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AmSECTODAY

AmSECT COVID-19 Response 04

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INFECTIONS ON ECMO

Laura Dell'Aiera, BS CCP

Why tolerate greater mortality risk from infections in ECMO patients?

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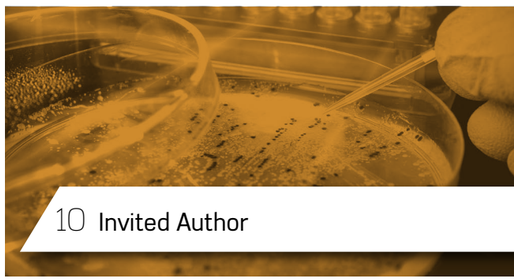
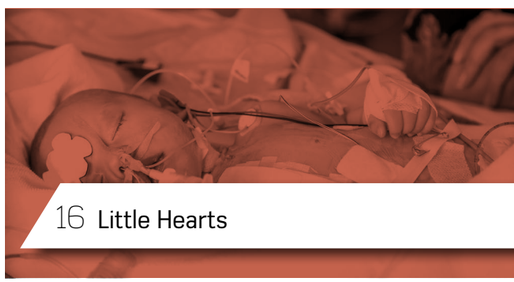
COLUMNS





James A. Reagor,
MPS CCP FPP

A CHANGE IN LEADERSHIP

PREPARING FOR THE AMSECT PRESIDENCY IN 2020

Please let me begin this president's message by saying thank you to all of you who take time out of your personal lives to serve our professional community. Whether you serve on a committee or board of a local, state, or national society, spend time sharing your experience through presentations, invited articles, or publications, or simply take the time to respond to a colleague's perfusion related email, phone call, or text message, thank you. You have all served to improve our community and impact the care of our patients.

This year, more than any other in my time on the Board, more candidates ran for office than I can ever remember. From the office of President-Elect to the elected committees, all positions had candidates, and many positions had multiple contenders. In total, almost thirty highly qualified candidates, passionate about our profession, offered to serve AmSECT's members and our profession by volunteering in elected positions. Those of you who did not get elected should not be discouraged but continue to look for ways to serve. There is a great deal of opportunities within our society to volunteer including committee membership, special projects, government relations, and much more. The life blood of our society is volunteerism and every member has the chance to participate.

Amazing things are happening within AmSECT and our profession. Initiatives such as, protocol creation, data registry associations, Centers of Excellence, best practice recommendations, and improved educational opportunities are just a few of the ongoing and future strategic initiatives. Collaborations with other national and international societies are a key focus to advance our society's continued commitment to the practicing perfusionist, improving outcomes, and uniting our profession as one voice.

As I have stated before, the Presidency and the other elected AmSECT Board positions are not positions of power but of service. AmSECT exists to serve its members and provide a voice on a national level which echoes all the way to the halls of your very own institutions. Serving the members of the largest society of perfusionists in the world is the paramount opportunity to aid AmSECT's strategic initiatives developed to support and strengthen our profession. If you are not engaged in our community beyond the walls of your institution, you can have a greater impact on our profession, and you can start by volunteering! I am blessed to be surrounded by a fantastic group of board members any of which, myself included, would be happy to speak with you and help you get plugged in an area that matches your interests. **CLICK HERE** to contact a board member and start the conversation.

RESPONSE TO COVID-19

On behalf of the AmSECT Board of Directors and Safety Committee, we extend our deepest concern, astute public health surveillance, and ongoing association support for our members, colleagues, and partners who are impacted by the outbreak of the COVID19 (Coronavirus) pandemic. Monitoring and improving the quality of life for our patients, their families, and extracorporeal technology professionals is at the core of our mission at AmSECT.

AmSECT continues to monitor the developments of COVID-19 and its impact on our community. We are committed to providing you with the tools, resources, and most up-to-date information to care for your patients, their families, your community, and you. To that end, AmSECT is participating in the Joint Perfusion COVID-19 Task Force which includes representatives from the American Board of Cardiovascular Perfusion, the American Academy of Cardiovascular Perfusion, Australian and New Zealand College of Perfusionists, Comprehensive Care Services, the Michigan Society of Thoracic and Cardiovascular Surgeons, Perfusion.com, and SpecialtyCare. This joint effort is monitoring the recent coronavirus outbreak and its impact on the perfusionists. Combining the strengths of all organizations, the goal is to disseminate information and resolve questions related to perfusionists and COVID-19.

In a situation such as this one, the infectious disease and crisis control centers of your hospital should be your primary source of public health information and mandates. Please adhere to their guidance and mandated protocols to ensure your patients and staff maintain optimal health to contain the dissemination of this virus. This is a rapidly evolving public health situation. Stay focused, alert, and informed in order to be an educated resource. Finally, protect yourself. You are very much valued, as your contributions positively impact the lives of so many patients.

Resources:

- **Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease**
- **Interim Infection Prevention and Control Recommendations**
- **Interim U.S. Guidance for Risk Assessment**
- **Healthcare Professionals: FAQ**

Please contact **AmSECT Headquarters** with any questions or concerns.

Infections on **ECMO**

BY LAURA DELL'AIERA

Why is it that the intolerance of infection in ECMO patients is not nearly as firm as that of surgical site infections?

Laura Dell'Aiera, *BS CCP*

As perfusionists we often hear OR chatter about rates of surgical site infections and the occasional celebrations after a reduction. We typically find ourselves on the periphery of such conversations and are grateful to fly under the radar. After spending ample time in the OR, you understand that the celebrations are a fleeting event as compared to the investigations following an increase in infection rates. While we are all happy to avoid the pointed finger, we do understand that such concern and diligence is important and necessary in proper patient care. Deep sternal wound infections (DSWI) will markedly increase your patient's risk of mortality if they happen to be one of the rare unlucky few. A DSWI, while occurring in a range of 0.2% to 8% of cases, can increase mortality by up to 45% (Pan et. al., 2017).

With such attention turned to an event that in many places occurs in less than 1% of cases, one would logically assume that a similar event happening in 65% of cases would have the attention and resources of an army. However, that is not the case. Infections in ECMO patients have been reported to be as high as 65%, increasing the risk of mortality by 38-63% (Biffi et. al., 2017).

