University of Maryland Medicine

FOR PHYSICIANS
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University of Maryland Medicine

ROUNDS

Clinical and Research Updates from the *University of Maryland School of Medicine* and the *University of Maryland Medical Center*

In this ISSUE

UMCH Ranked in Top 50 Nationwide for Pediatric Cardiology and Heart Surgery

The Children's Heart Program at the University of Maryland Children's Hospital (UMCH) was ranked this year for the first time among the nation's top 50 pediatric cardiology and heart surgery centers, according to the 2018-2019 edition of *U.S. News & World Report* Best Children's Hospitals.

"The Children's Heart Program is something special," says **Steven J. Czinn,** MD, the Drs. Rouben and Violet Jiji Professor in Pediatrics, chair of the Department of Pediatrics at the University of Maryland School of Medicine (UMSOM) and director of UMCH. "Receiving a national ranking from *U.S. News & World Report* solidifies what we've known for years — that our team provides the very best care for children with heart conditions. The recognition helps spread the word that we can help children with heart conditions in Maryland and around the nation."

"For patients and their families, the ranking is a stamp of quality that we are among the very best programs in the world," says **Geoffrey L. Rosenthal,** MD, PhD, professor of pediatrics at the UMSOM and director of the Pediatric and Congenital Heart Program at UMCH.

"Most children's heart programs are not ranked at all," Dr. Rosenthal says. "This ranking demonstrates excellence across the entire University of Maryland team

> *"This ranking demonstrates excellence across the entire University of Maryland team caring for children with serious and life-threatening illnesses. "*

caring for children with serious and life-threatening illnesses. The process is rigorous, looking at how well we score on a number of quality measures, and checking our participation in efforts to make care even better."

CLINICAL TRIAL FOR STEM-CELL THERAPY

Infants born with a rare heart defect called hypoplastic left heart syndrome (HLHS), for unknown reasons, have an underdeveloped or missing left ventricle, which is the heart's main pumping chamber. This defect causes the right ventricle to take on the extra workload and pump harder. Infants need heart surgery right after they are born and at least two more times as toddlers.

Sunjay Kaushal, MD, PhD, professor of surgery at the UMSOM and director of pediatric and adult congenital surgery at UMMC, is currently leading research on pediatric patients with HLHS to determine whether stem cells injected into the infants' hearts during the corrective surgeries will strengthen their hearts, delaying the need for a heart transplant.

Dr. Kaushal and Dr. Rosenthal are co-directors of the Children's Heart Program at UMCH.

COVER: Dr. Rosenthal examines an infant girl born with HLHS.
BELOW: Dr. Kaushal leads research exploring whether stem cell injections can further strengthen the hearts of infants born with HLHS.

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Children's Heart Program Expands to Southern Maryland

Obtaining first-rate health care for children with heart disorders recently became easier for families who live in Southern Maryland. They can now receive care close to home, thanks to **Deneen Heath,** MD, assistant professor of pediatrics at the University of Maryland School of Medicine (UMSOM). Dr. Heath, who joined the faculty in 2018, expanded the UM Children's Heart Program (CHP) to Bowie and Waldorf. CHP is part of the University of Maryland Children's Hospital (UMCH) at the University of Maryland Medical Center (UMMC).

"Pediatricians and patients were so excited that we had opened there," says Dr. Heath, who has begun reaching out to referring physicians in the Washington, DC, metropolitan and suburban areas to let parents of patients know they can schedule pediatric cardiology visits closer to their homes.

Also during 2018, UMCH was ranked for the first time among the nation's top 50 pediatric cardiology and heart surgery centers, according to the 2018-2019 edition of *U.S. News & World Report* Best Children's Hospitals. *(See page 1)*

BELOW: Dr. Heath checks the progress of an infant born with a congenital heart defect.

IN THE TRENCHES

A pediatric cardiologist, Dr. Heath specializes in pediatric and fetal imaging, as well as cardiomyopathy and heart transplants. She sees patients in Bowie, Waldorf and Baltimore.

The New York native first came to Washington, DC, for a pediatric residency at Georgetown University Medical Center. Subsequently, she moved to Texas Children's Hospital, where she spent three years learning general pediatric cardiology. She accepted the hospital's invitation to join the cardiomyopathy transplant team and then remained at the hospital for a fellowship in imaging and fetal echocardiography.

After returning to Washington, she worked as an attending physician for several years but longed to build clinical programs. Given her experience building a fetal heart program and a heart-failure cardiomyopathy program, among other projects, UMSOM and UMMC recruited her to expand CHP.

