

LEADING THE WAY



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DEPARTMENT OF SURGERY



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From the Chair | Douglas B. Evans, MD

This issue of “Leading the Way” starts off with a brief review of the two grant proposals which were awarded in 2019 from the Department of Surgery’s We Care Fund for Medical Innovation and Research. Two very exciting areas of research involving first, the management of families dealing with a new prenatal diagnosis of a fetal malformation and second, exploration of the epigenome in a quest to provide more organs for patients waiting for a liver transplant. Importantly, the Division of Research has launched the request for proposals for this year’s grants! The “We Care Fund” will once again support innovation and discovery across MCW.

The 2019 Scientific Review Committee included Drs. Marcelo Bonini, Clark Gamblin, David Gutterman, David Joyce, Karen Kersting, Gwen Lomberk, Aoy Tomita-Mitchell, Sridhar Rao, Peter Rossi, Kalpa Vithalani, Calvin Williams, Tina Yen and Douglas Evans. Under the direction of Dr. Gwen Lomberk, Chief of the Division of Research, the committee provides formal review of all proposals with three Reviewers scoring each grant. This year will mark the 8th year of competitive grant submissions and successful funding made possible by the We Care Committee under the leadership of Arlene Lee. The We Care Committee (listed on the next page) represents the



Our first year residents whose growing knowledge represents the future of medicine.

energy, enthusiasm, commitment and loyal support that makes medical research and treatment so much fun.

Over the past 10 years, the We Care Fund has

supported the research which fuels the fire of innovation and discovery and allows our faculty to be successful. Such basic, translational and clinical research creates a culture of discovery as part of the daily practice of medicine. Innovation and discovery represent the only way to ensure that tomorrow’s treatments are better than today’s. Importantly, research is also the cornerstone of good patient care and all successful educational programs – a commitment to the constant pursuit of new knowledge contains the promise that every patient receives the best possible treatment.

These best possible treatments are also highlighted in our quarterly Grand Rounds program entitled “Knowledge Saving Life” – an opportunity for each clinical Division to highlight inspirational patient stories of life-saving treatments

which would not have happened without the team of physicians and scientists who find innovative solutions to complex and unique clinical problems. Please join us for our next “Knowledge Saving Life” program on Wednesday, April 22. For those of you who attended this month’s presentations, you witnessed a courageous man on extracorporeal membrane oxygenation (ECMO) come to the front of the auditorium and talk about his current condition and his hope for a heart transplant in the near future (see article on page 10). For a detailed description of the talent and excitement that represents the Department of Surgery, please visit our [Annual Report](http://www.mcw.edu/surgery) at www.mcw.edu/surgery.

Knowledge Saving Life

Wednesday, April 22, 2020

7:00 - 8:30 AM

Helfaer Auditorium
Froedtert Hospital

With presentations from:
Trauma and Acute Care Surgery
and Colorectal Surgery

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MCW Surgery
knowledge changing & saving life

Congratulations to the 2019 We Care Fund Awardees!

By Meg M. Bilicki, Director of Development for the Department of Surgery



The Department of Surgery We Care Fund for Medical Innovation and Research is about the hope for a future with better treatments. Established in 2010, the We Care Fund has raised more than \$1.8 million from more than 1,000 patients, families, friends, faculty, and alumni. Every penny raised supports research and clinical projects that can't wait for traditional funding sources.

The funding mechanisms that comprise the We Care Fund are designed to create a pipeline of support that facilitates the exploration of ideas, the development of strong interdisciplinary team science, and the creation of new transformative collaborations to advance the frontiers of science and medicine. The We Care Fund awards grants in the range of \$20,000 to \$150,000 for projects and programs in the Department of Surgery.

The Scientific Review Committee, a rotating group of cross-departmental faculty members, meet each spring to review the proposals, and their diverse professional backgrounds and expertise ensure that we have a fresh perspective in each grantmaking cycle. In the end, the committee selects two unique and innovative projects for funding. Congratulations to the following recipients of the 2019 We Care Fund Grants:

Maternal and Fetal Health: The Impact of Stress Related to Fetal Anomalies

Terri A. deRoos-Cassini, MS, PhD

Associate Professor, Division of Trauma and Acute Care Surgery

Regulated Hepatic Reperfusion Organ Resuscitative System: From Bench to Bedside

Johnny C. Hong, MD

Mark B. Adams Chair in Surgery, and Chief, Division of Transplant Surgery

Raul Urrutia, MD

Director, Genomic Sciences and Precision Medicine Center, Warren P. Knowles Endowed Chair of Genomics and Precision Medicine, and Professor of Surgery, Division of Research

The We Care Committee, which includes professional, business, and community leaders, is the engine that drives fundraising for research and increasing community awareness. "To date, the We Care Fund has awarded \$1.1 million to 19 projects to improve diagnosis and development of new treatments for disease and injury," says We Care Committee Chair Arlene Lee. "This year, we received eight proposals from physicians and scientists with innovative ideas."

All full-time faculty and research scientists in the Department of Surgery are eligible to apply. The applications for the next We Care Fund award cycle are now available. For additional details on the background and structure of the We Care Fund, please visit www.mcw.edu/wecare.

We Care Fund for Medical Innovation and Research Committee, 2019-2020

Arlene A. Lee, Chair
Carrie Raymond Bedore
Aletha Champine
Betsy Evans
Jamie Evans
Deborah Gollin
Sandra Hansen Harsh

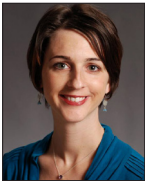
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Darren Miller
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Peggy S. Schuemann
Brian Trexell
Aaron Valentine
Jennifer L. Vetter
Liza Zito

Maternal and Fetal Health: The Impact of Stress Related to Fetal Anomalies



Terri A. deRoos-Cassini, PhD, MS
Associate Professor
Division of Trauma & Acute Care
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Amy Wagner, MD
Associate Professor and Section Chief
Division of Pediatric Surgery



Christina Bence, MD
General Surgery Resident

The advancement of ultrasound technology has revolutionized the ability to garner accurate prenatal diagnoses. The majority of pregnant women who undergo a prenatal ultrasound have positive feelings associated with it,¹ yet the prevalence of a fetal malformation diagnosed during routine ultrasound screening is 2.6%.² Unfortunately for these patients, learning that their pregnancy is abnormal can be devastating. Stress and anxiety have been well documented in women after receiving an abnormal ultrasound or prenatal diagnosis.^{3,4} In a study of mothers who received a fetal abnormality diagnosis, 88% reported their experience as a traumatic event.³ The severity of this should not be underestimated, as women learning of a pregnancy complication experience acute distress and mood-related symptoms comparable to those associated with a major depressive episode.⁴ Despite these concerning findings, the main governing bodies of obstetric medicine have not specifically addressed focused maternal antepartum mental health screening in this high-risk population.

