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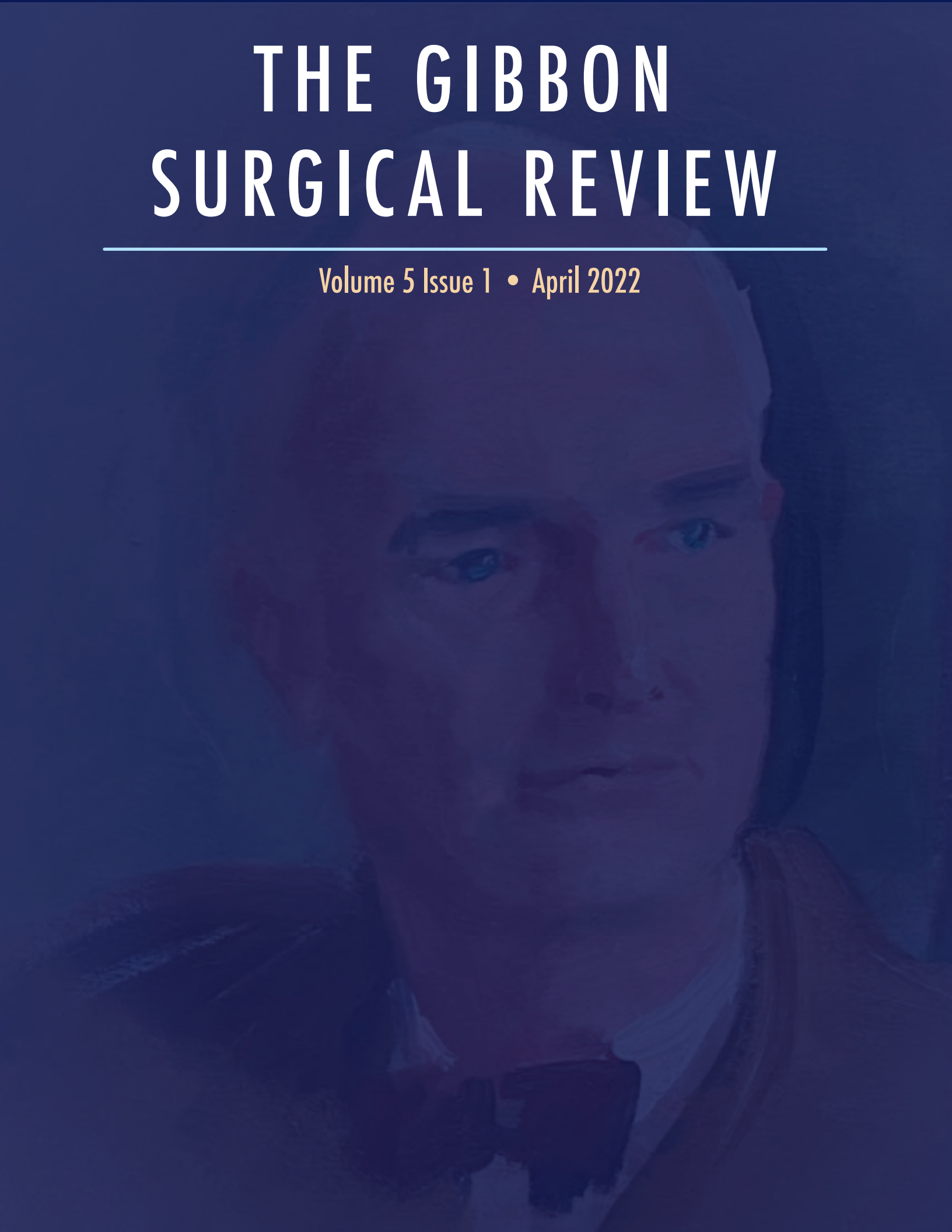

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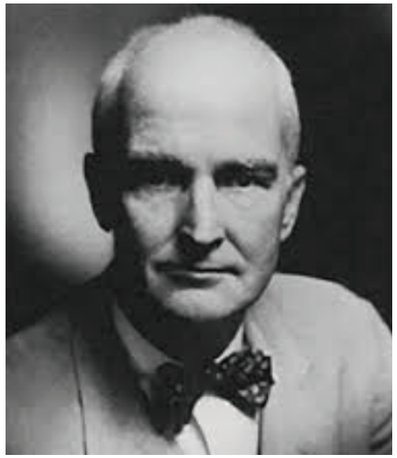
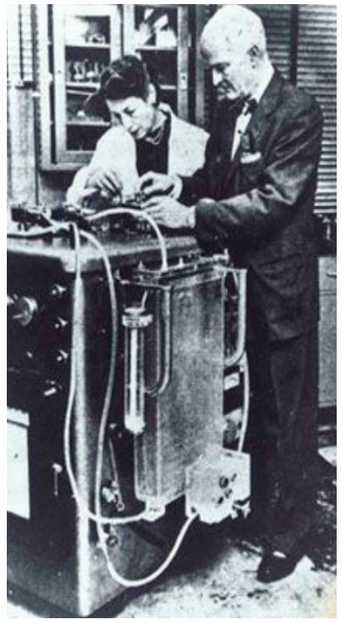
John H. Gibbon Jr., MD



Dr. John Heysham Gibbon, Jr. graduated from Jefferson Medical College in 1927, and after an internship at Pennsylvania Hospital, began a research fellowship at Massachusetts General Hospital. In 1930, he found himself assisting Dr. Edward Churchill in an emergency pulmonary embolectomy. At that time, the procedure was one of desperation, as no patient in the U.S. had survived the removal of blood clots in open-heart surgery. As Dr. Gibbon recorded the patient's waning vital signs prior to the procedure, he thought, "If only we could remove the blood from her body by bypassing her lungs, and oxygenate it, then return it to her heart, we could almost certainly save her life." Despite a successful removal of large clots from the patient's pulmonary artery, the patient never regained consciousness. This "critical event" initiated Dr. Gibbon's determination to produce a heart-lung machine.

Dr. Gibbon was Chief of Surgical Services at the 364th Station Hospital in the Pacific Theater. After the war, upon returning to Philadelphia, his alma mater offered him the position of Professor of Surgery and Director of Surgical Research, which he accepted. Through Jefferson Medical College's connections, IBM and its premier engineering department entered the picture and worked with Dr. Gibbon to develop a device known as IBM "Model I." His wife, Maly Gibbon, and the Jefferson Medical College surgical residents were also deeply involved in the evolution of this huge apparatus (too heavy for the building's elevators), which proved to be successful in repeated experiments on dogs. However, limitations on the machine for human patients existed and the decision was made to cannibalize parts of Model I for Model II, which was ready for its first test in February 1952. Although the heart-lung device was fully functional, the first patient, a 15-month-old child, died during the operation. The defect, in this case, was much larger than the surgeons had been prepared for.



On May 6, 1953, at Jefferson Medical College Hospital, Dr. Gibbon and his staff, with the help of his latest-designed heart-lung machine, "Model II," closed a very serious atrial septal defect between the upper chambers of the heart of 18-year-old Cecelia Bavolek. This was the first successful intra-cardiac surgery of its kind performed on a human patient. "Jack" Gibbon did not follow this epoch-making event by holding an international press conference or by swiftly publishing his achievements in a major medical journal. According to a recent biographical review by C. Rollins Hanlon, "Therein lies a hint of the complex, unassuming personality behind the magnificent technical and surgical achievement of this patrician Philadelphia surgeon." After the triumphant Bavolek case in May of 1953, Dr. Gibbon employed the Model II on two more patients in July 1953. Both children subsequently died, prompting Gibbon to declare a year's moratorium regarding use of the heart-lung machine, pending investigations into solving clotting problems and blood loss.

During the years leading up to his successful surgery, Dr. Gibbon had been sharing his blueprints and experiences with Dr. John Kirklin at The Mayo Clinic. Eventually, the Mayo Clinic built the "Model III" based on the proposed changes from Dr. Gibbon's lab, which led to several successful operations there. While Dr. Gibbon turned to his non-cardiac interests, others continued to perfect cardiac surgery. It is clear that Dr. Gibbon's contributions to the field of cardiac surgery were necessary in order for the field to develop, which is why he is often referred to the "father of cardiac surgery."