Why is it that the intolerance of infection in ECMO patients is not nearly as firm as that of surgical site infections? I set out to identify what we currently know about infections on ECMO and how they differ from the infections of other patients. As I searched, I was pleasantly surprised to find the "ELSO Infectious Disease Task Force". Of course, nothing is served up on a silver platter like this in the real world though. So, I was quickly deflated when I found that their last statement and recommendation was made in 2010. When I think about ECMO over the last decade (yes, 2010 was a decade ago), I see a totally different therapy. The increase in understanding, prevalence, comfort, technology, and uses has been enormous over the last decade. Certainly, the recommendations and advances in infection control must have changed as well!

Despite my skepticism, I read through the 25-page chapter on recommendations made by the task force, this time with the intention to compare and contrast the inevitable advances we have made. With each new recommendation and section, I found the information to be oddly, current.

To summarize, rates of infection seem to be higher in the adult population than in the pediatric population. The neonatal population had the lowest rate of infection at 7.9% (ELSO, 2010). Infection rates also increased as the length of ECMO therapy increased. Naturally, the authors questioned the causal element here. The ELSO data collected in 2010 was not specific enough to identify whether patients were acquiring infections due to long term ECMO therapy, or if their acquired infections were prolonging their ECMO courses (ELSO, 2010).

Authors of the ELSO document in 2010 also make strong recommendations about accessing the ECMO circuit. While they recognize that it may be necessary to draw the occasional sample from the circuit, they urge the users to use the highest caution. The suggestion is for the user to treat the ECMO circuit just as a protected central line. Proper preparation of the access hubs must be taken very seriously, and it is noted that the preferred prep solution is chlorhexidine. Whenever possible, drawing samples and placing infusions should be done at a direct patient site rather than on the ECMO circuit (ELSO, 2010).

Based specifically on available data in 2010, the Infectious Disease Task Force discourages the surprisingly prevalent practice of administering prophylactic antibiotics. According to available research, patients who received prophylactic antibiotics were just as likely to obtain an infection while on ECMO support. In fact, the concern was that those who received antibiotic therapy without proper indication were more likely to develop a resistant strain of infection (ELSO, 2010).

Further, although they may serve as a safety net, any extra access lines should be removed from the patient after ECMO is initiated and stabilized. This is encouraged even in systemically anticoagulated patients. The risk of bleeding from a properly removed line is felt to be less severe than that of an infection caused by its presence (ELSO, 2010).

One of the most interesting and applicable items on the task force's list of recommendations is the topic of pre-primed circuits. While searching for concrete data to place their recommendation on, several members conducted single center research on 30 day primed circuits and found that they were negative for any type of bacterial growth. One center went further as to implement a few practice changes, one of which was to use only circuits that were pre-primed in a controlled environment. Infection rates at that institution dropped from 29.3/1000 ECMO days to 20.1/1000 ECMO days. This suggests that the circuit built and primed in a controlled non-emergent fashion ahead of its need, is less likely to cause infection than a circuit built and primed emergently (ELSO, 2010).

The final task force recommendation was that the ELSO database be expanded to include more specific data. Culture sites and dates were pieces of information they felt would be helpful in infection evaluation. Additionally, further research to understand ECMO sources of infections and treatments would be necessary to combat this serious complication (ELSO, 2010)

By a stroke of luck, I was able to locate a publication from 2017 with a compilation of the current literature on ECMO and infections. Biffi and colleagues compiled a report in much the same way that the Infectious Disease Task Force had in 2010. It was my intention to make a direct comparison of the 2010 data to the 2017 data. There was clearly more research conducted between the two publications with more information in order to make informed recommendations. Much of this research was conducted in the pediatric and neonatal population and may not translate well into the adult population (Biffi et. al., 2017).

Amazingly, as a whole, the 2017 paper made no different recommendations than the 2010 paper. The rates of infection and mortality in today's population is unchanged, the most at risk populations have not changed, and cause of infection is still difficult to identify. The avoidance of prophylactic antibiotics due to lack of evidence supporting the practice was explained very clearly in the same manner and stands as a recommendation. Item by item, Biffi walked through each recommendation and with the addition of a few new pieces of supporting data, made the same recommendations as the ELSO Infectious Disease Task Force in 2010. Closing statements included the need for more specific data collection and more extensive research (Biffi et. al., 2017).

Along this journey I have answered some questions but also left with more unanswered questions than I had hoped. What are the obstructions to progress in this area? Why have we not improved over the last decade in our recommendations or rates of infection? My parting words for each of you come in the form of a charge. First, read the ELSO document of recommendations. There exists much more information than what could be covered here. Second, and most importantly, we as a profession need to move this area forward with new research and process improvement. We must strive for the next decade to show a drastically different report of incidence and mortality. As a community, let's be intolerant of infections in ECMO.

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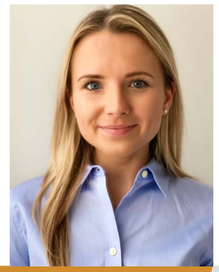

THE IMPORTANCE OF PRE-TRANSFUSION TESTING

Michelle Machala,
MLS (ASCP)

EVALUATING BLOOD QUANTITY NEEDS IN PREOPERATIVE PROCEDURES

ABSTRACT

Withdrawal of a patient's blood for autologous use is standard preoperative practice during cardiothoracic surgery, utilized as a safe method to provide the patient's own blood for oxygen transport and coagulation factors when needed, as well as limiting their exposure to foreign blood products. However, when indicated, homologous banked donor blood products may be used following completion of several analytic factors prior to administering the most-safe donor blood product, as well as to perfuse the patient without causing harm during Cardiopulmonary Bypass Surgeries (CPB). This clinical review highlights pre-transfusion testing, emphasizing the importance of clerical checks and potential issues posed without following proper standard operating procedures by Cardiopulmonary Perfusionists, Transfusion Medicine Technologists and all individuals involved prior to transfusion.

INTRO

The quantity of blood components ordered preoperatively is determined based on the physician's judgement of expected surgical blood loss for a given procedure, the patient's preoperative hemoglobin concentration, or on an institution's maximum surgical blood order schedule (MSBOS). The MSBOS serves as a guideline in directing pre-transfusion testing along with blood and blood component orders based on the patient's preoperative condition (1). Pre-transfusion testing is a multistep process covering pre-analytical to post-analytical phases. Failure to consider any factors constitute error and may be detrimental to the patient. Variables of the pre-analytical phase include patient identification during time of draw, labeling of the specimen, and proper specimen handling prior to laboratory testing. Analytic testing is the second phase, taking place in the laboratory from the moment the specimen is received and ends when the test result is interpreted and verified. The post-analytical phase includes all necessary steps taken after laboratory testing results are obtained. This includes transcription and reporting of results to report forms, assessment of clinically significant results, making sure proper labeling and issuing of a blood product is completed for the correct patient, as well as performing clerical checks by the Perfusionist prior to component transfusion during the procedure. Serious and potentially fatal patient consequences may occur if any variables throughout pre-transfusion testing are overlooked.