An abnormal prenatal diagnosis not only affects maternal health, but has known deleterious effects on the pregnancy and health of the unborn child.⁵ Maternal stress has been shown to be associated with an increased risk of placental blood flow abnormalities, preterm labor, and miscarriage in the short term.^{6,7} In the long term, there are also known injurious effects of maternal stress on a child's mental and physical health with associations related to psychiatric disorders, cognitive deficits, autism, and asthma.⁸ A study in Denmark found that children born to mothers who had significant bereavement and stress during pregnancy had increased utilization of primary

healthcare through adolescence and into early adulthood, mainly due to increased mental health needs and infections.⁵ The downstream effects of maternal stress on the life of the child are staggering. Therefore, identifying mothers at the highest risk of distress and providing evidenced-based intervention for maternal anxiety and depression during pregnancy is of paramount importance.

There is a paucity of knowledge regarding the risk factors associated with a higher incidence of psychological distress among women carrying fetuses with prenatally diagnosed abnormalities. The only such study to date identified parents of younger age, minority racial/ethnic status, post-college level education, and current/prior use of antidepressants as factors associated with higher risk of distress in parents expecting a child with a prenatally diagnosed anomaly.⁹ Further, 20% of pregnant women in the study reported significant post-traumatic stress disorder (PTSD) symptoms, and 23% scored positive for a major depressive disorder.

Expanding beyond the prenatal population, there is trauma literature that highlights the increased risk of developing PTSD in highly stressed populations, including racial/ethnic minorities and individuals of low socioeconomic status (SES).¹⁰ These associations are likely related to the cumulative biopsychosocial effects that persistent or repetitive stress have on an individual over a lifetime. This is explained by the concept of allostatic load (AL), which measures the cumulative consequence of a persistent allostatic (or adaptive) state across multiple body systems (including neuroendocrine, immune, metabolic, and cardiovascular) in the setting of prolonged stress.¹¹ Research has shown a correlation between AL and high stress experiences.¹²⁻¹⁵ Similarities likely exist within the population of women expecting fetuses with prenatally diagnosed anomalies, and that of a traumatic event.³ Fetal diagnoses can range from minor anatomic abnormalities that are unlikely to significantly impact a child's life, to those requiring surgical intervention in the newborn period, resulting in long-term disability, to others associated with a significant risk of death. Little is known about how diagnostic severity, as perceived by either the mother or physician, affects



the risk of maternal psychological distress and the impact on the mother's overall allostatic load.

When evaluating risk factors related to the development of psychological distress, it is also pertinent to assess for personal protective factors that could ameliorate said risk. This is the theory behind the psychosocial concept of resilience, defined as the ability to successfully adapt in the face of adversity.¹⁶ Validated measures of resilience include factors such as the ability to adapt in response to change, being able to “cope” well with stress, and to recover quickly following a threat or difficulty.¹⁶ No study to date has evaluated resilience in mothers with fetal anomalies who did not experience distress, yet resilience likely plays a major role in a mother's perception of and ability to deal with stress related to an abnormal fetal diagnosis.

Our project, backed by the We Care Fund, will improve scientific knowledge of PTSD, anxiety, depression, and maternal well-being in U.S. women with pregnancies complicated by fetal anomalies, and elucidate risk factors associated with increased psychological distress in this population. By drawing from other areas of the literature, including trauma and PTSD research, we have developed hypotheses regarding individual factors that are likely to influence maternal distress and/or resilience, including SES, racial/ethnic minority status, education level, prior psychiatric history, and cumulative lifetime stress (AL). Currently, provision of psychological assessment and treatment is not included in the routine care of patients with prenatal diagnoses of fetal anomalies at our center, nor is it the standard of care nationally. We aim to shift practice paradigms by providing concrete evidence for the increased risk of maternal distress in prenatally-diagnosed fetal anomalies, by establishing a set of identifiable and possibly modifiable risk factors related to the diagnosis of distress. We also will trial a unique set of survey-based, reliable, and valid measures that could be later implemented for universal psychological health screening in this population. We hope that in the future, this work will provide the basis for timelier diagnoses and appropriate, individualized treatment for pregnant women who are faced with an abnormal fetal diagnosis. This will not only impact the health of the mother during her pregnancy and beyond, but will also play an important role in the cognitive and physical health of the unborn child throughout their entire life.

FOR ADDITIONAL INFORMATION on this topic, see references, visit mcw.edu/surgery, or contact Dr. deRoon-Cassini at tcassini@mcw.edu.

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See additional references on page 7.

REGISTER TODAY!

THE MILWAUKEE AORTIC SYMPOSIUM

MARCH 20, 2020

Harley-Davidson Museum
400 W. Canal St.
Milwaukee, WI 53201

This educational activity is designed to address issues related to Acute and Chronic Aortic Dissection and other acute aortic syndromes. It will familiarize the audience with natural history, surgical techniques, avoidance of complications and new technology. Aortic dissection is a public health issue with a high mortality rate. Efficient prevention, timely recognition, and safe surgery can make a difference in clinical outcomes. Surgical techniques are rapidly evolving and will be discussed at this symposium.

Register at ocpe.mcw.edu/surgery

30TH ANNUAL MEETING OF THE SOCIETY OF BLACK ACADEMIC SURGEONS

APRIL 23 - APRIL 26, 2020

The Westin Milwaukee
550 N Van Buren St.
Milwaukee, WI 53202

The Society of Black Academic Surgeons (SBAS) has a long tradition of coming together to further our mission of promoting more active participation in academic surgery among African-Americans. This year, the annual meeting will be held in Milwaukee, Wisconsin over the course of four days under the direction of local arrangements chair, Dr. Callisia Clarke.

Register at <https://www.sbas.net/annual-meeting/>

EDWIN ELLISON SURGICAL SOCIETY MCW SURGERY ALUMNI REUNION OCTOBER 2-3, 2020

The MCW Department of Surgery Edwin Ellison Surgical Society (EESS) will host its inaugural Alumni Symposium on October 2-3, 2020. The EESS is the MCW Surgical Residency Alumni Society, named after the internationally-recognized Edwin Ellison, MD. Dr. Ellison united all of the surgical residency programs in the Milwaukee area into one program, and served as the first Chair of Surgery at MCW.

Please email surgeryevents@mcw.edu for more information and to pre-register.