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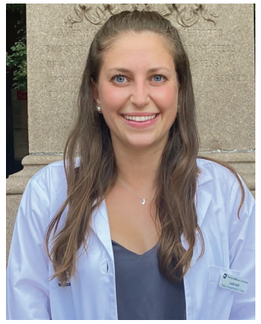

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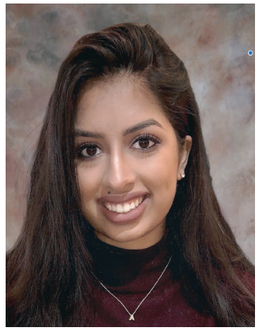

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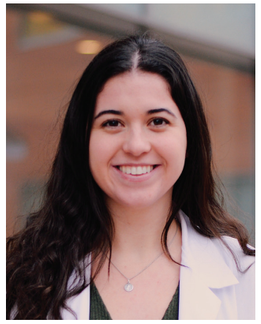

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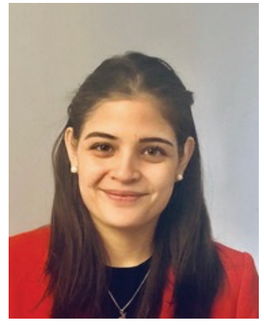

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A History of ECMO and its Use During the COVID-19 Pandemic

By Michelle Schafer, Class of 2024

REVIEWS

Throughout the COVID-19 pandemic, extracorporeal membrane oxygenation (ECMO) has emerged as a treatment for patients suffering from severe respiratory distress as a temporary solution to bypass the lungs and heart in favor of a mechanical oxygenator. Although the earliest versions of ECMO were developed in the 1950s and 1960s, the popularity of ECMO as a ICU treatment of last resort is recent, and is largely due to its success during the H1N1 influenza pandemic. However, ECMO use comes with a fair share of adverse risks, which should be thoroughly evaluated when its use is considered in the management of patients with severe COVID-19.

ECMO is designed to be a mechanical device that can function as an external artificial cardiopulmonary system. Deoxygenated blood from a large vein, such as the femoral, internal jugular, or subclavian, is pumped out of the body through tubing to a membrane oxygenator. The subsequent gas diffusion occurs on this membrane similarly to how it would in the alveoli, which acts to both oxygenate and remove carbon dioxide from the blood. Venovenous (VV) ECMO returns blood back to the venous system and acts as lung support, while venoarterial (VA) ECMO provides respiratory and hemodynamic support for the patient. In the 1950s, clinicians attempted to use the cardiopulmonary bypass machine as a form of life support in patients with acute cardiac or respiratory failure. Unfortunately, the bypass machine exposed the blood directly to oxygen, which induced both hemolysis and protein denaturation and caused major complications. Subsequently, clinicians began to study technologies that could externally oxygenate blood. Earlier attempts included the use of various plastic films as well as modified methods of hemodialysis, and had limited success. Doctors at Pacific Medical Center in San Francisco, California, had a 100% mortality rate in the patients that received treatment from their version of an ECMO machine from 1966-1970.[1] A metanalysis paper published shortly thereafter determined that survival rates in Acute Respiratory Distress Syndrome (ARDS) patients receiving ECMO were similar to outcomes from time-period conventional ventilation, with both producing similarly high mortality rates— 90.5% in ECMO patients and 91.7% in conventional ventilation.[1] This paper stalled ECMO research for some time due to the lack of difference in mortality, as well as the continuing obstacles faced in finding the appropriate anticoagulation necessary to allow the oxygenator to function properly without leading to adverse hemorrhagic events.

In 1971, Pacific Medical Center had their first successful case of a patient with acute respiratory distress syndrome (ARDS) using peripheral VA-ECMO with a Bramson membrane heart-lung machine. The patient was successfully weaned off the machine after 72 hours and discharged. In the following years and decades, additional cases of successful ECMO use were reported in both ARDS and neonatal respiratory failure.[1] In 2009, many patients hospitalized during the H1N1 influenza pandemic received ECMO therapy and were found to have improved six month survival rates.[2, 3] Subsequently in the 2010s, ECMO was seen as an emerging technology for other cardiopulmonary pathologic presentations, such as cardiac arrest and shock. Unfortunately, hemorrhagic, neurologic, and other significant complications were still being observed in high rates.[2]

ECMO has been used in the treatment of ARDS since its origination. Traditional ARDS is driven by release of proinflammatory cytokines, which ultimately leads to a protein-rich fluid accumulation in the alveoli and to decreased ability of the alveoli to ventilate the blood in the pulmonary circuit. In an early case series published in the Journal of Cardiac Surgery in 2020, VV-ECMO failure in a small population of hypercoagulable patients was found to stem from thrombi states causing oxygenator dysfunction.[4] This case report was one of many at the time that allowed physicians and scientist to realize that the ARDS seen in COVID-19 patients was unique. COVID-19 has been observed to cause a hypercoagulable state in some patients, which can result in microthrombi and damage to vessel endothelium causing decreased perfusion, mimicking the physiology of pulmonary emboli.[5]

The slightly altered pathophysiology of COVID-related ARDS warranted a novel name, leading to the term COVID-19 acute respiratory distress syndrome (CARDS).[6] Importantly, recognizing CARDS as unique from traditional ARDS led to changes and improvements in care. Many patients with CARDS developed hypoxemic and hypercapnic states, leading to a decision early in the pandemic to intubate and mechanically ventilate patients as promptly as possible; however, there was increasing potential for ventilation-induced lung injury and oxidative stress in these patients.[2] Resistant hypoxemia and hypercapnia lead to some patients being placed on ECMO, yet these patients were still susceptible to mechanical lung damage.[6] ECMO also presented challenges with increased dead space and greater carbon dioxide retention. Moreover, ECMO use is not without consequences, so physiotherapy and rehabilitative activities were exceedingly important in patients recovering from any ECMO use.[6]

The recency of ECMO as a widely adapted technology allowed for recommended use early in the COVID-19 pandemic

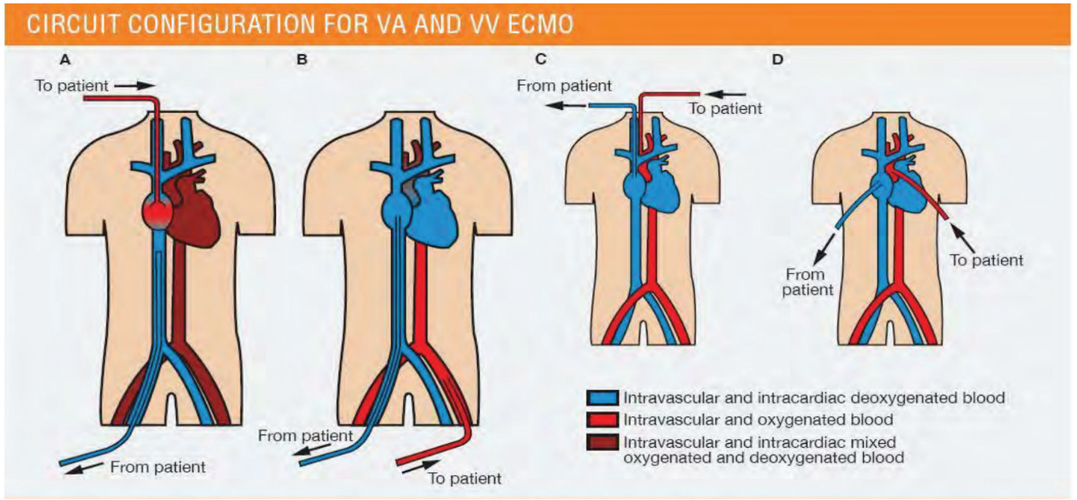

Figure 1: A) VV ECMO, femoral cannulation B) VA ECMO, femoral cannulation C) VA ECMO, carotic cannulation, D) VA ECMO thoracic cannulation. **Reproduced from: Gaffney AM, Wildhirt SM, Griffin MJ, Annich GM, Randomski MW. Extracorporeal life support. British Medical Journal. 2010;341:982-986.**

without having wide spread studies for the previously mentioned adverse events. A study published in early 2022 highlights these knowledge gaps, as well as the debate between experts and the use of ECMO in CARDS due to significant complications, such as increased bleeding risk and intercranial hemorrhage (ICH).[7] Due to the nature of the hypercoagulable state and formation of microthrombi in COVID-19 patients, the Extracorporeal Life Support Organization recommended that institutional anticoagulation guidelines be followed with the option to increase the anticoagulation intensity to potentially prevent the blood clots from catching in the oxygenator. This study tried to determine if the anticoagulation recommendations were the primary reasons for increased bleeding risk and ICH incidence, but were unable to determine if it was the cause or if it was the undetermined pathophysiology of the disease. However, they found that CARDS patients receiving VV-ECMO had a six-fold increased risk of ICH compared to a control group with ARDS due to a non-SARS-CoV-2 viral infection, demonstrating that there are still questions about the use of ECMO for COVID-19 patients, including the level of necessary anticoagulation.[7] The risk of potential bleeding from ECMO use in critically ill COVID-19 should be considered before cannulation.

The swift emergence of the SARS-CoV-2 virus and the severe lung disease caused by COVID-19 drove physicians and scientists to develop treatment guidelines that employed the use of ECMO. Because many COVID-19 patients have respiratory distress presenting similarly to traditional ARDS, and because ECMO use saw relative success during the influenza A H1N1 pandemic, the use of ECMO as a life support in patients with severe CARDS was utilized early in the pandemic. As it became clear that COVID-19 patients were presenting with hypercoagulable states, the associated thrombotic risks of using ECMO were explored. The use of ECMO as a treatment for patients with COVID-19 suffering from severe ARDS needs to be continually evaluated to determine whether the improvements in care eclipse the associated risks and potentially fatal adverse events.