BLOOD GROUP ANTIGEN AND ANTIBODY TESTING

The Blood Bank Laboratory's testing of a patient's ABO Rh blood group antigens and antibody screen during the analytic phase is an important routine preoperative test aiding in clinical and medical determinations made prior to transfusion or perfusion of blood. Blood and/or blood components may be selected and cross-matched for the safest possible transfusion, while also detecting significant antibodies that may pose a risk during Cardiopulmonary Bypass Surgeries (CPB). An antibody screen is performed to detect antibodies present in the patient's plasma directed against red cell surface antigens. This test is performed by adding the patient's plasma to a set of commercially available erythrocytes with a known pattern of antigen expression. This panel of erythrocytes contains clinically significant non-ABO antigens which are known to cause hemolysis in vivo. A positive antibody screen signifies the presence of one or more antibodies directed against red cell surface antigens. Alloimmunization, or the development of RBC antibodies occurs as a result of exposure to RBC antigens during pregnancy or from a previous transfusion (2). Epidemiologic studies reveal that 1-3% of the general patient population will have a non-ABO red blood cell antibody (3). A patient identified with a clinically significant antibody requires additional testing in order to find homologous RBC units that lack the antigen to which the antibody may attach to. A full crossmatch must be performed using the selected RBC units along with the patient's plasma to detect possible incompatibility.

ELECTRONIC CROSS-MATCH

Donor Red Blood Cells (RBCs) for an adult patient are selected and electronically cross-matched by the Blood Bank to a patient based on a valid ABO Rh blood type with a negative antibody screen tested within three days from the time the specimen was drawn. In addition, the patient must have no known history of clinically significant antibodies or special requirements. If records for previous samples cannot be obtained, a second specimen must be drawn to confirm the correct ABO Rh blood type and antibody status of the patient (4). Regarding a pre-surgical specimen, if the patient meets requirements such as having not been transfused three months prior to the specimen draw date and is not receiving any transfusions prior to the surgical procedure, the electronic crossmatch viability for the specimen may be extended and used on the day of surgery. If an error occurs anywhere during the pre-analytic to the analytic phase, an incorrect product may be dispensed and transfused with subsequent consequences for the recipient.

PRE-TRANSFUSION TESTING: ERRORS AND OUTCOMES

A preoperative misdraw occurs as a pre-analytical error, demonstrating failure in performing proper patient identification. If the wrong patient is drawn for a Type and Screen test along with an ABO Rh confirmation sample under the information of the correct patient, a Transfusion Medicine Technologist is able to dispense a false-negative compatible blood product at the time of request without the knowledge of any discrepancies. This is particularly important in the case of any patient lacking historical blood type information. The transfusion of the incorrect blood product may cause serious harm if the blood type of the incorrectly drawn patient is not compatible with that of the recipient. In the case of a miss-matched Rh Red Blood Cell (RBC) unit, a recipient who lacks the Rh blood group antigen "D" on their RBCs will produce an anti-D antibody if they encounter the D antigen on RBCs during a transfusion, causing a hemolytic transfusion reaction (5). A prospective study conducted by the Department of Transfusion Medicine of Shri Maharaja Gulab Singh Hospital (Jammu, India) reported a total of 2,229 errors detected out of 32,672 requisitions received for typing and cross-matching of blood and blood components for transfusion over a period of 1 year. Pre-analytical errors related to sample collection and labeling of samples comprised 793 (35.5%) and were the most common of all errors in the pre-analytical phase. ABO Rh incompatible hemolytic reactions were the most frequent harmful event with the frequency of 2.2/10,000 transfusions (6).

As previously mentioned, the transfusion of a blood product to a patient who had a misdrawn specimen identifying them with an incorrect blood type and a false-negative antibody screen can result in potentially fatal situation. However, there are other pre-analytical, analytical and post-analytical variables which may cause problems without the transfusion of homologous blood products. An example would be the preparation for a preoperative patient scheduled for cardiac surgery. Cold agglutinins are predominantly immunoglobulin M autoantibodies that react with surface antigens on the red blood cell at cold temperatures. During CPB, the hypothermic state of the patient can lead to hemagglutination, followed by complement fixation and subsequent extravascular hemolysis on rewarming.

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Michelle Machala, MLS ASCP, graduated from The University of Maine, where she received a baccalaureate in Medical Laboratory Sciences. She currently works as a Medical Technologist in Transfusion Medicine at New York-Presbyterian Hospital. All of Michelle's efforts and successes within the clinical field have landed her as an awarded student by the Clinical Laboratory Management Association and Co-Chair of a hospital based laboratory organization. She looks forward to continuing her education and enhancing her scope of knowledge in extracorporeal technology.

THE TALE OF BLOODY BRENDA: A TRIBUTE TO OR NURSES

Gary Grist, *BS RN*
CCP Emeritus

GIVING CREDIT TO **THE INEFFABLE BRAVERY** OF OR NURSING STAFF

Many decades ago, I walked into the new hospital operating room where I was just hired as a perfusionist and a scrub nurse. Two of the first things I saw were the OR locker room labels;"Doctors" and "Nurses". I immediately thought that this was going to be an interesting place to work. Since I was a scrub nurse I assumed I would be in the "Nurses" locker room. I was one of the very few male nurses in the hospital and the only one in the OR. But I was directed to the "Doctors" locker rooms. The signs should rightly be interpreted as "Men" and "Women", I was told by my supervisor, who apparently did not recognize the offensive nuance of the labels. In fact, there were no female physicians working in the OR; neither surgeons or anesthesiologists. However, there were two excellent nurse anesthetists who bunked on the "Nurses" side.