2019 DEPARTMENT OF SURGERY ANNUAL REPORT

Twenty-nineteen was a great year for the Medical College of Wisconsin and an especially meaningful year for our department. From its inception in 1964 with Edwin H. Ellison, MD, as the chair, the MCW Department of Surgery has remained steadfast in carrying out the legacy of innovative, patient-centered care.

View the annual report online at mcw.edu/surgery or contact Liz Chen at echen@mcw.edu to join the waitlist to receive a hard copy.



Regulated Hepatic Reperfusion Organ Resusci-



Johnny C. Hong, MD
Professor of Surgery
Mark B. Adams Chair in Surgery
Chief, Division of Transplant Surgery
Director, Solid Organ Transplantation



Raul Urrutia, MD
Professor of Surgery
Warren P. Knowles Endowed Chair of
Genomics and Precision Medicine
Director, MCW Genomic Sciences and
Precision Medicine Center

Donor Organ Crisis and Patient Death While on the Transplantation Waiting List

Patients suffering from liver failure do not have the luxury of a life-sustaining device while waiting for their transplants, and neither do candidates suffering from kidney, lung, or heart failure. Without timely liver transplantation, there is no hope for survival of these patients. The principal roadblock to the disparity between the number of available organs and the number of patients awaiting transplantation is life-saving transplantation. In the US, only about a third of patients on the liver transplantation waiting list received their transplants.

Among the major barriers to a successful organ transplantation is ischemia and reperfusion injury (IRI), an inherent event in clinical transplantation. Liver cellular damage from IRI occurs when the flow of blood, oxygen, and nutrients to the liver is interrupted (ischemia) during organ procurement and/or organ storage/preservation. These events result in the depletion of energy-rich phosphates, decay of hepatocyte mitochondrial function, and damage of endothelial cells, rendering the hepatocytes in a state of metabolic debt. Liver IRI continues with the reintroduction of blood (reperfusion) during organ revascularization. The immediate exposure of the ischemic cells of the newly transplanted liver to the patient's warm portal venous and arterial blood results in a cascade of pathways, which exacerbates the endothelial cellular damage and production of free radicals and proinflammatory cytokines. These complex events lead to further hepatocyte damage and mitochondrial failure, referred to as reperfusion injury.

Each year, approximately 3,000 donated livers in the US are being discarded due to poor quality, while the same number of patients die due to lack of suitable transplant organs. In addition, 15-25% of transplanted livers do not show full functional recovery from IRI, and as many as 6% fail immediately after transplantation due to irrecoverable cellular damage from IRI. In other words, the ability of a donated liver to recover from IRI during organ preservation

and implantation determine the organ's suitability for and function after transplantation. As such, the need to develop new therapies to expand the organ donor pool is acute at a time of severe organ shortage.

Patented Liver Resuscitation System

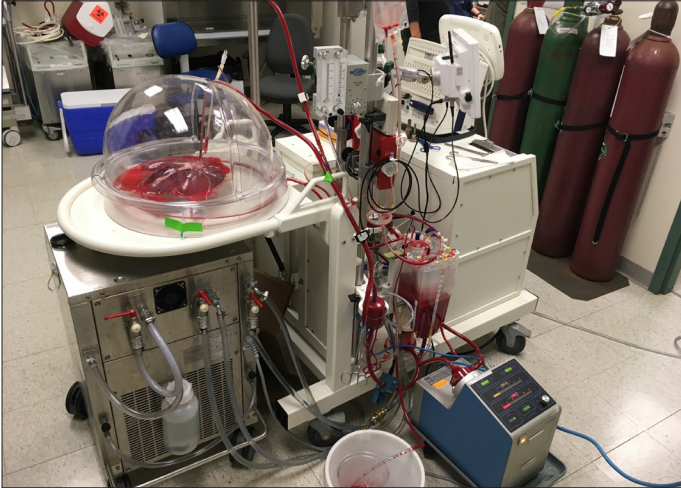
With a goal of mitigating liver IRI and increasing the number of suitable livers for transplantation, we have developed a liver resuscitative system, Regulated Hepatic Reperfusion (RHR). This system was developed over a decade ago in Dr. Johnny Hong's research laboratory. An experimental porcine donation after circulatory death (DCD) liver transplantation model was utilized to simulate events in human liver transplantation. The RHR system treated severely damaged livers with a proprietary substrate-enriched, leukocyte-depleted, oxygen-saturated perfusate delivered under a subnormothermic and pressure/flow-controlled milieu. The treatment aims to resuscitate compromised liver cells prior to exposure with the host warm blood on organ revascularization. Throughout phases I and II of the experimental model, RHR mitigated liver IRI, preserved mitochondrial function, and bioenergetics, improved the liver function and prolonged survival. The United States and Patent and Trademark Office (USPTO) has recently awarded a patent for this innovation (RHR).

The MCW Organ Transplantation Team will bring this innovation from the research laboratory to the patient bedside, in the hopes of converting donated organs, initially deemed unsuitable for transplant, into organs that can be used to save lives.

Genetic Exploration to Protect More Patients

The MCW Organ Transplantation and Genomic Sciences and Precision Medicine Collaborative Research Team has been assembled to study the molecular profiles of IRI in liver transplantation. Molecular profile assessments provide information regarding the molecular pathways from the genome to the phenome, which are controlled by epigenetic modifications. Epigenetics is the study of gene expression mechanisms that do not involve the alteration of the nucleotide sequence. Because epigenetic phenomena are potentially modifiable, they pose as attractive therapeutic targets and could introduce a new paradigm for gene regulation during IRI.

In our current project, *The Effects of Ischemia and Reperfusion Injury in Liver Transplantation on Epigenetic Profiles: A Pilot Study Using a Porcine Experimental Model*, a multidisciplinary research team will use advanced methodologies from genomic sciences, precision medicine, and big data modeling to investigate how methods for preserving organs for transplantations potentially



affect, the future expression pattern of the organ in the recipient, via the epigenome. The power of this approach lies in the fact that in contrast to the genome, the ability of the epigenome to regulate the expression of genes that could improve cell, tissue, and even organ survival can be modified using new specifically designed pharmacological tools. This ability to be functionally regulated by drugs, therefore, builds the trajectory toward future therapeutic intervention. The latter ability to pharmacologically manipulate the epigenome raises optimism that this research will catalyze the discovery and development of new approaches to harvest, recover, and prolong the life of organs — a goal of significant clinical importance.

FOR ADDITIONAL INFORMATION on this topic, see references, visit mcw.edu/surgery, or contact Dr. Johnny Hong at jhong@mcw.edu.