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The First Pig-to-Human Heart Xenotransplantation

By Eric Teicher, Class of 2025

RESEARCH SPOTLIGHT

This past January 7 marked a major milestone in the field of surgical transplantation: surgeons announced that they had performed the first transplant of a pig heart to a human recipient. Although many questions remain, including the prognosis of the patient, this marks a major milestone in the field of xenotransplantation. The surgery was performed by an expert team at the University of Maryland School of Medicine. To achieve this historic moment, the pig heart required many genetic changes for the organ to function successfully in the patient. This surgical research spotlight will detail the exact mechanisms by which this was performed.

The procedure stood to be the first time a pig organ was transplanted into a living human. However, the prospect of transplanting porcine organs into humans is not new. Previously in 2021, surgeons at New York University Langone Health center transplanted kidneys from a similar line of genetically modified pigs into humans with no functioning brain activity. As a result, the organs were viably sustained using a ventilator on the deceased patients. Other research has focused on xenotransplantation into non-human primates, yet researchers are optimistic this pig-to-human heart transplant will open many doors for the future of clinical research.

The transplant recipient was 57-year-old David Bennett. Bennet had advanced heart failure and ventricular fibrillation. He was deemed ineligible for a human heart transplant according to University of Maryland School of Medicine listing guidelines due to prior treatment nonadherence. Thus, the team sought a "compassionate use" authorization from the Food and Drug Administration (FDA) to give Mr. Bennett a heart from a genetically modified pig.

The primary concern with xenotransplantation— similar to human transplantation— is immune rejection in the recipient. A total of 10 genes were modified or added to the pig cell line. First, 3 genes that produce sugars on the surface of the pig cells were knocked out. These antigens would typically result in recognition of the pig cells as foreign. Additionally, researchers genetically added a total of 6 additions of human genes to the pig: 2 anti-inflammatory genes, 2 genes that promote normal blood coagulation, and 2 other regulatory proteins that downregulate the antibody response.

The final gene deletion removed a growth hormone to prevent any abnormal growth once the heart was implanted into the donor. The researchers wanted to mitigate the possibility of heart failure by preventing any additional growth of the already innately larger pig heart.

Finally, to prevent rejection after transplant, Mr. Bennett was given a novel, experimental antibody immunosuppressant called KPL-404. Typical immunosuppressants would not be as effective given the strong antibody response against the transplanted organ. KPL-404 is an anti-CD40 immunosuppressant, meaning that it binds to a specific receptor called CD40 that suppresses the activity of antibody-producing B cells, which also prevents T cell activation. Prior to transplantation, the heart was bathed in a circulating bath, including water, adrenaline, cortisol, and cocaine as part of the priming process prior to transplantation.

The University of Maryland transplant team has said the surgery went well and "the heart function looks great." However, despite all efforts to keep Bennet alive, he passed away on March 8th. The University of Maryland did not report on an exact cause of death but reported his condition had been deteiorating since days earlier.

Although most of the prior research in xenotransplantation has involved transplantation into baboons, researchers state that it is important to study the transplants in humans given the vast differences in antibody profiles between the species. Non-human primates often have antibodies that humans lack, making it difficult to predict a response. Although the FDA has only authorized this single transplant pertaining to Mr. Bennett's case, the team is optimistic that future clinical trials, hopefully in humans, would result in an unlimited supply of donor organs. If successful, the medical landscape would be changed forever.

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Residency Interviewing in the Zoom Era

By Jose Arriola, Class of 2025

FEATURES

This is the second year in a row in which residency programs conducted virtual interviews as a result of the COVID-19 pandemic. This meant swapping their hospital tours for YouTube videos or providing Uber Eats gift cards in lieu of lunch sessions. Similarly, 4th year medical students needed to adapt to this new situation. From an outsider perspective, it may seem these changes are doable and reasonable for the time being. However, there is evidence suggesting that these changes might be more permanent. A recent survey showed that 56 General Surgery program directors (PDs) agreed that virtual interviews are less expensive. In fact, 40 out of those 60 agree that they will adopt both virtual and in-person interviews in future cycles.[1] On the other hand, another study showed that 45% of surveyed PDs in other fields disagree that the 2022/2023 interviews should be virtual regardless of COVID-19.[2] This aligns with a study from the University of Texas which found that medical students still favor in-person interviews.[3] Due to this conflicting information, we decided to explore this dichotomy.

Pro: The cost of interviewing for residency has been highly reduced

The Associarion of American Medical Colleges (AAMC) has estimated that a student spends around $4,000 during an in-person residency interview cycle. In fact, those same estimations suggest the amount can even be as high as $13,225.[4] However, expenses such as travelling, meals and lodging are eradicated in the virtual setting. Saving this huge sum of money is advantagous for 4th year medical students. According to a study done with 2021 urology applicants, the amount of money saved was around $2,198 in travel costs per applicant.[5]

Pro: Planning interviews is easier

Another advantage of online interviewing is the ability to prepare and plan an interview more easily. During interview season, 4th year medical students are still participating in clinical rotations; hence, there is a whole science behind scheduling interviews. Generally, students schedule interviews during the small vacations, but sometimes they need to ask clerkship directors for additional days off. Furthermore, sometimes students need to group interviews geographically to avoid multiple transcontinental trips. Zoom meetings allow students to avoid these hassles and focus more on practicing for the actual interview.

Con: You are not able to showcase your true self

One of the main disadvantages of online interviewing is that you do it behind a screen. This can cause different problems such as the inability to properly use body language. This can be worrisome, considering some studies suggest nonverbal behaviour can account for around 55% of effective communication.[6] In consequence, online interviewing also makes it hard to portray one's personality correctly as it is sometimes more difficult to form a connection with the interviewer. Interestingly, one of the medical students we interviewed did not find these issues too worrisome. In fact, she commented that when practicing for interviews with her home institution, she focused more on setting up the correct lightning and Zoom background. While being able to showcase one's true self may be more challenging during online interviews, there are other issues the applicants needed to consider in these virtual times.

Con: It is difficult to assess the residency program

The same way it is hard for students to express themselves to programs, it is difficult for students to fully assess a program's positives and negatives. In fact, some programs decided to shift their budget from pre-interview dinners and hospital tours to creative media solutions, i.e., videos, websites, etc.[7] While these help medical students in getting to know the program, it does not allow them to truly gauge the residency experience. Students need to choose their top choices based on how well they felt the online interview went, as well as, how much they learned about the program and the city from the screen. As one of the interviewed students mentioned: "It does make it harder to decide how to rank programs in cities that I've never been to ."

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An Interview with Dr. Andrew Newman

INTERVIEW

By Ari August, Class of 2025
and Gregory Whitehorn, Class of 2025

Dr. Newman is a Clinical Assistant Professor of Surgery in the Division of Plastic Surgery. He received his Bachelor of Science from the College of William and Mary and attended medical school at The University of Virginia School of Medicine. He completed consecutive residencies in General Surgery and Plastic Surgery at The Hospital of the University of Pennsylvania. Dr. Newman specializes in microsurgery. He is certified by the American Board of Plastic Surgery and is a Member of the American Society of Reconstructive Microsurgery.

What led you to pursue a career in surgery?

I was super psyched to go to my medicine rotation. I was in med school at UVA…I dove headfirst in–I loved it. I kind of thought, "Huh, maybe I'm going to go into the medical side of things." I did some MICU and loved that, "Maybe I'm going to go into intensive care." I went into third year and I was like, "That's cool, I like that! Well, that's neat too." I did rule some things out, but I guess that's the way I ended up approaching it; not "This is what it's going to be," but "This is what it's *not* going to be." And then surgery came along towards the end. I just had more of a positive feeling in the operating room than I did anywhere else. So if I had to pin it, it'd be on what the feeling is in the operating room.

What are some of the most rewarding parts of what you do on a daily basis?

My practice is in breast reconstruction so the bulk of my patients are breast cancer patients. Breast cancer is unfortunately an incredibly common disease. From a plastic surgery standpoint, we share a fairly condensed and emotionally poignant process with that patient. [The standard breast cancer patient] is diagnosed and they've already seen their gynecologist…a breast surgeon, a medical oncologist, they've maybe seen a radiation oncologist, and then they see us. They've had a ton of visits, everything is a bit of a whirlwind, and it's hard because there's a lot of different treatment options. It's just choice after choice and it's overwhelming.

Our time course is fairly short, so I get to see them through the reconstruction process which can go up to a year on average, with maybe a revision. Then we get to say goodbye. It is such a positive experience, I can't tell you how many times I've been really deeply, earnestly thanked for what I've done for that patient. That last visit is powerful for me. I feel super lucky, I feel super appreciated, and I guess you come to figure out a little more clearly what value you're adding to the patient's overall experience. The more time I spent with these patients the more I've come to realize that what I'm doing isn't saving lives but it's improving lives. And it's improving them for many people in a pretty profound way. That moment especially, that farewell visit, is sort of the high point for me emotionally in what I do.

