary to ischemia-reperfusion injury of the heart and lung. Endotoxins are released from mucosal surfaces, and complement cascade activation after the exposure of blood to the CPB circuitry. These processes result in increased production of oxygen free radicals, prostaglandins, thromboxane A<sub>2</sub>, platelet activating factors, a variety of cytokines, and nitric oxide (NO). High serum concentrations of NO have been found to correlate with the development of the systemic inflammatory response syndrome, which supports the hypothesis that VS is at least in part an inflammatory process. (4)

Conventional treatment includes judicious fluid resuscitation and the use of intravenous vasopressor therapy, with catecholamines being the first line of defense. Though effective, these treatments, especially in excessive amounts continue to have detrimental effects on the function of the myocardium and perfusion of the entire body. High doses of vasopressors can lead to peripheral ischemia or mesenteric ischemia, which can progress to the development of muscosal injury, tissue necrosis, and metabolic acidosis (5).

Interestingly, new treatments have begun to emerge as rescue therapies in the setting of VS. Methylene blue (MB) and Hydroxocobalamin or Vitamin  $B_{12}$  has been used successfully to combat VS. To date, no large-scale randomized trials exist in the use of these medications due to the severe nature of VS. Several case studies have been reported with successful use of these medications with improvement in mortality, and a decrease use in vasopressors.

Methylene Blue impacts the NO synthetic pathway by inhibiting inducible nitric oxide synthase and inhibits the subsequent activation of cell-soluble guanyly cyclase. This process prevents the accumulation of cyclic guanosine monophosphate (cGMP) and vasodilation within the smooth muscle (6). Levin et al. showed a decrease in mortality (0 versus 21.4%, P=0.01, n=56) and duration of vasople-gic syndrome (2 versus 48h; P=0.002) for patients receiving MB in the postoperative period after cardiac surgery when experiencing VS (7).

The most common used dosage of MB was found to be 2mg/kg intravenous bolus, followed by a continuous infusion (6). The continuous infusion may be more beneficial as the plasma half-life was found to be 5-6 hours in nature. Though dosage of MB appears to be agreed upon, the timing of administration is still of controversy. MB continues to be used as a rescue therapy, but studies suggest that early administration was associated with reduced renal failure and perioperative mortality compared with postoperative intensive care unit administration (6). Administration of MB after multi organ failure was shown to have no significant impact in mortality (5).

Methylene blue does not come without adverse effects. Worsening arterial oxygenation, impaired alveolar capillary gas exchange in the lung, mesenteric vasoconstriction and compromised blood flow have been reported. Hemolysis, methemoglobinemia, nausea and vomiting, chest pain and hypertension were considered toxic manifestations with the use of MB (6). Due to its greenish-blue coloring, distortion of pulse oximetry readings lead to misleadingly low pulse oximetry levels and must be taken into account.

Hydroxocobalamin, more commonly referred to as Vitamin  $B_{12}$  has been reported as another agent used in VS. Vitamin  $B_{12}$  is also a NO scavenger, along with carbon monoxide and hydrogen sulfide in vasoplegic syndrome. (8). Its administration is associated with clinically significant increases in systemic hypertesnsion, and may be a useful treatment to attenuate capillary leak to facilitate transition to a negative fluid balance in critically ill patients with VS. (9) When used in the setting of VS, studies showed that mean arterial pressures increased to >65mmHg within 15-30 minutes of administration and were sustained well over 60 minutes.

Optimal dosing for  $B_{12}$  remains up for discussion, though case studies reported a 5gm bolus over 10 to 15 minutes per manufacturers recommendations. Side effects of  $B_{12}$  administration include chromaturia and interference with colorimetric laboratory tests. Cost still limits the use of  $B_{12}$  without further studies proving its effectiveness.

To date, there is no standard treatment for VS. Due to the acute and extreme nature of this phenomenon, it is difficult to truly study the use of newer medications versus the use of conventional treatment.

We as perfusionists and perfusion students continue to make adjustments in an attempt to alleviate the phenomenon known as VS. Through surface modifications, reducing CPB prime, minimization of the blood to air surface contact and maintaining appropriate perfusion and oxygen delivery, the realm of cardiac surgery has become safer and VS has occurred less frequently. Without further studies of the use and effectiveness of methylene blue, hydroxocobalamin, or other treatments VS will continue to have severe implications of cardiac surgery.