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Enhanced Recovery after Surgery Program



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Major abdominal surgeries have typically been followed by extended post-operative hospitalizations, accompanied by a relatively high frequency of complications. The predominant post-operative factor that leads to an extended post-operative recovery is the onset of ileus. Ileus is often accentuated by the use of opioid medications for post-operative pain control and the aggressive administration of intravenous fluids after surgery, which is thought to incite bowel-wall edema. Another major factor frequently limiting post-abdominal surgery recovery and increasing readmissions is the development of post-operative complications, most commonly, surgical-site infections.

To prevent these morbidities after undergoing abdominal surgery, care bundles were introduced to address the underlying limitations on post-operative recovery. These protocolized care bundles became known as Enhanced Recovery After Surgery (ERAS) programs. ERAS is now a well-established programmatic tool used in adult surgical fields and shown to decrease post-operative complications and length of stay without increasing readmission rates. ERAS programs include a bundle of pre-, intra-, and post-operative care measures that aim to maintain homeostasis by minimizing pre-operative fasting and volume shifts, preventing infectious and thrombotic post-operative complications, promoting early mobilization, avoiding unnecessary tubes and drains, and promoting multimodal opioid-sparing anesthetic and pain management schemes that minimize post-operative

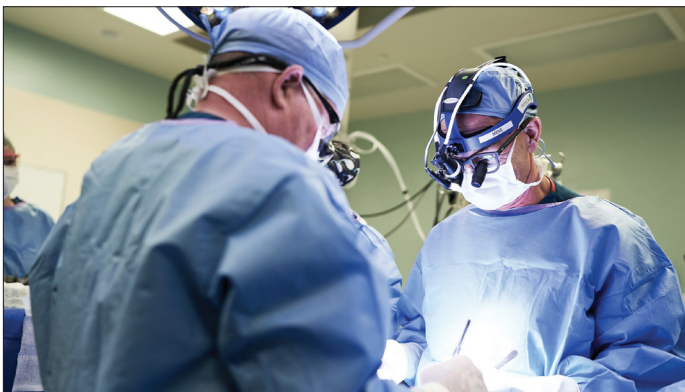
ileus and enable early reinitiation of enteral nutrition.¹⁻³ Together these elements are thought to minimize metabolic stress during the perioperative period in order to expeditiously return the patient to their baseline physiologic state.

ERAS was first introduced for adult patients undergoing gastrointestinal surgery, especially within colorectal surgery.⁴ Patients undergoing bowel resections for inflammatory bowel disease were especially ideal candidates for ERAS, given their relatively high frequency of post-operative complications. ERAS has now been applied to a variety of other adult surgical fields, including gynecology, hepatobiliary surgery, cardiothoracic surgery, and urology. The use of ERAS programs in adult surgery has been quite successful, and multiple randomized controlled trials showing that these care bundles decrease length of stay and complications.⁵⁻⁷ Initially there were concerns that earlier discharge from inpatient care would translate into higher readmission rates, but readmission rates have been unaffected.⁵⁻⁷ Significant hospital cost reductions have also been demonstrated with the introduction of ERAS programs.^{4, 8, 9}



There is a paucity of data regarding the use of ERAS for children, and ERAS has been introduced only within a select population of pediatric surgical patients.¹⁰ No formal ERAS care is currently being provided to children undergoing major abdominal surgery at Children's Wisconsin. Initial results with ERAS have been promising among pediatric colorectal patients, with a single center demonstrating a decreased length of stay without increasing complications or readmissions after ERAS program implementation.^{11, 12} There was also a decrease in perioperative opioid use without sacrificing the adequacy of post-operative analgesia.¹³ Although this preliminary work was limited to pediatric colorectal surgery, data from adults suggest that a similar benefit could be provided to pediatric patients undergoing other major abdominal operations.⁸

Differences between adult and pediatric patient populations, however, could potentially limit clinical improvements or negatively impact the patient care experience when ERAS is applied to children. A revised set of protocol elements may also be necessary to meet the unique perioperative needs of children. In pediatric surgical fields, the added complexity of caring for not only the patient, but also the parent(s) exists. Parents are typically closely involved in monitoring their child's post-operative pain, tolerance of interventions, and readiness for mobility. Not only must the patient be clinically ready for discharge, the parent(s) must also believe that their child is ready for discharge and feel empowered to continue



to be Offered at Children's Wisconsin

any necessary care provisions at home. Commitment to an ERAS pathway of care therefore must begin with early introduction of the expected care plan to parents to set appropriate and reasonable expectations.

Given the successful use of ERAS in adult surgical fields and preliminary evidence of success when ERAS is applied to children, the pediatric surgery group at Children's Wisconsin decided to design, implement, and evaluate an ERAS program for children and adolescents undergoing major abdominal surgery. A multidisciplinary team of pediatric perioperative care providers from surgery, anesthesia, and nursing has evaluated the current literature and developed an ERAS program that reflects the best practices currently available for pediatric perioperative care for major abdominal surgery. The program will broaden ERAS application to a larger population of patients with a similar potential for benefit as seen in pediatric colorectal surgery patients – patients undergoing major abdominal operations associated with extended post-operative hospitalization, increased complications, significant post-operative ileus, and considerable pain-control needs.

As the program is implemented, the ERAS team will monitor adherence to protocol elements and clinical outcomes. Post-operative length of stay, frequency of post-operative complications, and readmission rates after the ERAS program implementation will be compared to a historical cohort of patients. Resource utilization and cost of inpatient perioperative care and any post-operative readmissions or reoperations will also be contrasted between patients treated before and after ERAS program implementation. We hypothesize that the implementation of the ERAS program will yield decreased post-operative lengths of stay, decreased frequencies of post-operative complications, similar rates of hospital readmissions, and decreased resource utilizations and perioperative care costs.

The overall goal of the new ERAS program at Children's Wisconsin is to utilize a multidisciplinary team-based approach to improve the safety and efficiency of pediatric surgical care, while maintaining an excellent patient- and family-centered perioperative care experience. ERAS is a novel approach offered thus far at only a handful of children's hospitals in the country. Through careful evaluation of the outcomes within our new ERAS program, the project will provide critical data to determine the value of an ERAS program when applied to pediatric perioperative care.

FOR ADDITIONAL INFORMATION on this topic, see references, visit mcw.edu/surgery, or contact Dr. Kyle Van Arendonk at kvanarendonk@chw.org.

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See additional references on page 11.