> "...that farewell visit, is sort of the high point for me emotionally in what I do."

What inspired your research on the aesthestics of limb reconstruction?

It was interesting to look at aesthetics in limb reconstruction because that's a scenario where you wouldn't really think about it, right? You'd say "Gosh, aren't you just sort of happy that you've got a closed healed soft tissue below and a healed fracture underneath and you can walk on it?" We found that a lot of patients weren't just happy with that, and we shouldn't stop there either. We're getting better at limb salvage and we're getting better at soft tissue reconstruction. Now that patients are functional...and now they're walking...ok now they're wearing shoes again...now they're pain-free. How can we continue to make this better? Those kinds of things push you.

That's something that I've found challenging about plastic surgery: our results are right there in front of your eyes. This is different from some surgical fields in that the patient's interpretation of the outcome is a giant part of what we do. If I think it worked out well and the patient doesn't, that's a problem, that's a real problem.

How do you balance empathy for the patient with methods to prevent emotional burnout?

I think plastic surgery gives you a fairly low toll of emotional burnout. This is part of why I ended up where I ended up. I had a hard time with cardiac surgery for what you just said: emotional burnout seemed just inevitable for me. I was in my second year of residency, and I had a three month stretch of cardiac ICU. The outcomes can be challenging in something like that, so emotional burnout ended up directly informing my decision to say, "No, I can't do this." You have to think about how you deal with complications because they're going to happen, and they're going to happen again, and again.

The complications I see with my patients I do take very personally, and I'm probably not the best at it. But it made me realize I made a really good decision because if I'm having a hard time with some of these complications I just never would've been able to deal with something like cardiac surgery.

Something I really liked in surgery when I was a med student is when we went to M&M. I really liked the sort of directness of surgical M&M and that, "Let's talk about our mistakes, let's face them, let's not avoid confronting them." I think ultimately to get better we are going to have to look very critically at what we've done and how we can make that better. I liked that as a student–and I think that's been something important to ultimately avoid emotional burnout.

> "You have to really love what you do. There's no substitute for being enthusiastic about what you're learning and what you're striving to do."

How do you maintain work-life balance?

[*laughs*] Work-life balance is just a mess. I heard somebody answer that question by laughing and saying, "You need to drop the distinction between your work and your life and you just need to let them kind of get like this: [*interlocks fingers*]." Which on the one hand makes my blood pressure go up, but on the other hand it allows you to stress a little bit less about time management. If I let go of that micromanaging, then it's a little bit easier.

I have two kids who are almost eight and almost five. My wife, Jane, is a pediatrician. We do talk a lot about balance, but I don't have any secret for it. It's a challenge no matter what we're going to go into, and I think some people choosing surgery may wonder, "Is [the time commitment] a potential negative for my career choice?" I don't think that should be a primary driver of what you go into because [every profession is] going to be fairly busy. Ultimately what type of person you are, more so than the hours, is going to determine what you decide to go into.

What is your advice for students looking for their right path in medicine?

There are two points I want to talk about when people are thinking about choosing a path. One: being a medical student on a surgical rotation can be a bore because you might end up seeing the same two or three procedures over and over again. While that's useful as a resident because you're going to need the physical reps to get good at that procedure, as a medical student you're either going to be observing or doing something fairly basic like holding a retractor. If you don't have a good conversation or it's not a good vibe, that can get really boring. When I was a medical student, I was the laparoscopic camera driver on a bariatric rotation so I saw umpteen-thousand gastric bypasses and I held the camera and didn't hold it well. I had to figure out, and every medical student who goes into surgery has to do this, "Do I think I'm really going to like being the person across the table from me? Because I don't really like doing what I'm doing right now."

The second point I wanted to make is that I probably put too much importance into the relationship I had with a mentor early on. He was a cardiac surgeon and a great medical student advocate, and those two things don't often coexist. He got me involved with the team and the open cardiac cases, which was really cool. I thought, "I'm going to go into surgery, and I'm going to go into cardiac surgery." Once I went into residency at a different place and that person was gone, I realized, "Oh! I sort of just wanted to be around that person, not necessarily do heart surgery."

What kind of qualities do you think are important characteristics of a successful surgeon like yourself?

First and foremost, you have to really love what you do. There's no substitute for being enthusiastic about what you're learning and what you're striving to do because it's going to take time no matter what you pick.

In looking at surgical residency, one habit that a lot of surgical residents develop later in their residency is meticulously documenting how to do a particular procedure. For me, that was a little notebook. I didn't really start keeping one until towards the end of residency, and I was like, "Gosh, I've gotta remember this!" But that was enjoyable for me to do, that didn't feel like work, it was sort of fun to kind of piece all that together. If work becomes uninteresting, then I don't care what your work ethic is, eventually you will burn out. This is the moment you do your best to figure out an area that will keep you excited and keep you engaged.

General surgical residencies are going to take a long time, but you're not picking something so you are happy in five years–you're picking something so you are happy in fifteen years. There's going to be such a long period of time for you to practice whatever your field of choosing. I can't overstate this: it's going to be a long time–in a good way–but man, don't sweat the extra year or two or three that it takes if that's where you want to go.

Lung Transplantation for Patients with Severe COVID-19 Pulmonary Disease

By Marisa Joel, Class of 2024

REVIEWS

As of January 2022, there have been approximately 60 million confirmed cases of the coronavirus disease 2019 (COVID-19) and nearly 850,000 COVID-19 deaths in the United States.[1] The symptoms of COVID-19 range from those of a minimal upper respiratory tract infection to severe respiratory failure with multiple organ failure.[2] In patients with severe disease, a robust host immune response mediated by both cytokines and inflammatory cells plays a major role in lung destruction. Severe COVID-19 lung infections may result in acute respiratory distress syndrome (ARDS) and pulmonary fibrosis with characteristic pulmonary ground class opacification on CT scan.[3]

Lung transplantation is a life-saving treatment for a variety of end-stage lung diseases. The indications for lung transplantation are usually due to end-stage lung diseases, like pulmonary fibrosis. Lung transplant, however, is infrequently considered for patients with ARDS attributable to infectious causes.[4] Significant dysfunction of other vital organs, such as that seen after severe COVID-19 infection, poses potential contraindication to lung transplantation.[5] Lung transplant (LT) after severe lung damage due to COVID-19 infection represents unexplored territory.

Several concerns limit the use of LT as a therapy for patients with severe ARDS secondary to COVID-19. First, it is possible that the superinfecting pathogen might recur in the allograft. Second, severe vascular and pleural damage secondary to COVID-19 infection might create technical barriers to the transplant procedure. Fibrotic lung disease, such as that due to COVID-19, has been shown to make the vascular anastomosis technically more challenging.[6] This subsequently increases the time of tissue ischemia, further worsening outcomes. Third, most patients with critical COVID-19 have likely endured exceedingly prolonged hospitalization, immobilization, compromised nutritional status, and treatment with corticosteroids and neuromuscular blockade, all of which lead to marked deconditioning and subsequent difficulty in rehabilitation following the LT.[7] Lastly, it is uncertain whether the lung is capable of repairing itself after severe COVID-19, in which case consideration must be taken to understand the long-term outcomes associated with spontaneous recovery as compared to LT. Experts agree that 4 weeks is considered an absolute minimum, and more often wait for 8+ weeks, before seriously considering transplantation. Anecdotally, cases with CT evidence of fibrosis have subsequently improved without transplant intervention.[8]

Despite these concerns, however, there have been successful LTs in patients who experienced COVID-19 pneumonia in whom full lung recovery was unlikely without surgical intervention. The earliest reports were those in China, suggesting that LT may be an option for COVID-19 patients with Polymerase Chain Reaction (PCR)-negative results.[9,10] Later cases in the United States expanded upon Chinese reports by demonstrating that LT can be completed in patients with positive RT-PCR results, provided that Vero cell cultures confirm non-infectivity.[11]

A case series of successful LTs at Northwestern University Hospital found that lung disease after severe and prolonged COVID-19 infection–associated ARDS shared pathological and molecular features with pulmonary fibrosis requiring LT, suggesting LT may be the only option for survival in these patients.[7] Based on their experiences with successful LTs, researchers made the following recommendations: (1) bilateral rather than single LT to decrease subsequent development of pulmonary hypertension, (2) allowance of sufficient time to exclude possible spontaneous lung recovery, (3) patient involvement in the transplant decision when possible, (4) requirement of two negative PCR test of bronchoalveolar fluid.[7,12]

Given the many considerations and complex interplay between COVID-19 infection and various comorbidities, the decision to proceed with LT in the cases of severe pulmonary disease is not a clear path. King et al. have proposed a potential diagnostic algorithm for the evaluation of inpatient lung transplant candidates with COVID-19, shown in Figure 1.[13] Khozani et al. have suggested ten considerations[14] that should be taken into account during a COVID-19 patient evaluation for LT candidacy: (1) patients must not be older than 65, as cases of older patients showed poorer outcomes such as increased length of stay, 1 and 3-year mortality, and risk of postoperative infection due to declining immunity.[15] It is important to note that most COVID-19 patients admitted to the ICU are older than the maximum age limit for LT[16]; (2) Candidates must have single-organ dysfunction only, as the feasibility of LT for