That wasn't it at all. Both locker rooms had the same number of lockers, which seemed fair at first sight. Except that there were four times more "Nurses" than "Doctors". So each physician got his own locker but the nurses had to double up or even triple up. Also, the "Doctors" had a shower and the "Nurses" did not. Whoever designed these locker rooms apparently did not think that OR nurses would get sweaty and bloody during the work day and might want to shower off before going home. Apparently, getting sweaty and bloody only applied to "Doctors".

"Doctors" wore the typical scrubs that we all wear today; a pullover shirt and pants with a cord waist tie. The "Nurses", however, were REQUIRED to wear these horrible short sleeve scrub dresses. They hated them for too many reasons to expand upon here. The hospital did not even supply them with warm up jackets. The nurses could buy their own jackets, but they were required to be freshly laundered every day. The nurses were not allowed to wash the jackets at home. They must use the hospital's outside laundry service where they could be properly sanitized. After two or three runs though the outside laundry, each nurses' own jacket was usually lost (or maybe stolen) by the outside contractor. When they were not scrubbing many of the nurses took to wearing our re-useable, sterile cloth (yes, I said cloth) scrub gowns for warmth and arm protection. This was frowned upon by the powers-that-be because it used the sterile gowns for a non-sterile purpose causing the labor to repair (patch holes), launder and sterilize these gowns to go to waste. (Was it wasteful to want stay warm and clean from patient detritus? I didn't think so.) Even though I was a scrub nurse, I was also a perfusionist. So, I guess it was OK for me to wear pants and shirt.

THE LAST TIME I SAW HER, SHE WAS KNEELING AT THE FOOT OF THE BED **STILL TRYING TO STEM THE FLOOD OF BLOOD WITH A LAP SPONGE**.

These are just some of the examples of what the nurses had to put up with in the late 70's and early 80's. Actually, things had improved some since I started working in the late 60's. Back then, floor nurses were REQUIRED to wear their nursing caps, as well as white dresses or white skirts and blouses with white hose and white shoes. As I remember, "Doctors" had no dress code. The 60's was a time in American medical culture when doctors were treated like gods and nurses like handmaidens. And, the most godly "Doctors" of them all were the heart surgeons. Nurses were expected to stand and offer up their chair whenever a surgeon came on the floor or entered an operating room. (I am not kidding about this!) And if a nurse or any other paramedic were to offer advice to any doctor, they were considered "uppity and disrespectful". It could even cost them their jobs if the doctor complained to the hospital administration.

At least, in the late 70's and early 80's, nurses no longer had to stand when a doctor (particularly a surgeon) entered the room. And it was a lot harder for doctors to have a nurse who they did not like fired. Nurses still showed physicians respect, but they no longer showed the deference of a servile handmaiden **. As one popular cigarette commercial of the time said; "You've come a long way, baby!"

That brings me to Brenda. Brenda was a scrub nurse (RN) who scrubbed mostly hearts. I worked with her most days. When not scrubbing hearts, she scrubbed every other thing that came down the pike; ortho, ENT, neuro, eyes, etc. Brenda was absolutely dedicated, as most of the OR nurses were, to helping sick kids in any way she could. Even if it meant putting up with the abusive and disrespectful nuances within the OR environs.

One day a severe trauma patient arrived. This was a girl about 10-12 years old who had been in an auto accident. Her pelvis was crushed and she was bleeding profusely from her perineal area. The pelvis is made up of seven large bones fused at sutures in childhood. If the suture fusions are ruptured or the pelvic bones themselves are broken open, bleeding becomes a serious problem. This is because the pelvic bones are the largest flat bones in the body and contain a lot of bone marrow. They also act as reservoirs for venous blood. If a pelvic bone is fractured, the internal bleeding can be as bad as if the inferior vena cava is severed. This child also had perineal trauma and the prolific bleeding from the crushed pelvis was coming out of that wound.

We rushed into the OR and positioned the child on the table. Brenda donned a mask and gloves, grabbed some large lap sponges and applied pressure to the perineum to try to stop the bleeding. When the orthopedic surgeons (pods) came into the room, they had us lower the foot of the table and attach knee crutches to hold the child's legs in a 'knee and hip' flexed position. Brenda kneeled at the foot of the shortened bed, still pressing the lap sponges against the torrent of blood.

The surgeons and two scrub nurses quickly gowned and gloved (there was no time for a proper hand scrub). They threw some betadine over the child's lower abdomen and hips followed by the positioning of a large sterile surgical drape which covered the whole child, the entire table … and Brenda. They then proceeded to do something I had never seen before or since. They used hand drills to make holes on either sides of the child's pelvis. Then they endeavored to feed a rigid steel rod through the hole on one

side, trying to avoid other vital pelvic organs and structures, through to the other side. The idea was that once the rod was through-and-through the pelvis, they could apply washers and nuts on each end of the rod. As the nuts were tightened, the squeeze from the washers compressed the pelvis and its ruptured boney sutures together and, hopefully, stop the bleeding.

What was everybody else doing? The anesthesiologist was busy establishing a secure airway, starting large bore IV access, giving anesthetic medications, monitoring and charting vital signs (this was well before computer charting, automated blood pressure cuffs and even pulse-oximeters) and reversing the shock that was rapidly developing.

The scrub nurses were trying to pass the surgical instruments and keep their Mayo stands organized as the surgeons kept lobbing instruments back at them in a frenzy.

My job was to pump blood in. There was no cell salvage in those days. There were no packed cells then either. We used whole blood. I went through the first few units of cross-matched, type specific blood that we had. That was gone in about 5 minutes. Then I began to give just type specific blood. When we ran out of that, I started pumping in type compatible blood. We rapidly depleted most of the blood in our in-house blood bank. The community blood bank was rushing more units to our hospital. I don't remember exactly, but I think I eventually pumped in about 50 units of whole blood during the procedure.

The circulators were charting and running for supplies, particularly large lap sponges. Then I suddenly thought, "Hey! Where's Brenda?" The last time I saw her, she was kneeling at the foot of the bed still trying to stem the flood of blood with a lap sponge. She was still there, throwing out blood soaked (and I mean SOAKED) sponges and yelling for more! She remained there though out the case, on her bare knees, in that lousy scrub dress. The only protection she had was her bouffant hat, paper face mask and rubber gloves. No gown and no eye protection.

I yelled for somebody to relieve Brenda. But, she wouldn't hear of it. She was already contaminated from multiple units of donor blood flowing from the wound; on her head, face and eyes, down her bare arms into the shoulder openings of her dress and over her bare, unprotected legs. She did not want anyone else to risk a similar exposure. In fact, there WAS NOBODY free to relieve her. All the OR personnel were already tied up in this case or in other on-going cases.