Acute Mechanical Circulatory Support & Ex-



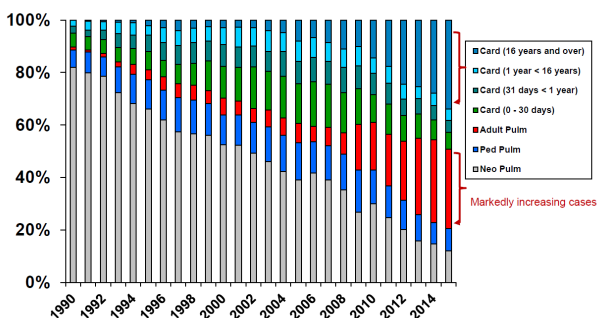
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 Associate Professor of Surgery
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 Director, Mechanical Circulatory
 Support & ECMO

We expanded and formalized the Medical College of Wisconsin Mechanical Circulatory Support & Extra Corporeal Membrane Oxygenation (MCS/ECMO) service in 2018, supporting the growing number of adult patients with cardiogenic shock and acute respiratory failure. The MCS/ECMO service is coordinated with a reorganized Cardiogenic Shock System, bringing together a multidisciplinary team in response to a “SHOCK” call for internal activation, in addition to supporting regional referring hospitals and clinics.

The cardiogenic shock activation process at Froedtert Hospital was initiated in 2017 to support patients with acute myocardial infarction and decompensated heart failure. Due to the success of the program, it expanded to include patients in cardiogenic shock and acute respiratory failure refractory to conventional medical management. Upon receiving a SHOCK page, a multidisciplinary team provides prompt, thorough evaluation for advanced care. The SHOCK team includes members of cardiovascular surgery, perfusion, interventional cardiology, advanced heart failure, critical care anesthesia, medical intensive care, and other specialists available as needed. The combination of a rapid referral process, along with expert evaluation and prompt coordination of transportation, has encouraged an expanding referral volume from regional hospitals and clinics.

ECMO began as a rescue mechanism for neonates and infants with self-limited respiratory illnesses or congenital heart disease. However, in recent years, there has been a shift toward both adult cardiac and pulmonary support. By 2016, adult ECMO was the fastest growing patient cohort, a trend that continues today. Patients at Froedtert & MCW have numerous treatment options for cardiac and pulmonary support to provide an individualized approach.² These include central or peripheral ECMO, in addition to right, left, or biventricular temporary mechanical cardiac support, which serve as a bridge to recovery, durable ventricular support, or transplantation.

Since the creation of

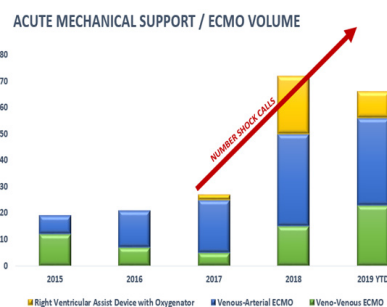


ELSO Registry International Report 2016, Adult ECMO Volumes



The Multidisciplinary ECMO / Mechanical Circulatory Support Team

our SHOCK system, we have demonstrated a consistent, exponential rise in the number of patients transferred to Froedtert & MCW. The ECMO volume at Froedtert & MCW



Froedtert and the Medical College of Wisconsin Institutional ECMO / Mechanical Circulatory Support Volume

has expanded nearly four fold since 2015, and was the leading center in the country utilizing a Protek Duo[®] (LivaNova PLC, London, UK) cannulation approach for right-ventricular support in 2018. We rank third in the nation for Impella[®]

(ABIOMED, Danvers, MA) temporary left-ventricular support, and recently pioneered a novel transcarotid approach for Impella 5.0[®] implantation and arterial access for ECMO. The program has taken an aggressive approach to treating patients that have traditionally been turned down for advanced MCS or ECMO support due to high-risk comorbidities such as trauma and pregnancy. Venovenous ECMO has also been used to support patients for complex-airway surgery. Despite treating these high risk patients, the program consistently ranks well above the Extracorporeal Life Support Organization (ELSO) national averages for survival with low morbidity.¹

Caring for the ECMO population, a complex and critical cohort of patients, is a labor-intensive effort requiring a multidisciplinary team. Under the direction of MCS/ECMO Director Lucian A. (Buck) Durham III, MD, PhD, we have built a core team which includes Director of the Heart and Vascular Service Line Kim Coubal, dedicated Mechanical Circulatory Support Advanced Practice Provider Angelia Espinal, and two RN ECMO Coordinators, Jennifer Guy and Cassie Seefeldt. ECMO patients are

tra Corporeal Membrane Oxygenation



Froedtert Hospital Simulation Center

medically managed in the Cardiovascular Intensive Care Unit in collaboration with Critical Care Anesthesia and a core group of MCS resource nurses who are highly trained in mechanical circulatory support. The program provides around the clock, in-house, perfusion coverage to support the MCS/ECMO patients.

To provide the highest level of quality care, our team continually works on cutting-edge treatments and care protocols for these critically ill patients. Our team designs and facilitates life-like ECMO patient scenarios which are run using our Eigen Flow 2[®] ECMO Simulator (Curtis Life Research, Indianapolis, IN) to practice skills, emergency situations, and team building in the Froedtert Hospital Simulation Center. The Simulation Center has the capability for the SimMan 3G, an advanced patient simulator, to sync with the Eigen Flow 2. Currently, we provide simulations for our multidisciplinary team, with the future goal of offering comprehensive ELSO-approved training courses to outside institutions.

Through our ECMO educational program, we have been able to expand our partnership with Flight for Life. The ECMO simulation training allows everyone to gain greater experience in caring for and transporting patients on ECMO. They provide resources for rotor, fixed-wing, and ground transportation of our patients. This partnership increases our outreach potential, but more importantly, gives patients an option for timely transfer to our program.

Our ECMO Program is the only adult program in the state designated as a Center on the Path to Excellence in Life Support by the ELSO, achieving the Silver Award in our first year of application. This designation recognizes centers that demonstrate an exceptional commitment to evidence-based processes and quality measures, staff training and continuing education, patient satisfaction, and ongoing clinical care.

FOR ADDITIONAL INFORMATION on this topic, visit mcw.edu/surgery or contact Dr. Lucian Durham at ldurham@mcw.edu.