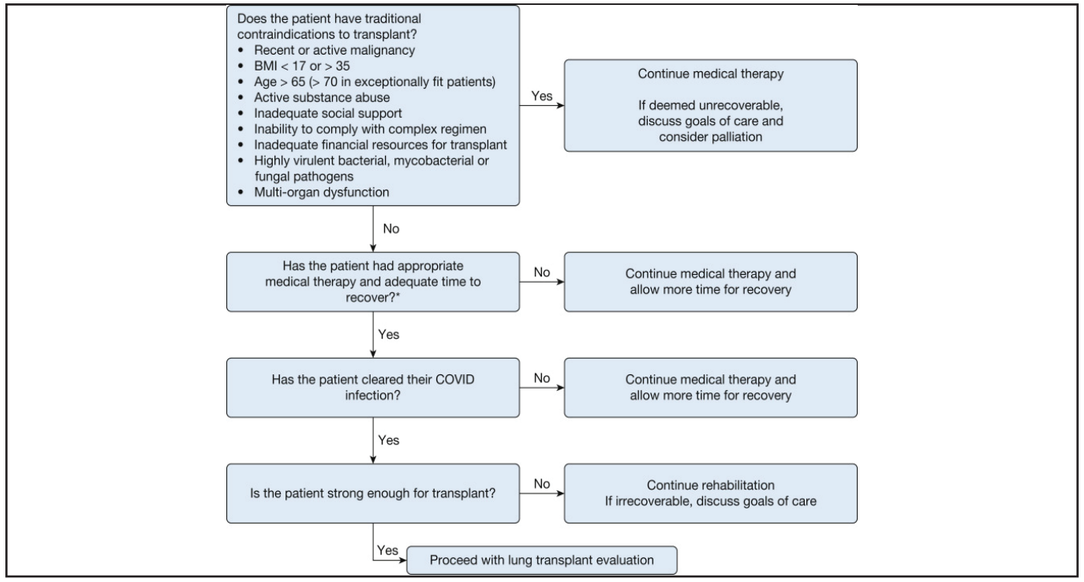

Figure 1: Algorithm for Evaluation of Inpatient Lung Transplant Candidates with COVID-19.
Reproduced from: King CS, Mannem H, Kukreja J, et al. Lung Transplantation for Patients With COVID-19. Chest. 2022;161(1):169-178. doi:10.1016/j.chest.2021.08.041

COVID-19 patients with multiorgan failure requires additional consideration; (3) Spontaneous recovery must be ruled out by waiting the minimum 4 week timeframe prior to proceeding with LT; (4) There must be radiological documentation of refractory lung disease; (5) The patient must be informed and able to discuss transplantation; (6) Patients must receive adequate physical health care while on the waiting list[17]; (7) Patients should be eligible for standard transplantation criteria such as sufficient body-mass index and absence of other notable comorbidities, including severe heart disease[18]; (8) Recent SARS-CoV-2 PCR result should be negative, as the post-surgery fatality rate is remarkably higher for patients who tested positive for infectious diseases, even in asymptomatic cases[16]; (9) The surgical center should be qualified in performing high-risk surgeries; and (10) Wide donor pool should be accessible to qualified surgical centers to maximize survival chance of patients on the waiting-list.[19]

While there have been reports of promising outcomes, lung transplantation for treatment of severe pulmonary disease caused by COVID-19 is far from a panacea. Even studies reporting positive LT outcomes for patients with irreversible lung disease call for more research to determine the long-term outcomes of LT for patients with severe COVID-19.[4,7] LT for COVID-19 should be limited to patients requiring mechanical ventilation or ECMO despite several weeks of care in the ICU, advancing disease severity, radiographic signs of irreversibility, and a high risk of developing life-threatening complications. Though it may prove life-saving, the decision to proceed with LT for COVID-19 infection is not without risk and should be made by a multidisciplinary team following sufficient time to rule out spontaneous recovery.

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Risk Factors for Five-year Mortality After Carotid Endarterectomy

By Taylor Haddad, Class of 2023

RESEARCH SPOTLIGHT

Atherosclerotic disease is a leading cause of modern-day morbidity and mortality. Carotid stenosis, caused by a build-up of cholesterol plaque, commonly burdens the carotid artery bifurcation and is among one of the most studied vascular pathologies. Clinically, carotid stenosis may manifest as a transient ischemia attack, stroke, or other neurologic sequelae, however many patients experience asymptomatic disease that is found incidentally. Current management guidelines recommend carotid endarterectomy (CEA) for asymptomatic carotid stenosis if occlusion is greater than 70% in patients with acceptable surgical risk. Yet, depending on patient demographics and comorbidities, the risk of 5-year mortality for this population can reach up to 70% following CEA.[1]

Using the robust Vascular Quality Initiative (VQI) online database, Blecha, DeJong, & Carlson (2022) explored risk factors for 5-year mortality in asymptomatic patients following CEA. Historically, studies have demonstrated the benefit of CEA versus medical management in asymptomatic patients, however recent research shows the implementation of modern medical management has proven to decrease risk of stroke in this population. Notably, the authors underscore that the benefits of elective CEA for asymptomatic disease requires a long survival. Therefore, this research aims to more precisely pinpoint risk factors in surgical candidates to assist with reducing unnecessary surgeries when medical therapy may be a more suitable option for asymptomatic disease.

This study is a retrospective review of 30,615 patient records from the VQI database. Inclusion criteria consisted of documented survival status, complete data on all of the study variables, and asymptomatic neurological status. Of the patients that met study parameters, 5,414 (18%) experienced mortality within 5 years post-CEA. Variables that were studied include demographics (gender, age, race, body mass index), past medical history (specifically assessing history of congestive heart failure, diabetes, chronic obstructive pulmonary disease, end-stage renal disease and dialysis status, active coronary artery disease, and prior myocardial infarctions) prior surgical history (with a focus on coronary artery bypass or percutaneous artery stenting), and medical therapy (aspirin, P2Y12 antagonists, statins, and beta-blockers). Importantly, this study also assesses social determinants of health such as housing status (homelessness vs. assisted living vs. home) and social factors (e.g., smoking).

Of the variables studied several identified risk factors and their associated odds-ratios include: housing status other than home (2.1) > black race (1.3) > age (1.04) > female gender (0.99). High risk comorbidities include hemoglobin less than 10mg/dl (2.1) > history of congestive heart failure (1.9) > history of COPD (1.8) > BMI under 20kg/m2 (1.7) > history of lower extremity major amputation (1.5) > LE bypass = history of neck radiation = renal insufficiency = smoking history = diabetes (1.3). It was also found that taking statins and aspirin at the time of surgery was protective against 5-year mortality. Beta blockers and P2Y12 inhibitors were not found to be protective. The results were formulated into an advanced mortality risk calculator. With one-point for renal insufficiency, history of smoking, diabetes mellitus, history of radiation, history of lower extremity bypass or venous intervention, black race, and major amputation. Two points are added for BMI under 20 kg/m2, COPD, and history of congestive heart failure. Three points are allotted for hemoglobin under 10, living status other than home, age greater than or equal to 80 years old. Five points are given for end stage renal disease on dialysis. The authors highlighted as the risk calculator score increases, so does the risk for 5-year mortality following CEA for asymptomatic disease. Patients with a score of zero are at a 5% risk 5-year mortality, compared to those with a score of 3 and nearly a 20% risk and those with a score of 8 with slightly over 40% risk.

The greatest risk factors for 5-year mortality in this study were hemoglobin less than 10mg/dl and 2.1 and housing status other than home, both demonstrating odds-rations of 2.1 and reaching statistical significance with p-values <.001. The significance of housing status influencing mortality highlights the importance of socially responsible surgical care that assesses all spheres and variables of a patient's life that may impact success both in and out of the hospital.

These findings offer novel insight into the long-term risks of CEA in patients with asymptomatic carotid stenosis. Importantly, this work emphasizes the need to screen asymptomatic patients prior to surgery, fully assessing their demographic, social, and medical risk factors that may contribute to their risk of 5-year mortality following the procedure. This study's novel risk calculator will lead to thorough screening and better inform pre-surgical risk stratification and allow patients with asymptomatic carotid disease to make a more informed decision regarding their care.