Finally, after about 45 minutes, the pods succeeded in ratcheting the nuts and washers tight enough against the sides of the pelvis to close the fractures and stop the bleeding. I could not believe it worked! Frankly, I don't think the pods believed it was going to work either.

When the drapes came off, there was Brenda still holding pressure against what was now a trickle of blood. As she stood erect I could see that she was covered in blood, from head to toe. I had never seen a human being bathed in blood like she was; but she was beautiful for what she did.

We managed to get the patient out of the OR alive, but I do not know if the child survived to go home. I don't think it was possible, but you never know. I have seen some genuine miracles in my time. This could have been one.

Some of the other nurses helped "Bloody Brenda" to the "Doctors" locker room where she got in the shower to wash the gore off. Her clothes, including her underwear and OR shoes were discarded in the contaminated waste. There was no hope of saving them. She drove home in one of those terrible scrub dresses (to protect her good street clothes from any residual blood and germs) and her street shoes. Once at home, she soaked in a tub and washed her hair with her own shampoo to soak off the musty, rancid smell of shed blood.

Brenda was not any more dedicated than any of the other wonderful OR nurses I worked with. In fact, she was typical of them. Anyone of those nurses would have done the same if they had been in the same predicament. If not for Brenda's action to stifle the blood flow, I am certain that child would have died in the OR during surgery. I am proud to say that I worked with Brenda and this extraordinary group of "uppity and disrespectful" OR nurses.

Post script: The battle of the scrub dresses was soon to end. One of the "pro nurse" anesthesiologists began wearing scrub dresses while he worked to make a point. I think it made the other doctors uncomfortable to see his hairy legs. Soon the policy mandating scrub dresses for female nurses was modified. The hospital would still have scrub dresses, but now the nurses could wear "womens" scrub pants. These were almost as bad as the dresses. These scrub pants were the kind with a wide elastic waist band and extra-wide hip room; essentially "maternity" pants for OR nurses.

Soon both the dresses and the maternity pants started to disappear. I blamed the outside laundry service. With the scrub clothes shortage, the nurses were forced to wear "Doctors" scrub clothes or they couldn't work. The hospital kept buying replacement dresses and maternity pants, but they mysteriously kept disappearing. Soon it became a matter of financial stress on the OR operating budget to constantly replace the dresses and maternity pants. So the OR nurses were finally allowed to wear the more comfortable "Doctors" scrubs. Not too long after that, the nurses got warm up jackets and a shower in their "expanded" locker room with additional lockers. Was Bloody Brenda's adventure responsible for all that? I say definitely "Yes"… possibly.

What happened to Bloody Brenda? She went back to school and became an excellent and well respected nurse anesthetist specializing in pediatrics. Perhaps she wanted to work at the head of the table rather than under it!

*This article can also be found on my free educational, non-commercial web site <Perfusiontheory.com>

**"The Image of Nursing: The Handmaiden", author Sandy Summers. Nursing Times. Oct 7, 2010. https://www.nursingtimes.net/roles/nurse-managers/the-image-of-nursing-the-handmaiden/5020163.article

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Gary Grist, BS RN CCP Emeritus, was a perfusionist from 1968 through 2014 and is now retired. His career highlights include winning the AmSECT Award of Excellence in 2015, the AmSECT Research Award in 2010, the AmSECT Perfusionist of the Year in 2002 and the Excellence in Nursing Award in 1995 from The Children's Mercy Hospital in Kansas City, Mo.

OPTIMIZING FFP ADMINISTRATION FOR INFANT CPB, IS THERE A 'RIGHT' WAY?

Amy Evans

BLOOD CONSERVATION CAPTURING THE ATTENTION OF THE PERFUSION PROFESSION

INTRODUCTION

Blood conservation has captured the attention of our profession for myriad reasons, from transfusion reactions, infection risks and cost to negatively impacting postoperative morbidity rates.1 Despite our best efforts to minimize circuit size for cardiopulmonary bypass (CPB), the administration of allogeneic blood products is often required in neonates and small infants due to the effects of hemodilution. Moreover, neonates and small infants present a unique challenge to the pediatric perfusionist due to their immature coagulation system which manifests with fluctuating levels of coagulation factors and anti-coagulation proteins.2 In an effort to use blood products responsibly and in a streamlined manner amongst institutional teams, transfusion algorithms and protocols have been developed to guide the clinician. However, there seems to be a variation in the timing of perioperative fresh frozen plasma (FFP) administration in the neonate and small infant population as well as the role of factor concentrates. Perhaps, optimizing the timing of FFP administration for maximal effects or using alternative products could help our concerted efforts of avoiding unnecessary blood transfusions.

Fresh frozen plasma is separated from donor whole blood and frozen, usually within 8 hours of collection, and is subsequently thawed prior to administration. FFP contains pro-coagulants, including all of the coagulation factors except platelets as well as anticoagulants such as protein C, protein S, antithrombin, and tissue factor pathway inhibitor. In addition, FFP contains albumin and immunoglobulins (Figure 1). The first randomized clinical trial of FFP was conducted in a cohort of both adult and pediatric patients undergoing cardiopulmonary bypass in 1964.3,4 Since then, FFP has been used in the pediatric population for a variety of conditions from antithrombin III deficiency, coagulation test abnormalities, actively bleeding patients, disseminated intravascular coagulopathy, and other acquired or congenital coagulopathies.5 While FFP is specifically useful for the cardiac surgery setting to restore clotting factors and antithrombin III for substantial heparinization, the use of FFP is not without risk. Some of the risks associated with blood product transfusions include transfusion-related acute lung injury, transfusion-associated circulatory overload, transfusion reactions, and infectious disease transmission.6 In part, due to these risks and in an effort to conserve blood products, alternatives to FFP may be beneficial to consider.

LARGE, RANDOMIZED STUDIES RESEARCHING THE USE OF FFP IN NEONATE, INFANT, AND PEDIATRIC CPB CASES ARE LIMITED.