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To refer a patient or request a transfer/consultation, please use the references below:

ADULT PATIENTS

All Non-cancer Requests

Referrals: 800-272-3666

Transfers/Consultations:
877-804-4700

mcw.edu/surgery

Clinical Cancer Center

Referrals: 866-680-0505

Transfers/Consultations:
877-804-4700

PEDIATRIC PATIENTS

Referrals/Transfers/

Consultations: 800-266-0366

Acute Care Surgery:
414-266-7858

Surgery Aiding Patients with a “Nonsurgical” Disease



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Myasthenia gravis (MG) is an autoimmune neurological disorder that primarily affects the motor neuron endplates. There are multiple autoimmune antibodies that cause MG. However, some patients have no detectable antibodies. Symptoms vary from only affecting the ocular muscles, known as ocular MG, to total respiratory collapse, known as a myasthenic crisis. Patients with symptoms between these extremes are described to have generalized MG. The Myasthenia Gravis Foundation of America (MGFA) created a classification of symptoms to give definitions to clinical researchers and clinicians.¹ Ocular myasthenia is Class I. A myasthenic crisis is Class V. Generalized patients — those with varying degrees of somatic involvement — make up Classes II-IV. The overall incidence of MG is estimated at 0.3 to 2.8 per 100,000, with a worldwide prevalence at 700,000.²

For many patients, the source of the antibodies is the thymus gland. For that reason, part of the workup for any new MG diagnosis is a CT or MRI of the chest. In most adults, the thymus should be involuted and not present; however, in patients with MG, up to 90% percent will have some thymic abnormality.³ A thymic mass, or a Thymoma, is found in 10%-20% of patients, and thymic hyperplasia, enlargement or persistent presence of the gland, is seen in 60%-70% of patients. It should be noted that not all people with a thymoma or hyperplasia will have MG.

The association between the thymus and MG was first described by Alfred Blalock in 1939.⁴ In 1941, Blalock published a case series, using both autopsies and clinical results from four patients who underwent thymectomy.⁵ Despite this, and many other case series describing improvement or resolution of MG with thymectomy, the mainstay of management of MG has been medical management.⁶ Prior to 2016, only patients with thymoma were recommended to undergo resection. Now, the American Academy of Neurology considers thymectomy for patients without thymoma as a Class II recommendation to increase the probability of improvement or remission.⁷

In 2016, a ground-breaking article about the role of surgery in the treatment and management of the MG was published in the *New England Journal of Medicine*.⁸ A large group of physicians, comprised of neurologists and surgeons (including members of our faculty here at MCW), contributed to the Thymectomy Trial in NonThymomatous Myasthenia Gravis Patients Receiving Prednisone Therapy (MGTX) Study Group. In this study, 126 patients were

randomized into two groups — one group received alternate day prednisone therapy to treat their MG, and the other received a transsternal thymectomy in addition to alternate-day prednisone. MGTX focused on adult patients with stable, medically treated MG with a duration of less than five years that did not have a thymoma. In the MGTX study, patients had to have more than ocular symptoms, Class I, but less than a crisis, or Class V. This was the first trial to ever directly compare thymectomy to nonsurgical management of MG. Patients were followed for three years. The results were overwhelming in support of thymectomy. Patients who underwent a thymectomy had a lower time-weighted average Quantitative Myasthenia Gravis score, lower average prednisone doses, less need for immunosuppression and had 30% less hospitalizations for exacerbations. As a result of these findings, thymectomy patients had fewer treatment-associated symptoms related to medications and lower distress levels related to symptoms. Following this study, the MGTX group reported a follow-up that showed continued improvement of patients up to five years.⁹

Since MGTX, more series have been produced, showing further advantages of thymectomy in MG. The use of minimally-invasive techniques, namely robotic approaches, have been proven to both be safe and effective in treating MG.^{10,11} Also, the earlier use of thymectomy in children and the elderly has been reported with positive results.¹²⁻¹⁴ Additionally, the use of thymectomy in patients with Class I symptoms suggest that even this population would benefit from early resection and can even block progression of more advanced classes of symptoms.^{15,16} This is especially significant since almost 85% of patients initially present with ocular myasthenia have a reported transformation rate as high as 80%.¹⁷

In light of these studies, the field of neurology is still hesitant to completely embrace the idea of thymectomy. The MGFA was more positive about surgery in its most recent update of treatment guidelines, but this came out just before the release of the MGTX.¹⁸ In a follow up from 2018, after MGTX was published, the same guideline contributors commented that further analysis would be needed to amend the consensus for the role of thymectomy.¹⁹ This is an area of contention between Neurologists and Thoracic Surgeons.^{20,21} At this point, there is no doubt that thymectomy is helpful for most patients with MG. Future research is needed to define just how many can benefit from surgery and the timing of intervention.

Currently, we offer any patient with a diagnosis MG a consultation. We most often offer a robotic thymectomy, sparing the patient from a sternotomy, with most patients typically staying only one night in the hospital. We, in the

Thymectomy for Patients Suffering from Myasthenia Gravis

section of Thoracic Surgery, along with the expertise of our excellent colleagues in Anesthesia, will continue to offer this to appropriate candidates and aid in the wider acceptance of role in thymectomy in this unique patient population.

FOR ADDITIONAL INFORMATION on this topic, see references, visit mcw.edu/surgery, or contact Dr. Paul Linsky at plinsky@mcw.edu.

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Aortic Stenosis Therapy at the Medical College



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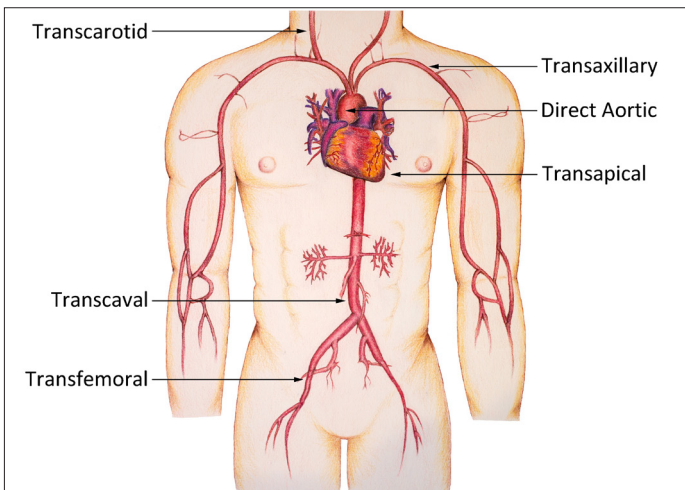
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Division of Cardiothoracic Surgery
Division of Cardiovascular Medicine
Director of Structural Heart Interventions

Few medications or operations have had as dramatic of an impact on human survival as surgical aortic valve replacement for aortic stenosis. Transcatheter aortic valve replacement (TAVR) has revolutionized the surgical treatment by allowing physicians to replace the aortic valve in a beating heart using minimally-invasive methods which do not require a large surgical incision or the use of cardiopulmonary bypass on the arrested heart.