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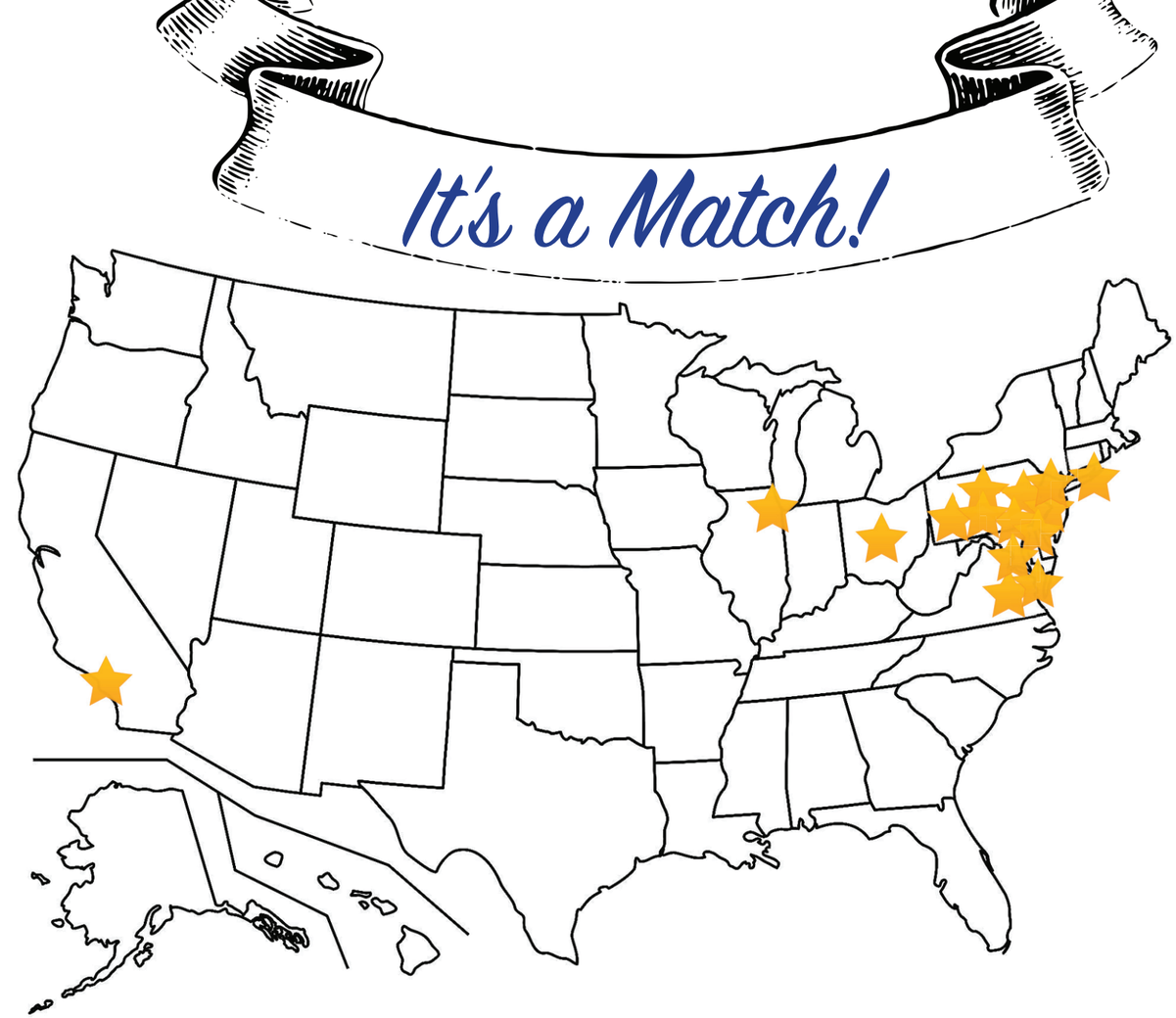

This Summer, the Class of 2022 is heading to...

GENERAL SURGERY

Thomas Jefferson University
Cleveland Clinic Foundation
Howard University Hospital Center
Lankenau Medical Center
Penn State University, Hershey Medical Center
Zucker SOM/Northwell Health Staten Island
Allegheny General Hospital
Geisinger Health Systems

INTEGRATED THORACIC SURGERY

University of Virginia

INTEGRATED VASCULAR SURGERY

Rutgers-NJMS
Medstar Georgetown

INTEGRATED PLASTIC SURGERY

UCLA Medical Center
University of Chicago
Cooper University Health System

Interview with Dr. Scott Cowan

INTERVIEW

By Anjali Patel, Class of 2023
and Amiti Jain, Class of 2025

Dr. Scott Cowan is a trained general and thoracic surgeon who now serves as the Medical Director for Enterprise Risk and as the Enterprise General Surgery Quality lead. He completed medical school and general surgery residency at Jefferson before completing his thoracic surgery fellowship at Massachusetts General Hospital. After training, Dr. Cowan worked as a general thoracic surgeon at Penn Medicine for 3 years until returning home to Jefferson in 2010. Here, he was exposed to the field of quality and safety and was inspired by mentors including Dr. David Nash and the thoracic surgery legend, Dr. Herbert Cohn. Dr. Cowan received his Master's degree in Healthcare Quality and Safety through the Jefferson School of Population Health and then functioned as the Vice Chair for Quality in the Department of Surgery while he was clinically active as a thoracic surgeon – a challenging feat. Dr. Cowan also served as Vice President and then President of the Pennsylvania National Surgical Quality Improvement Program (NSQIP) Consortium and played a role in developing the City of Philadelphia Perioperative Opioid Prescribing Guidelines.

I just wanted to begin by recognizing the Gibbon Surgical Society for all of the incredible work that has been accomplished in the past and all of the great work that is currently underway. I had the true pleasure of serving as the Faculty Advisor to the Gibbon Surgical Society for many years and miss collaborating with our Gibbon medical students on projects and activities.

How much of your current job involves interacting with patients versus administrative duties?

I have transitioned to 100% administration over the past few years given my strong interest in risk management and my background in quality and safety. This transition has provided the incredible opportunity to learn from the true leaders in these fields including Drs. David Nash, Jonathon Gleason, Herbert Cohn, Joshua Clark, Lisa Ramthun, and many others. It has been an exciting journey.

In situations resulting in patient harm, how are underlying causes determined?

In terms of patient harm related to medical errors, there was a landmark publication by the Institute of Medicine (IOM) in 1999 that you will see referenced in many talks and writings about quality and safety that changed the way we think about medical errors and adverse events. The authors of the IOM report, "To Err is Human: Building a Safer Health System" noted that most errors are systemic in the healthcare system and that the majority of these errors can't be resolved at the provider level.[1]

Jefferson's approach to errors involves a very well-structured error classification system that follows the root cause analysis (RCA)[2] approach that was implemented largely by Dr. Oren Guttman and other Enterprise leaders. The approach allows for a rapid categorization of the event followed by a systematized process that is used to identify the underlying cause of these events. The final step involves developing and implementing an action plan to prevent these events from happening again. RCA[2] looks and feels very different from our previous processes and has been functioning extremely well in our enterprise hospitals.

Can you touch on how physician burnout and fatigue potentially contribute to system failures?

The COVID pandemic has brought the issues of fatigue and burnout to the forefront of medicine and now are a large focus of health systems. Not only has COVID impacted the mental and physical wellness of our health care staff, COVID has also created a large staff shortage in hospitals across the country which introduces a new component of risk. Jefferson has a robust, multitiered wellness program that has been designed to provide staff with much needed wellness resources. Studies have shown that burnout and fatigue have definitely been associated with medical errors and the goal is to help reduce these issues to further improve the quality and safety of care provided to our patients.

I have had the privilege of working with wellness leads from our Jefferson Enterprise hospitals in implementing a peer support program call RISE (Resilience in Stressful Events). Although system errors are evaluated by RCA[2] following adverse events, attention is rarely focused on the emotional impact on our healthcare colleagues that are involved. Peer supporters are trained to provide psychological first aid (PFA) to Jefferson employees following difficult hospital-related adverse events. The Jefferson RISE Program started at Jefferson Abington Hospital and is now live at nearly all enterprise hospitals with a plan to go live at Einstein Hospital in July, 2022. RISE is a very proactive program and, to date, over 200 employees have received peer support following adverse events.

Since the COVID pandemic began, there have been countless changes in healthcare. What's your perspective on telehealth appointments from a risk standpoint?

Great question. All hospital systems had to pivot quickly to accommodate the high-volume of telehealth visits during the COVID pandemic. Prior to the pandemic, our IT leadership at Jefferson had developed and implemented a strong telehealth program that required some optimization and proved successful throughout the COVID pandemic. Telehealth does introduce a variety of new risks including diagnostic errors, patient access issues, patient confidentiality and documentation requirements and the risk management team works closely with IT leads to help reduce risk with these processes.

We know that one of the prominent projects run by the Enterprise quality and safety leads is the initiative to decrease CLABSI (Central Line Associated Bloodstream Infections). What has our health system done to reduce these?

CLABSI's can be life threatening infections with an associated mortality of 12-25%. Best evidence shows that CLABSI's can be reduced using central line bundles which include best practices for line insertion, maintenance and monitoring. Through a coordinated multidisciplinary effort across the Jefferson Enterprise, the CLABSI reduction team efforts resulted in a decrease in the standardized infection ratio (SIR) by 14% which is an incredible achievement. There is an ongoing effort to reduce this complication and a CLABSI Temporary Action Group (TAG) has been created to focus on standardizing best practices around central lines.