PLASMA DERIVATIVES	
Plasma Derivatives	**Preparation Available**
Coagulation Factors	Factor VIII concentrates
	Factor IX concentrates
	Anti-thrombin III
Albumin	Albumin
	Plasma Protein Fraction
Immune Globulins	Non-specific immune serum globulin (ISG)
	Rh immune globulin (RHIG)
	Hepatitus B immune globulin (HBIG)
	Varicella-Zoster immune globulin (VZIG)
	Tetanus Immune Globulin (TIG)

FIGURE 1: PLASMA DERIVATIVES

Standard 13 Priming	
Standard 13.1	The Perfusionist shall consider the impact the prime has on the smaller circulating blood volume of the pediatric patient and its effect on: • electrolyte levels • colloid osmotic pressure • coagulation
Standard 13.2	When priming with exogenous blood, a circuit prime gas and electrolyte levels shall be obtained prior to initation of bypass and adjustments made to correct and physiologic abnormalities. [37,38]
Guideline 13.1	When priming with exogenous blood, the use of prebypass ultrafiltration (preBUF) or washed red blood cells should be used during priming procedure. [39,40,41,42,43,44]
Guideline 13.2	The perfusionist should consider matching prime composition to the individual patient values.

FIGURE 2: AMERICAN SOCIETY OF EXTRACORPOREAL TECHNOLOGY

CURRENT PRACTICES

At Duke University Hospital, half a unit of FFP is added to a unit of packed red blood cells (PRBC) as well as 12.5 grams of 25% albumin to coat the circuit and help maintain colloid osmotic pressure for neonates and small infants with high-pressure suture lines. Pre-bypass ultrafiltration (pre-BUF) is performed on the sanguineous prime. The other half of the FFP unit is given if volume is needed throughout the CPB run or during the rewarming phase of CPB. We may give FFP, platelets and/or cryoprecipitate during modified ultrafiltration based on the results of laboratory values drawn during CPB. Our anesthesiologist may administer additional products after the termination of CPB. Similarly, when I was a student at MUSC Children's Hospital, for patients less than 8kg FFP was utilized in the same fashion: half of a unit in the CPB prime and the other half infused during re-warm. For patients greater than 8kg, a calculated amount of 25% albumin is added to achieve a target post-dilutional colloid osmotic pressure of 16mmHg. The AmSECT pediatric standards and guidelines (Figure 2) provide an outline for blood management with the priming techniques mentioned above, as well as efforts to avoid hemodilution. However, the role of FFP in pediatric perfusion is not delineated. As we strive to stay abreast of the latest research and techniques, the question of how we can optimize and/or change our current practice is inevitable.

Standards and Guidelines For Pediatric and Congenital Perfusion Practice (5/31/2019)

LITERATURE REVIEW

Large, randomized studies researching the use of FFP in neonate, infant, and pediatric CPB cases are limited. Most publications are smaller, institution-specific and sometimes had contrasting conclusions regarding the outcome. Unfortunately, the lack of randomized clinical trials concerning the use of FFP in pediatrics undergoing cardiac surgery hinders our ability to improve our practice in this realm. Recent studies that have been conducted on the subject of FFP in pediatric cardiac surgery focus on the timing of FFP treatment, using FFP as a CPB prime constituent and potential alternatives to FFP.

A study by P. Bianchi et al. looked at the optimal timing of perioperative FFP administration, using 73 infants weighing less than 10kg randomly divided into two study arms with differentiation of FFP transfusion timing: receive FFP in the CPB prime with RBCs or a 5% albumin and RBC prime with FFP administration immediately after CPB. In the 24-hour postoperative period, the chest tube drainage was significantly greater in patients in the late FFP arm (mean of 33.1mL/kg) in comparison to patients that received FFP in the CPB circuit prime (mean of 24.1mL/kg). In addition, at the 24 and 48-hour postoperative marks, fibrinogen levels were significantly higher in the early FFP arm. There were no significant differences in laboratory tests including: platelet count, platelet concentrates, aPTT, INR, and EXTEM clotting time. Furthermore, there weren't significant differences in PRBC transfusion rates, mechanical ventilation time, or postoperative length of stay.7 The authors conclude by identifying the clinical implications of low fibrinogen levels postoperatively, such as the direct correlation to postoperative bleeding.8

Similarly, a double-blind study by Dieu et al. investigated the role of FFP as a CPB prime component. This randomized study included 56 patients weighing 7 to 15kg to receive either 15mL/kg of Plasmalyte-A or FFP in the CPB prime in addition to PRBCs. All patients received tranexamic acid prior to CPB initiation. This study also showed there was not a significant difference in allogenic blood transfusions between the arms of the trial when products in the CPB prime were excluded. Furthermore, there was not a statistical difference in postoperative blood loss per kilogram. Interestingly, the FFP arm had more than twice the number of redo-sternotomy patients (n=14) in comparison to the crystalloid arm (n=6).9 This study shows a different conclusion than that reached by P. Bianchi et al., suggesting there is no

substantial evidence to support including FFP in the CPB prime.

The development of alternatives to FFP may also help reduce the risks of transfusions and conserve resources. For example, OctoplasLG is a "commercially produced plasma prepared from single-donor units with the same blood group which is filtered, treated with a solvent detergent to inactivate viruses and reduce bacteria and prion transmission." A retrospective study comparing FFP to OctoplasLG use intra-operatively was conducted over ten years in 105 pediatric patients <10kg undergoing tetralogy of Fallot repair. It should be noted that 27 patients in the FFP group received aprotinin prior to the drug being discontinued. Thus, these patients received more heparin in the CPB prime. The FFP group received significantly more PRBCs and plasma transfusions postoperatively. Fibrinogen levels were higher postoperatively as well as chest drain output in the OctaplasLG group. In terms of cost, FFP costs $45.04 (USD) versus $111 (USD) per unit of OctoplasLG. These figures do not take into account the cost of the transfusion-related complications, which were higher in the FFP group.10 In conclusion, OctaplasLG is a safe and cheaper alternative to FFP however, the results of this study warrant further investigation with randomized clinical trials in the pediatric population.11

The use of human fibrinogen concentrate (HFC) was investigated in 50 pediatric patients and compared retrospectively to a similar cohort of 50 patients treated prior to the introduction of HFC at their institution. The HFC was administered during rewarming on CPB at a dose of 70mg/kg. Important differences include: the HFC recipient group received significantly less FFP and platelets during CPB, from the anesthesiologist after CPB and overall. However, the HFC treated group received more cell saver blood. This team uses ROTEM to guide their transfusion decisions and aim to correct coagulation values affected by hemodilution shortly before separating from CPB. There was no difference in blood loss or factor VII administration. Also, the HFC arm patients had significantly higher postoperative PT values in comparison to their preoperative PT values. There was not a difference in ICU transfusion rates despite the HFC cohort having a significantly longer CPB time. The authors compare the cost of 250-350mg of fibrinogen from a unit of cryoprecipitate to be $186 whereas, this same dosage range of fibrinogen in the form of HFC costs $212-$287.12