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# Friend of the Academy, Advocate for Perfusionists



Cardiac surgeon, Dr. W. Gerald Rainer, from Denver, Colorado, and Honorary Member of the American Academy of Cardiovascular Perfusion, died this past November, one day after his 90<sup>th</sup> birthday. On many occasions over two decades he attended Academy meetings as an invited panelist, guest, or speaker, the last of which was in 2003 when we celebrated the fiftieth anniversary of the first successful open-heart case using cardiopulmonary bypass. Many luminaries in the field attended that meeting, and Dr. Rainer gave a superb overview of the development of cardiac surgery prior to the use of cardiopulmonary bypass.<sup>1</sup> Typically, he was gracious to acknowledge the "courageous pioneers", many of whom he had worked with during his distinguished career.

Less well known was Dr. Rainer's behind the scenes efforts in the early 1980s to bring surgeons and perfusionists together during some fractious times. The primary objection from the surgeons' perspective concerned the 1981 deadline set by the American Board of Cardiovascular Perfusion, which mandated only graduates of accredited educational programs would be eligible to sit for the certification examination. With consummate skill and diplomacy, Dr. Rainer proposed the creation of the Coordinating Committee for Perfusion Affairs (CCPA) to bring the vested and often passionate parties together. Hostile statements<sup>2, 3</sup> and editorials<sup>4</sup> were published in the thoracic surgery journals regarding the 1981 deadline, which evolved within a few short years to one praising the perfusion profession.<sup>5</sup> The CCPA was short-lived but there is little doubt it significantly prevented the backward movement to the days of onthe-job training of perfusionists. For that alone, we owe Dr. Rainer our profound thanks.

He was always a gentleman, and his presidential address<sup>6</sup> to the Society of Thoracic Surgeons bears re-reading for his emphasis on leadership traits and characteristics. He wrote of those qualities he thought important and which he believed had been manifested by past leaders of their society. Unwritten was the clear impression that Dr. Rainer embodied all aspects of those essential traits he espoused.

We mourn his passing and look to him for the extraordinary example he set.

#### Mark Kurusz, CCP (Emeritus) Austin, Texas

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# Awards Committee Selects Winning Paper Presentations



Three students received **Lawrence Awards** for their paper presentations at the Annual Seminar in San Diego.

*Kelsey Coyle* - Can The Effects Of Estrogen On The Vasculature Be Leveraged To Improve Cardiac Surgery Outcomes?

*Kimberly Pham* - Would You Put Green Tea In Your Prime?



**Kimberly Pham** 

Kelsey Coyle

Halle Swann - Improving Hemolysis Levels Associated With Cardiotomy Suction

The Lawrence Award is a \$500 cash award for the best student papers presentations.







Julie Fenske

In addition, Julie Fenske was awarded the **Best Paper** of the Conference - a \$750 cash award funded by the journal *Perfusion* for her presentation entitled, "Development Of A Model For Albumin Priming In Pediatric Cardiopulmonary Bypass Circuits."

# 2019 Annual Academy Meeting Host Hotel



# Hammock Beach Resort 200 Ocean Crest Drive Palm Coast, Florida

Single/Double Occupancy - \$220.00 per night (Main Tower Ocean View - Premium One Bedroom) Reservations: 866-841-0287

Please mention that you will be attending the Annual Conference of The American Academy of Cardiovascular Perfusion when making your reservations.



#### The ACADEMY ANNUAL MEETING DEADLINES

ABSTRACT DEADLINE	October 15, 2018
MEMBERSHIP DEADLINE	December 6, 2018
PRE-REGISTRATION	January 4, 2019
HOTEL REGISTRATION	January 7, 2019
2019 ANNUAL MEETING	February 6-9, 2019

#### **Others Meetings**

### Sanibel Symposium 2018

April 4-7, 2018 Sanibel Harbour Marriott Resort & Spa Fort Myers, Florida Website: http://www.perfusion.com/cgi-bin/ productcart/pc/viewPrd.asp?idproduct=129

#### 14th International Conference on Pediatric Mechanical Circulatory Support Systems Pediatric Cardiopulmonary Perfusion Conference May 2-5, 2018

Ann & Robert H. Lurie Children's Hospital of Chicago Chicago, IL

Website: http://childrens.pennstatehealth.org/ community/participate-in-research/researchprograms/pediatric-cardiovascular-research/ international-conference/conference-information



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