Many of us have read and highly regard Atul Gawande's book, The Checklist Manifesto, detailing how even the most competent surgical team can benefit from using checklists. How are surgical checklists and timeouts used at Jefferson?

First of all, I love Dr. Gawande's book. I have a copy of The Checklist Manifesto right next to me on my bookshelf. I love the idea and utility of using checklists in many areas of medicine and surgery particularly as they apply to time outs. There are great data to support the use of surgical checklists.[2] The real opportunities now lie in how to best integrate these checklists into our electronic medical record and use data entered into our EMR to audit compliance with checklist elements. At Jefferson, the quality and safety teams, risk management and many of our providers work closely with our EPIC optimization team and IT colleagues to leverage technology to increase data transparency and make data usable at the patient's bedside. Over the past 2 years, an incredible quality, safety and experience program was created at Jefferson called OnPoint. OnPoint includes a Safety Management System, Quality Management System, Patient and Family Centered Care, as well as the OnPoint Reporting and Feedback/OnPoint Insights program.

Any message you'd want to convey to folks reading this interview?

As a student, I never realized all of the opportunities to pursue interests in areas that are, in a sense, non-traditional when you think of medicine. There are many paths you can go down to enhance your career and create a satisfying and rewarding experience. There are also opportunities to become involved regionally and nationally in societies related to your area of practice and interest. Even as an attending who completed training 15 years ago, I still feel like a student and enjoy learning more about surgery, medicine, quality and safety and risk management every day.

You have a lot to look forward to!

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GEN SURG 101: The J-Pouch

By Leah Iosif, Class of 2024

GEN SURG 101

The idea of an ileal-anal anastomosis was first developed as an alternative to an ostomy. In 1933, Rudolph Nissen was the first physician to attempt an anastomosis between the ileum and anal sphincter, but unfortunately was unsuccessful. Following Nissen, between 1941 and 1947 various physicians began experimenting with alternative methods of ileo-anal anastomosis. In Philadelphia, PA, during 1952, Valiente and Bacon developed the idea of a three-loop ileal pouch with an efferent spout that was sutured to the anal sphincter. While they noted anal sphincter control was maintained, the test subjects all suffered from severe post-operative complications that proved fatal.[1,2]

In 1978, Sir Alan Parks and Mr. John Nicholls successfully put together the idea of an ileal anal anastomosis and 3-limbed ileal reservoir, as they are the first to describe an ileal pouch anal anastomosis (IPAA). Parks and Nicholls created an S pouch, using 3 loops of small intestine and a hand-sewn anastomosis between the pouch and the anus.[2]

Today, the favored approach is the J-pouch which was created by Dr. Utsunomiya. He built on the previous methods and developed the concept of using 2 loops of small intestine to make the J-pouch. The basis of the J-pouch was designed around 2 main concepts, a lateral anastomosis between the looped terminal ileum and an anastomosis between the anal canal and top of the ileal loop. Additionally, the use of a hand-sewn anastomosis has fallen out of favor for a stapled approach which reduces the incidence of damage to the anal sphincter and transition zone.[1,3]

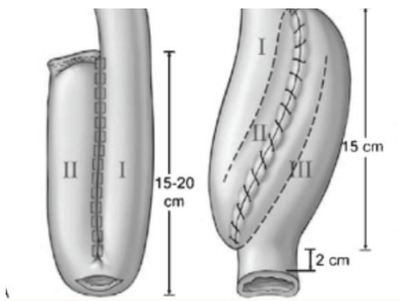

Figure.2. J pouch (left) and S pouch (right). **Reproduced from Kirat, Hasan T, and Feza H Remzi. "Technical aspects of ileoanal pouch surgery in patients with ulcerative colitis." Clinics in colon and rectal surgery vol. 23,4 (2010): 239-47.**

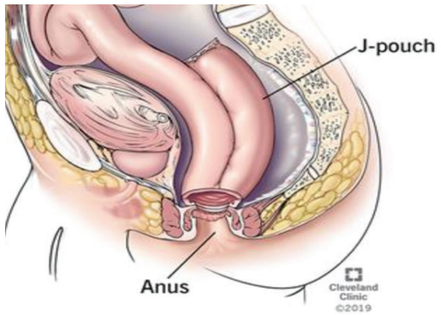

Fig. 1. J-pouch. **Reproduced from: The Cleveland Clinic. J-pouch surgery . The Cleveland Clinic website.** https://my.clevelandclinic.org/health/treatments/21062-j-pouch-surgery. Updated 2019.

Indications and Goal of Procedure:

The indications for the J-pouch procedure are: Ulcerative Colitis refractory to medical management, colorectal cancers requiring total abdominal colectomy and Familial Adenomatous Polyposis (FAP). The aim of the J-Pouch procedure is to provide continence, avoid permanent stoma, prevent malignant degeneration and cure disease. [4]

The Procedure

1. Proctocolectomy:

A midline vertical incision is made and the sigmoid colon and rectum are mobilized. The rectum is transected at the top of the anal columns, making sure to cut 1-2 cm above the dentate line which is important in the maintenance of continence. The mesentery of the descending colon is incised lateral to the inferior mesenteric vein. Mobilization of the left side of transverse colon is done along Toldt's fascia until reaching the inferior margin of the pancreas. Toldt's fascia serves as a surgical landmark in mobilization of the mesocolon. The greater omentum is then dissected out. Dissection is continued until full mobilization of the descending colon and splenic flexure is achieved. A right colectomy is then performed first by freeing peritoneal attachments, once again following along Toldt's fascia. Once mobilized, dissection is continued from the cecum, to the hepatic flexure and ending with the transverse colon. [5, 6,7]

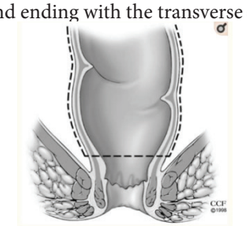

Figure 3. Showing point where rectum is transected (1-2cm above dentate line). **Reproduced from: Kirat, Hasan T, and Feza H Remzi. "Technical aspects of ileoanal pouch surgery in patients with ulcerative colitis." Clinics in colon and rectal surgery vol. 23,4 (2010): 239-47.**

2. J Pouch Creation:

Small bowel is mobilized from its mesentery to the third part of the duodenum. The terminal 30-40 cm of ileum is used for the creation of the pouch, and is folded into two segments, each 15-20 cm long. The two segments are then anastomosed side to side using a GIA stapler creating a large pouch lumen. At the apex of the pouch, a longitudinal enterotomy is made which serves to facilitate anastomoses between the two ileal loops and connects to the anus. The blind end of pouch is stapled closed. [5, 6,7]

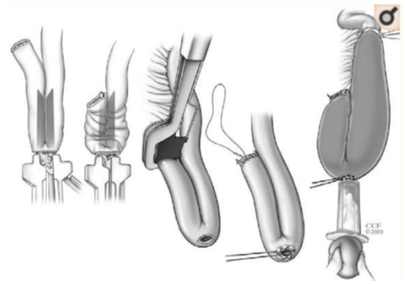

Figure. 4 . J Pouch Creation steps. **Reproduced from: Kirat, Hasan T, and Feza H Remzi. "Technical aspects of ileoanal pouch surgery in patients with ulcerative colitis." Clinics in Colon and Rectal Surgery vol. 23,4 (2010): 239-47.**

3. Ileostomy Creation

The ideal site for stoma placement is typically within the rectus abdominus and beneath the umbilicus laterally. An area of small intestine proximal to J-pouch is brought through the skin and sutured into a stoma.[5,6,7]

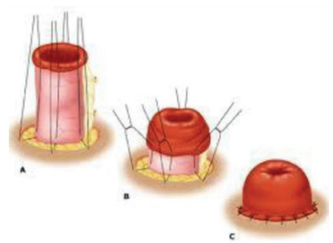

Figure 5. Ileostomy and Stoma Creation. IBD Surgeries. **Reproduced from: Preconception and Pregnancy in IBD website.** https://pregnancy.ibdclinic.ca/Ibd-Surgeries. 2022.