CONCLUSION

The literature is lacking in recent randomized clinical trials to provide clinicians with reliable class 1A evidence for the role and optimal timing of FFP administration in pediatric cardiac surgery. The administration of FFP and management of CPB related hemodilution extends much further than achieving postoperative hemostasis. For instance, early post-operative bleeding has the potential to delay sternal closure but also results in increased blood product administration and has been linked to increased mortality in infants after CPB.13 Post-operative bleeding in neonates and small infants is inevitable in cardiac surgery. Unfortunately, we don't have enough evidence to answer the pivotal question of how we may go about optimizing our resources and timing of FFP administration. While the use of commercially available alternatives to FFP may evolve within the pediatric cardiac setting to the point of becoming a standard of care, we should strive to identify common ground on intra-operative FFP administration. A consensus amongst pediatric cardiac surgery institutions regarding FFP transfusion triggers

THERE WAS NOT A DIFFERENCE IN ICU TRANSFUSION RATES DESPITE **THE HFC COHORT HAVING A SIGNIFICANTLY LONGER CPB TIME.**

and their prophylactic role is a worthwhile endeavor. This will require more randomized trials with substantial cohort sizes to allow our profession to confidently make clinical decisions and potentially, changes to our current practice. Not only would this serve as a benefit to our patients in a variety of ways, but it would serve our profession well by helping to facilitate future studies. Our goal should be to ensure we are providing the best evidence-based care to our patients.

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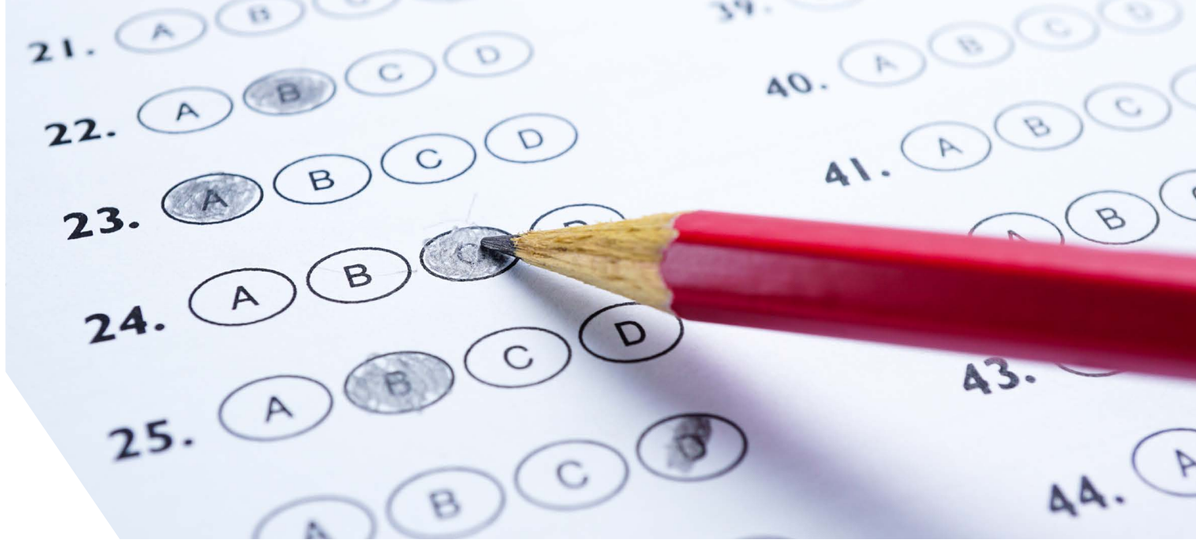
Amy Evans, is originally from North Pole, Alaska, and moved to Charleston, South Carolina, in 2009 to attend the College of Charleston. She graduated from the College of Charleston in 2013 with a Bachelor of Science in Athletic Training. After graduating, she worked as a patient care technician on the Orthopedic and Joint Replacement Unit at the Medical University of South Carolina (MUSC) hospital for three years. During this time, she completed the MUSC Global Health Certificate Program, which enabled her to obtain an appreciation for the nuances of providing sustainable and effective global health.

LABORATORY/TRANSFUSION MEDICINE, INFECTION CONTROL & PATIENT BLOOD MANAGEMENT



1. **All of the following applies to storage of red blood cells except_____.**

a. Deceased 2-3 DPG levels
b. Decreased nitric oxide – Hgb
c. Decreases aggregability (pro-thrombotic effects)
d. Impairs RBC deformability
e. B and C

2. **The "storage lesion" phenomena states that transfusing a RBC's will increase your hemoglobin, but it may not increase oxygen delivery.**

a. True
b. False

3. **Administration of Anti-Thrombin III (AT-III) supplement is probably more desirable than transfusion with homologous fresh frozen plasma for all of the following reasons except _____.**

a. FFP does not reliably restore the ACT for patients with Heparin Resistance
b. ATIII helps to avoid the risk of TRALI
c. Use of AT-III is therapeutically more effective than FFP to treat AT-III deficiency
d. Compare to AT-III supplement less volume of FFP is enough to treat AT-III deficiency
e. None of the above

4. **Which of the following is/are ways to safely avoid a blood transfusion?**

a. Optimize oxygenation
b. Optimize hemodynamics
c. Reduce metabolic demand
d. A and B
e. All of the above

5. **Transfusion is associated with_____.**

a. No change in hospital acquired infections
b. An increase in most hospital acquired infections
c. An increase in deep mediastinal wound infections only
d. A decrease in hospital acquired infections
e. None of the above

6. **Which of the following is/are required to perform acute normovolemic hemodilution?**

a. Patient's baseline Hematocrit
b. Arterial or venous access to collect blood with adequate anticoagulation for intended volume
c. Established policy and procedure to conduct ANH
e. All of the above

7. **Platelets is/are required for _____.**

a. Adhesion and aggregation
b. Thrombin Formation
c. To increase platelet number and function
e. All of the above