Based upon data from the Partner Trial ¹, Partner II Trial ², and two-year preliminary data from the Partner III Trial, the Food and Drug Administration (FDA) and the Centers for Medicare and Medicaid (CMS) have expanded the availability of TAVR as a treatment option for all patients with severe, symptomatic aortic stenosis, irrespective of surgical risk ^{3, 4}. In the current era, the percutaneous transfemoral approach for TAVR has the lowest risk for mortality or any complication compared to all other therapies for aortic stenosis, whether surgical or transcatheter. Currently at the Medical College of Wisconsin, the percutaneous transfemoral approach is performed in over 95% of TAVR cases. Using directional pulsed intravascular lithotripsy, MCW physicians can transform extremely calcified ilio-femoral arteries (which

are generally not accessible for percutaneous access) into viable pathways for TAVR valve implantation. ⁵ The benefit of the percutaneous femoral approach is that patients can receive a new aortic valve without general anesthesia or a surgical incision. However, in about 5% of patients, the percutaneous femoral approach cannot be used because of small femoral artery size, untreatable severe peripheral vascular disease, an abdominal aortic aneurysm, or congenital anomalies such as aortic coarctation or fibromuscular dysplasia (FMD). In these patients, a non-transfemoral approach (termed “Alternative Access”) for TAVR is required.

At the Medical College of Wisconsin, we have utilized five different Alternative Access routes for TAVR, each with their own indications and challenges. Initially, as TAVR technology was evolving and TAVR valve delivery systems were large in diameter, placing the TAVR valve through a small apical incision in the left ventricle on the beating heart was the method of choice (termed “Transapical”). Transapical delivery is the most technically challenging Alternative Access approach because of the need to temporarily instrument the apex of the beating left ventricle. In addition, this approach may have a negative long-term impact on left ventricular function. However, in select patients, this is still the only viable access option. As technology has advanced and TAVR delivery systems decreased in size, other Alternative Access routes became possible. These include using a small anterior thoracotomy incision to deploy the TAVR valve directly through the ascending aorta (termed “Direct Aortic”), and the use of a small sub-clavicular incision and direct implantation through the axillary artery (termed “Trans-Axillary”). With favorable anatomy, the abdominal aorta can even be accessed by passing the TAVR delivery system from the inferior vena cava (via the right common femoral vein) into the descending abdominal aorta (termed “Transcaval”). The resulting tract between the abdominal aorta and inferior vena cava is secured with a vascular occlusion device. Dr. Michael Salinger in the MCW Division of Cardiothoracic Surgery is a national proctor for this innovative technique. However, most recently at the Medical College of Wisconsin, implanting the TAVR valve using the common carotid artery (termed “Transcarotid”) has become our Alternative Access method of choice. The Division of Cardiothoracic Surgery at the Medical College of Wisconsin has one of the largest patient series using the right common carotid artery as access for temporary, percutaneous left ventricular assist device implantation (Impella 5.0). ⁶ Based on excellent patient outcomes in this series, we hypothesize that the less invasive TAVR procedure using common carotid artery access should also yield excellent clinical outcomes for patients. Recent



Vascular Access Sites Used at Froedtert Hospital for placement of TAVR valves | Illustration by Carissa Aboubakare

of Wisconsin – All Roads Lead to TAVR

studies have demonstrated that the Transcatheter approach for TAVR has a lower complication rate compared to other commonly used alternative access routes.^{7, 8} The benefit of the Transcatheter approach is that the common carotid artery is easily accessible through a superficial skin incision. This incision is well-tolerated by patients and is associated with minimal morbidity post-operatively. In our own hands, even though general anesthesia is required for the procedure, Transcatheter length-of-stay closely mirrors the uncomplicated transfemoral approach where patients can quickly resume their regular activities of daily living.

At the Medical College of Wisconsin, we are committed to improving the safety and expanding the indications of transcatheter heart valve replacement. Froedtert Hospital was the first institution in Wisconsin to routinely use an embolic protection device to reduce the risk of stroke during the TAVR procedure.⁹ In addition, we are currently enrolling patients who have severe aortic stenosis without symptoms to see if early valve replacement can improve long-term outcomes (Early TAVR Trial¹⁰). We are also offering patients TAVR who have heart failure and decreased left ventricular function, but only moderate aortic stenosis to see if this can improve clinical outcomes and quality of life (TAVR Unload¹¹). For select patients (STS intermediate surgical risk), we are offering the option of receiving the next generation TAVR valve (Lotus Edge – Boston Scientific) as part of the Reprise IV Trial¹².

FOR ADDITIONAL INFORMATION on this topic, see references, visit mcw.edu/surgery, or contact Dr. Paul Pearson at ppearson@mcw.edu.

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Improving Research Capacity and Research



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PGY4

In 2014 I moved to work as a sub-intern and research associate for the general surgery team at Hôpital Universitaire Mirebalais, Haiti. Haiti shares an island with the Dominican Republic and is home to 11 million people. Due to a fragmented healthcare system, it has some of the worst health outcomes in the Caribbean. One in twelve children will die before the age of 5, 532 women die per 100,000 live births and the average Haitian life expectancy is 63.¹ These numbers are staggering when compared to the worldwide averages of 1 death in 26 children under the age of 5, 211 maternal deaths per 100,000 live births, and average life expectancy of 72.1. Given the varying degrees of surgical care offered in the country, we suspect the lack of access to safe, affordable, and timely surgical care contributes to the poor health outcomes across the nation of Haiti.

Currently, approximately 637 private and public health care facilities exist in Haiti, of which nearly 10 percent have some degree of surgical capacity.³ Although half the Haitian population resides in rural areas, a large number of facilities that offer surgical care are located in urban areas. The surgical workforce in Haiti is estimated at 5.9 surgeons per 100,000 people compared to 54.7 surgeons per 100,000 in the United States.² The need for surgical, anesthetic and obstetric providers was perhaps the most evident after the devastating earthquake in 2010. While

estimates vary, the earthquake claimed the lives of at least 160,000 people and collapsed 30,000 buildings in the capital city.⁴ To both decentralize the Haitian healthcare and increase the number of clinical providers in the country, the Haitian Ministry of Health and Partner's in Health, and Zamni Lasante built a tertiary teaching hospital; Hôpital Universitaire Mirebalais. In October 2013, Hôpital Universitaire Mirebalais (HUM) opened its doors and the

first class of general surgery, pediatric, and internal medicine residents began their intern year. Nine months later, I had moved to Haiti and was working with the first class of general surgery residents at HUM.