4. Ileostomy Reversal:

Incision is made around ileostomy and it is removed from abdominal wall. Bowel is stapled and reconnected. [5,6,7]

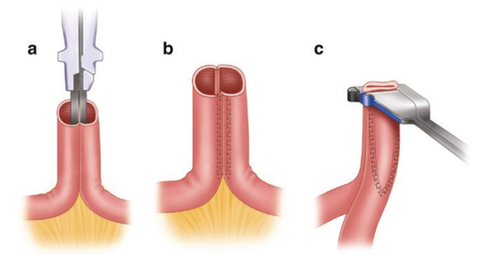

Figure 6. Ileostomy reversal. **Reproduced from: Sheedy, S.P., Bartlett, D.J., Lightner, A.L. et al. Judging the J pouch: a pictorial review. Abdom Radiol 44, 845–866 (2019).**

5. IPAA: Ileal Pouch-Anal Anastomosis

The anvil of stapler is placed through the enterotomy opening at the apex of the J-pouch. This is secured with a purse string suture. At the anorectal stump another purse string suture is used, and with a trans-anal approach, the circular stapler is advanced. The stapler is fired, and this competes the IPAA. [5,6,7]

Contraindications to Procedure:

A complete contraindication to the procedure is patients with diseased small bowel commonly seen in Chrohn's disease. In addition, obese patients and women with past obstetric complications are at increased risk of pouch failure, and women can be at an increased risk of infertility.[4,8]

Common Complications:

Pouchitis; inflammation of the ileal reservoir; pelvic sepsis; pouch failure; and small bowel obstruction.[4,8]

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The Business of Surgery: Recognizing Barriers to Gender Equity

By Diana Jimenez, Class of 2023

FEATURES

Where are all the women in surgery? This question was the headline of a 2019 Association of American Medical Colleges (AAMC) article that outlined the years-long struggle in recruiting and retaining female surgeons. According to the AAMC 53.7% of medical students are female.[1] However, the percentage of women in general surgery residency remains disproportionately low with only 30% of women making up surgical residents in 2020, up from 15% in 2000.[2] In contrast to surgical residencies, women make up 43% of internal medicine residency programs.[3] In academic medicine women only make up 19% of academic surgeons compared to 36% of internists. Additionally, female surgeons make up only 9% of professors in medical schools, compared to 19% of internal medicine faculty.[4] Only 7% of surgical department chairs are women compared to 19% of medicine department chairs.[4,5] Furthermore, Elmore et al.[6] found that women surgeons were 60% more likely to experience burnout and were more likely to have symptoms of depression than their male counterparts. According to current literature, residency training, mentorship and professional fulfillment are the 3 biggest factors impacting the careers of female surgeons.

Residency

From recruitment to program logistics, residency programs should be continuously evaluated and improved to be consistent with current priorities including implicit biases and a rigid schedule. Part of increasing representation of women in surgical programs includes building programs that are not only inclusive of women, but also understand the specific challenges they face during residency. According to Stephens et al.[7], women trainees experience less autonomy than their male counterparts. The problem is prevalent with 6% of female chief residents receiving the designation of needing "extensive guidance" compared to 1% of their male coresidents. Pregnancy during residency is another unique stressor that is further compounded by a challenging and inflexible training schedule. A study of female surgeons who had children during residency found women were likely to face difficulties surrounding work scheduling, in addition to a lack of lactation and childcare support.[8] Forty percent reported seriously considering leaving surgical training. A 2019 study found that 43% of residents took less than 2 weeks of parental leave.[9] In 2021, Kim et al.[10] found only 35% of all female surgeons were able to have all their desired children without assisted reproduction therapy as compared to 57% of men.

Mentorship

Mentorship is a double-edged sword for women. The small number of senior female surgeons creates a mentorship burden as the growing number of residents and young attendings struggle to find mentors whose experiences mirrored their own. Mentorship and support not only play a role in successful surgical training but also are crucial in the development of an academic career and professional advancement. As a whole, women represent only 19% of tenured professors, 12% of department chairs, and 11% of medical school deans.[11] With a scarcity of mentors, innovative solutions that consider the unique challenges faced by female surgeons must be developed.

Professional Fulfillment

Lack of representation, decreased autonomy, and suboptimal guidance and support during training can have negative long-term effects on the career of women surgeons. A survey by the Michigan Medicine Department of Surgery found that female surgeons reported lower professional satisfaction compared to men.[12] Two well-studied aspects contributing to this finding include compensation and career advancement. Greenup et al.[8] found that across the board, female surgeons make 8% less than their male counterparts even when controlling for years of training, subspecialty, faculty rank, and metrics of clinical and academic productivity. Referrals, an important component of compensation, also favors male surgeons. Dossa et al.[13] reported male physicians were significantly more likely to refer patients to male surgeons than female surgeons.

In contrast to compensation, career advancement and promotion is more difficult to measure and assess. In academic medicine, advancement is closely tied to research and editorial activities. Stephens et al.[7] outlined differences in research funding, with junior faculty women receiving a median of $350,000 compared to the $889,000 men received even after controlling for degree, years of experience, and institutional characteristics. In addition, men consistently receive more R01 grants at all career stages and are more likely to have higher scores on their renewal applications than women.[14] The disparity in funding could also explain why women are underrepresented as primary investigators in scientific journals representing only 17% of last author publications in the top 25 surgery journals.[15] In 2017 only 19% of those serving in high impact surgery journals were women.[7] The lack of inclusion of women in editorial boards came under a national spotlight when the Journal of Vascular Surgery published an article about 'unprofessional' behavior in surgeons. The all-male authored and edited article drew backlash for essentially grading the social feeds of surgeons, particularly women surgeons. In its statement announcing the retraction of the article, editors of the journal pledged to increase the diversity of their editorial boards.[16]

Two Thomas Jefferson Uniersity Hospital residents perform a cholecystectomy. 2022. Courtesy of Jefferson General Surgery Residency Prgram,

Moving Forward

Renowned liver surgeon Dr. Nancy Asher once made the following remarks highlighting Dr. Olga Jonasson's career as a pioneering female surgeon: "Dr. Jonasson was the first to ask where are all the women? This question focused our attention on the pipeline, lack of female leadership, and decreased visibility at meetings. It forced us to think about how to attract women in our fields." Dr. Jonasson, who embarked on a surgical residency despite being told her choice was "absurd" by a medical school dean, became the first female Chair of Surgery at a major academic institution. Her accomplishments inspired countless women surgeons that followed.

Though the outlined obstacles may seem daunting, advocates within the field have made great strides towards recruiting and retaining more women in surgical specialties since Dr. Jonasson. Since 2000 the percentage of female academic surgeons has nearly doubled.[2] Progress has also been made towards improving the lives and careers of the women already in surgery. Mentorship, and specifically, trained mentorship-mentee relationships empower women within their practice to seek professional fulfillment. Programs like the University of Wisconsin's Entering Mentoring program, where 500 women from 39 institutions have received formal mentorship training, are effective and act as a platform to connect women surgeons across the United States. Considering the shortage of female surgeons currently, support must also come from willing male surgeons. An example of successful male mentorship is The American Thoracic Society's program recognizing effective male mentors to female residents. To bridge the pay gap, recent initiatives by several organizations such as the Mayo Clinic now offer identical salaries to men and women.[7] Finally, in an effort to be more mindful of women's issues, many hospitals now have dedicated lactation rooms. Changes over the last 20 years came only as a result of the sacrifice prior women surgeons made in order to establish themselves as equals in the operating room. It is because of their dedication, the obstacles which were once walls are now merely hurdles.

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The Gibbon Surgical Society

The John H. Gibbon, Jr. Surgical Society (GSS) at Sidney Kimmel Medical College (SKMC) at Thomas Jefferson University is a unique student interest group that has been working hard to increase interest in the field of surgery among medical students for the last 38 years. The society has over 400 total active members on a year to year basis, spread across the four-year curriculum. The GSS increases exposure and interest to the surgical field through a unique blend of episodic and longitudinal programming that helps bring together students, residents, and faculty in an educational setting.

The crux of the GSS approach to bolstering medical student interest is early exposure. Over the years, the GSS has run many programs specifically targeted at students in the pre-clinical curriculum to increase surgical exposure, including overnight shifts on the trauma service, call with the organ procurement team, and SCALPELS, a longitudinal surgical curriculum that runs concurrently with the pre-clinical curriculum. There are also events that are available to all students. The GSS runs a quarterly journal club, which is led by a surgeon at Jefferson in the field that is currently being studied by the second-year medical students. Many surgeons take this time to not only educate the students in critical review of the findings of papers, but also the underlying statistics that were used. The Philadelphia Surgical Symposium is the GSS's signature event each year. Students from all medical schools in the Philadelphia region are invited, and it is intended to be an informative opportunity for medical students interested in surgery. There is an associated regional medical student research poster session and competition during the event, complemented by presentations from a faculty member from each school, ranging in topics from clinical experiences, to advocating for a particular field of surgery, to hot topics in research.

While the COVID-19 pandemic has changed the landscape of medical education, the GSS has worked tirelessly to create new and exciting programs to keep students engaged. Between moving some previously established programming to a virtual format to starting new and innovative experiences including podcasts and virtual anatomy sessions, the GSS board has ensured a robust experience for all students wanting to become more involved with the surgery department at Jefferson.

The GSS was presented at the AAMC's Learn, Serve, Lead 2017 conference as a model for an effective medical student interest group. This journal, the GSR, is written, compiled, and curated by SKMC students through the invaluable help and planning of the GSS members, and stands not only as a testament to the involvement and hard work of the GSS, but also of the student body as a whole.

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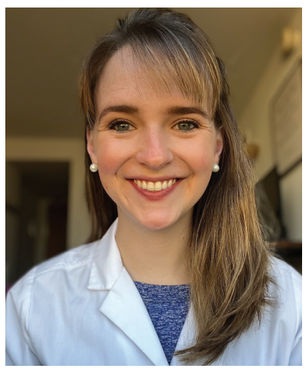

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