8. **Which of the following organizations continues to guide and advance transfusion systems?**

a. American Red Cross
b. American Society of Hematology
c. AABB
d. A and C
e. All of the above

9. **_____ is a common transfusion reaction in which pulmonary edema develops primarily due to volume excess or circulatory overload.**

a. TACO
b. NACHO
c. TRALI
d. TRIM
e. None of the above

10. **Which of the following is/are tested on all blood donations?**

a. CMV
b. Zika Virus
c. Bacterial Contamination
d. A and B
e. All of the above

11. **_____ reactions are the most common reaction reported after a transfusion.**

a. Acute hemolytic
b. Delayed hemolytic transfusion
c. Febrile non-hemolytic transfusion
d. Hypotensive transfusion
e. B and D

12. **Which of the following is a serious but rare reaction that occurs when fluid builds up in the lungs, but is not related to excessive volume of blood or blood products transfused?**

a. TACHO
b. NACHO
c. TRALI
d. TRIM
e. None of the above

13. **Which of the following is/are associated with increased risk of cardiac surgical site infection?**

a. Obesity
b. Diabetes mellitus
c. Kidney disease
d. A and B
e. All of the above

14. **Which of the following test(s) is/are less sensitive to the effects of non-heparin factors than ACT or aPTT and is considered a more accurate measure of residual heparin activity.**

a. Bleeding time
b. Thrombin time
c. Anticardiolipin time
d. Anti-Xa
e. A and C

15. **The TEG and ROTEM devices have limited ability to discriminate between platelet dysfunction and defects in fibrin generation and are often complemented by platforms that can detect specific defects in platelet function.**

a. True
b. False

Self-Quiz Answers

1. C. DECREASES AGGREGABILITY (PRO-THROMBOTIC EFFECTS) **2.** TRUE **3.** D. COMPARE TO AT-III SUPPLEMENT LESS VOLUME OF FFP IS ENOUGH TO TREAT AT-III DEFICIENCY
4. E. ALL OF THE ABOVE **5.** B. AN INCREASE IN MOST HOSPITAL ACQUIRED INFECTIONS **6.** E. ALL OF THE ABOVE **7.** E. ALL OF THE ABOVE **8.** E. ALL OF THE ABOVE **9.** A. TACO
10. B. ZIKA VIRUS **11.** C. FEBRILE NON-HEMOLYTIC TRANSFUSION **12.** C. TRALI **13.** D. A AND B **14.** D. ANTI-XA **15.** A. TRUE

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To see the complete list of foundation donors, visit **AMSECT.ORG**.

AmSECT Membership Transition

The recent AmSECT Bylaws Amendment vote to update the language describing the timing of membership dues payments was approved by the AmSECT membership in 2019. Based on the approval, AmSECT will implement annual dues instead of anniversary dues beginning in January 2020 and rolled out with full dues payment for January renewals, and then reduced rates per month for the rest of 2020. By 2021, everyone will renew in January at their standard dues payment, and everyone will have a membership expiration of 12/31/2021. For more information on the change, please visit **WWW.AMSECT.ORG/MEMBERSHIPTRANSITION**.

Journal of ExtraCorporeal Technology: 2020 Digital Transition

As a reminder, starting with the March 2020 issue, JECT is going digital! All members will receive issues of JECT emailed directly to their email inbox in addition to having access to the JECT archives on the AmSECT website. Active, Transitional, Retired, and Lifetime Members that would like print copies of JECT can still purchase a subscription for an annual rate of $50. Additional details about the transition can be found on the **AMSECT WEBSITE HERE**.

Volunteer Appreciation Month:

THANK YOU AmSECT VOLUNTEERS!

Our society would like to extend a heartfelt thank you to all those who dedicate their time and expertise to AmSECT year in and year out. Their tireless effort to improve patient care and safety by providing for the continuing education and professional needs is invaluable to the profession of perfusion. View all of our outstanding volunteers on our website **HERE!**

AmSECT WELCOMES NEW MEMBERS

AmSECT would like to welcome the following new members who have recently joined the society:

Ruben Arze
Laurie Baldwin
Alyssa Barker
Kacie Baumgartner
Kali Begum
David Belcher
John Bennett
Anna Bequette
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Brianna Wiscount
Robert Wise
Lexi Wivell
Christopher Yann
Garrett Yantosh
Karen Yeakley
Adam Young
Ernestina Zappa

AmSECT 2020 ELECTION RESULTS

The new members of the AmSECT Board of Directors were elected in early 2020. Thank you to all AmSECT Members who participated in this election cycle. Final results are listed below. Terms for newly elected representatives began at the conclusion of the Annual Corporate Membership Meeting at the 2020 AmSECT International Conference.

Board of Directors: Officer Positions

Tami Rosenthal, CCP MBA FPP
President-Elect

William Scott Snider, CCP LP
Treasurer

Theron Paugh, BS CCP
Secretary

Board of Directors: Zone Director Positions

Molly Dreher, CCP FPP
Zone 4 Director

Jennifer Mottern Porembski, MS CCP
Zone 4 Director

Renee L. Axdorff-Dickey, CCP MBA
Zone 1 Director

Elected Committee Positions

Al Stammers, MSA CCP
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Krysta L. Gleeson, MBA MS CCP
Bylaws Committee

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Nominating Committee

Board of Directors: Beginning March 8, 2020

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William Scott Snider, CCP LP
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Ben Swanson, MPS CCP
Zone 2 Director

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Zone 4 Director

Theron Paugh, BS CCP
Secretary

Gregory A. Mork, BA LP CCP
Zone 2 Director

Jennifer Mottern Porembski, MS CCP
Zone 4 Director

AmSECT & IBBM Announce New CES-A Exam

The American Society of ExtraCorporeal Technology (AmSECT) and the International Board of Blood Management (IBBM) are pleased to announce the first Adult ECMO Specialist Certification Exam. The exam is intended for RNs, RRTs, and other allied health professionals monitoring adult ECMO procedures and circuits.

The exam will be offered three times online in 2020. For more information, visit the IBBM website at http://intbbm.org/ces-certification/

Exam Registration Dates
March 20 - April 20, 2020
June 19 - July 20, 2020
September 21 - October 21, 2020

Exam Dates
May 13 - May 15, 2020
August 19- August 21, 2020
November 18- November 20, 2020

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