During their second year of residency, many residents at HUM wanted to answer questions about their clinical practice using research. Without substantial resources or experience, they began to ask me for help with projects or ideas. As we worked together on these projects, it became evident there was little formal training on clinical research in Haitian medical education. By the end of the year, HUM's surgical team had created a surgical research database. From this database, two Haitian residents completed preliminary research studies and presented their work at international conferences. The success of their research endeavors led to ongoing projects the following years. The relationships I established at HUM have resulted in a five-year partnership with Haitian surgeons and surgical residents interested in pursuing clinical research.

By 2019, these relationships have evolved to Dr. Dodgion and myself supporting a surgical research group in the Southern Peninsula of Haiti. This research group consists of three Haitian surgical attendings, two U.S General surgeons, and trainees from around the world. Twice a month the group meets via Skype to discuss current, ongoing, and future research projects. When able, members of the research group travel to Haiti to assist with data collection and project planning in real time. Our past work focused on exploring how increasing surgical capacity at a hospital in the Southern Peninsula affected case volume and outcomes. We found that investing in local surgical capacity by hiring full time Haitian surgeons and expanding the operating room facilities safely increased surgical volume.⁵ Currently, our research efforts are focused on examining barriers patients face when seeking surgical care in Haiti and the pediatric burden of surgical disease. Over the course of this partnership, our Haitian colleagues have presented their work at the American College of Surgeons and Academic Surgical Congress and our group continues to grow. Seeing our colleagues' passion throughout our partnership, we recognize that as we strengthen research capacity we must also advocate for research equity.

A majority (~80%) of total authors of indexed publications from research performed in Haiti over the last 50 years (about surgery, obstetrics, and anesthesia-SOA) have no Haitian affiliation. Furthermore, only one regularly published biomedical journal in surgery exists in Haiti. This highlights both the absence of research equity and the need for continued research capacity strengthening in the country. High-income country (HIC) authors are knowingly or unknowingly complicit with the global health trend of conducting parasitic research.⁷ This brand of research,



Dr. Deborah Jenny Robert and Dr. Alexis Bowder at the American College of Surgeons. Dr. Robert was the first female general surgery resident to graduate from the residency program at the Hôpital Universitaire Mirebalais.

Equity in Haiti



Members of the research team enjoying the chance to have a meeting in person at the American College of Surgeons. From left to right Dr. Michelson Padovany, Dr. Jacques Peterson Thosiac, Rolvix Patterson, Dr. Alexis Bowder, Dr. Luther Ward and Dr. Chris Dodgion.

while conducted on the local health care system, results in disproportionate professional benefit for foreign researchers.⁸ Beyond limiting the professional development of would-be Haitian researchers, foreign research priorities are frequently misaligned with the actual research needs in countries like Haiti. Thus, inequity in research can have the pernicious, if unintended, effect of hindering the development of the local health care system.⁹

There are solutions to this problem. For example, across five countries in sub-Saharan Africa, training programs have resulted in substantial gains in research capacity as evidenced by increases in publication volume and local authorship.^{10,11} However, concerted research capacity building programs in Haiti are in nascent stages, but there is a movement across the country to develop a national clinical research curriculum. In March of this year, I will be representing our research group at the first National Surgical Research Stakeholder meeting. Over one hundred representatives from academic institutions, non-governmental organizations, and civil societies will attend. The goal of the workshop is to develop an action plan for moving equitable clinical research forward and continue the development of a national clinical research curriculum for the country.

FOR ADDITIONAL INFORMATION on this topic, see references, visit mcw.edu/surgery, or contact Dr. Alexis Bowder at abowder@mcw.edu.

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Examining Current Patterns of Opioid Prescribing and Use After Bariatric Surgery

Jordanne Ford
MCW Student (Year 2)
Faculty Advisor: Dr. Jon Gould



Abdominal Trauma Superficial Surgical Site Infection (sSSI) Risk Score Validation

Stephanie Strong
MCW Student (Year 2)
Faculty Advisor: Dr. Chris Dodgion



Racial and Ethnic Variation in Prevalence of Human Papillomavirus Genotype in Anal Dysplasia

Tara Mather
MCW Student (Year 2)
Faculty Advisors: Drs. Carrie Peterson, Kirk Ludwig, & Timothy Ridolfi



Diversity of Germline Mutations Among Patients with Localized Pancreatic Cancer

Ashley Krepline, MD
MCW General Surgery Resident (PGY 3)
Faculty Advisors: Drs. Kathleen Christians, Ben George, William Hall, Douglas Evans, & Susan Tsai



Rates of Mental Health Disorders and Resilience in Mothers with Fetal Anomalies Using an Outpatient Screening Tool – A Pilot Study

Christina Bence, MD
MCW General Surgery Resident (PGY 4)
Faculty Advisors: Drs. Terri deRoos-Cassini & Amy Wagner



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G. Hossein Almassi, MD
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Paul J. Pearson, MD, PhD
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Dr. Thomas Carver and Dr. Jon Gould also received teaching pins from other departments; Dr. Carver for lecturing on Continuous Professional Development and Dr. Gould received for Clinical and Translational Research Pathway.



Thomas Carver, MD
Associate Professor
Division of Trauma & Acute Care Surgery



Jon Gould, MD
Alonzo P. Walker
Professor in General Surgery and Chief
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Surgery Residents



Jackie Blank, MD
PGY 4



Zoe Lake, MD
PGY 3

MCW Surgery In the News

Drs. Lyle and David Joyce were featured in a *USA Today* article titled, "In 1998, a surgeon sewed a new heart into a cowboy. Nearly 31 years later, he did it again." Check it out here: bit.ly/2T3IXkY

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MARK YOUR CALENDARS

- February 19: Aurora Pryor, MD, Ellison Visiting Professor**
- March 20: The Milwaukee Aortic Symposium**
- April 23 - 26: Society of Black Academic Surgeons Annual Meeting**
- May 13: Jean Starr, MD, Towne Visiting Professor**
- May 15-16: WISC 2.0 WISconsin Women in Surgery Conference**
- June 1: Amy Goldberg, MD, Lunda Visiting Professor**
- June 1 - 3: Midwest Regional Trauma & Acute Care Surgery Symposium**
- June 4 - 6: Central Surgical Association Annual Meeting**
- June 10: Mary Fallat, MD, Glicklich Visiting Professor**
- June 17: Mary Hawn, MD, MPH, Eberbach Visiting Professor**
- October 2-3: Edwin Ellison Surgical Society, MCW Alumni Reunion**
- October 23 - 24: Surgical Oncology Symposium**

Please contact Heidi Brittnacher (surgeryevents@mcw.edu) for more information on any of these events.

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