"I enjoy being in the trenches of a growing program and helping to lead that growth," she says. At the time, she viewed CHP as small and underappreciated, even as its cardiologists' work met or surpassed the quality seen at larger centers.

NO NEED TO SETTLE

From the start, Dr. Heath saw many strengths in CHP – strengths that also led to this year's ranking in the top 50 nationwide. She praises not only the cardiologists, but also the nurse practitioners in the Pediatric Intensive Care Unit, who she says elevate care by really getting to know patients and enhancing the continuity of care. She also lauds the sonographers in the program, recognized by the Intersocietal Accreditation Commission for quality in transthoracic, transesophageal and fetal echocardiography. Moreover, she

KEY POINTS

- The Children's Heart Program at the University of Maryland Children's Hospital was ranked for the first time this year among the nation's top 50 pediatric cardiology and heart surgery centers, according to the 2018-2019 edition of *U.S. News & World Report* Best Children's Hospitals.
- New practice locations in Bowie and Waldorf enable patients to receive pediatric and fetal cardiology services from UM Children's Heart Program without traveling to Baltimore.
- Pediatric cardiologist Deneen Heath, MD, who recently joined University of Maryland School of Medicine, specializes in imaging, cardiomyopathy and pediatric heart transplant patients.
- In Bowie, Waldorf and Baltimore, Dr. Heath assesses and treats young patients who have congenital heart disease, cardiomyopathy, chest pain, heart murmurs, syncope and other cardiac conditions.
- A new UM Children's Hospital program in Baltimore intervenes early to lessen cardiomyopathy caused by anthracycline chemotherapy received in childhood.
- Most centers send newborns with congenital heart disease who need urgent treatment after birth to another facility, but UMMC treats mother and baby together.
- The Children's Cardiomyopathy Foundation recognized UMMC for providing excellent care.

values the cross-disciplinary collaboration helping to lead that growth.

"While everyone has a role, in some places, those roles become isolated. At Maryland, you definitely get the sense that there's a team approach to each patient," she says.

Excellent patient outcomes also played a big role in luring her to the University of Maryland Medical System (UMMS), the umbrella organization that includes two large medical centers near Dr. Heath's practice sites – UM Prince George's Medical Center in Cheverly (part of UM Capital Region Health) and UM Charles Regional Medical Center in LaPlata.

"I've had the good fortune of practicing at great institutions with great outcomes for most of my career," she explains, and she's unwilling to settle for less.

Her love for patients with cardiomyopathy also influenced her decision.

"A transplant is a great option if that's your only option, but my driving force over the past 10 years has been to figure out how to improve our patients' own heart function so they don't have to have a heart transplant, or if they do need it, to delay it for several years or decades," Dr. Heath says. When she heard that **Sunjay Kaushal,** MD, PhD, professor of surgery at UMSOM, was studying whether stem cells could improve hypoplastic left heart syndrome, she was intrigued. *(See page 2)*

Dr. Heath also likes UMCH's family-friendly approach to newborns diagnosed with congenital heart disease who need care immediately after birth. Some centers put these newborns on a flight to another facility. However, because many of the pregnant mothers also are cared for in the University of Maryland Center for Advanced Fetal Care, both mother and the baby can have coordinated care by UM physicians in the same hospital. *(See page 9)*

"We can care for the mom and the baby in the same place, and she doesn't have to be separated from her newborn," says Dr. Heath. Kept together, mother and baby can bond normally and later return to their neighborhood clinic for follow-up.

This dovetails with Dr. Heath's final reason for coming to UM. She needed a workplace that supports her main goal: to provide compassionate care.

"I found that at Maryland," she says.

CONVENIENT ACCESS

In that spirit, the state-of-the-art clinics in Bowie and Waldorf enhance timely access to a wide range of services for patients who live in Southern Maryland and the Washington suburbs. Patients can receive evaluation and treatment for all kinds of congenital heart disease, as well as screening for syncope, innocent murmurs, cardiomyopathy or chest pain. Without going far, pregnant women can obtain fetal echocardiograms and fetal cardiac counseling.

Families in these regions appreciate not having to travel to Baltimore or Washington, DC, for sub-specialty experts in pediatric cardiology. For some, that goes beyond convenience.

The clinics, in spacious, nonhospital settings, offer welcoming waiting areas and friendly front-desk staff.

"I've received great feedback from patients and their families; they love going there," Dr. Heath says.

"While everyone has a role, in some places, those roles become isolated. At Maryland, you definitely get the sense that there's a team approach to each patient," Dr. Heath says.

NEW HEART TOXICITY CLINIC

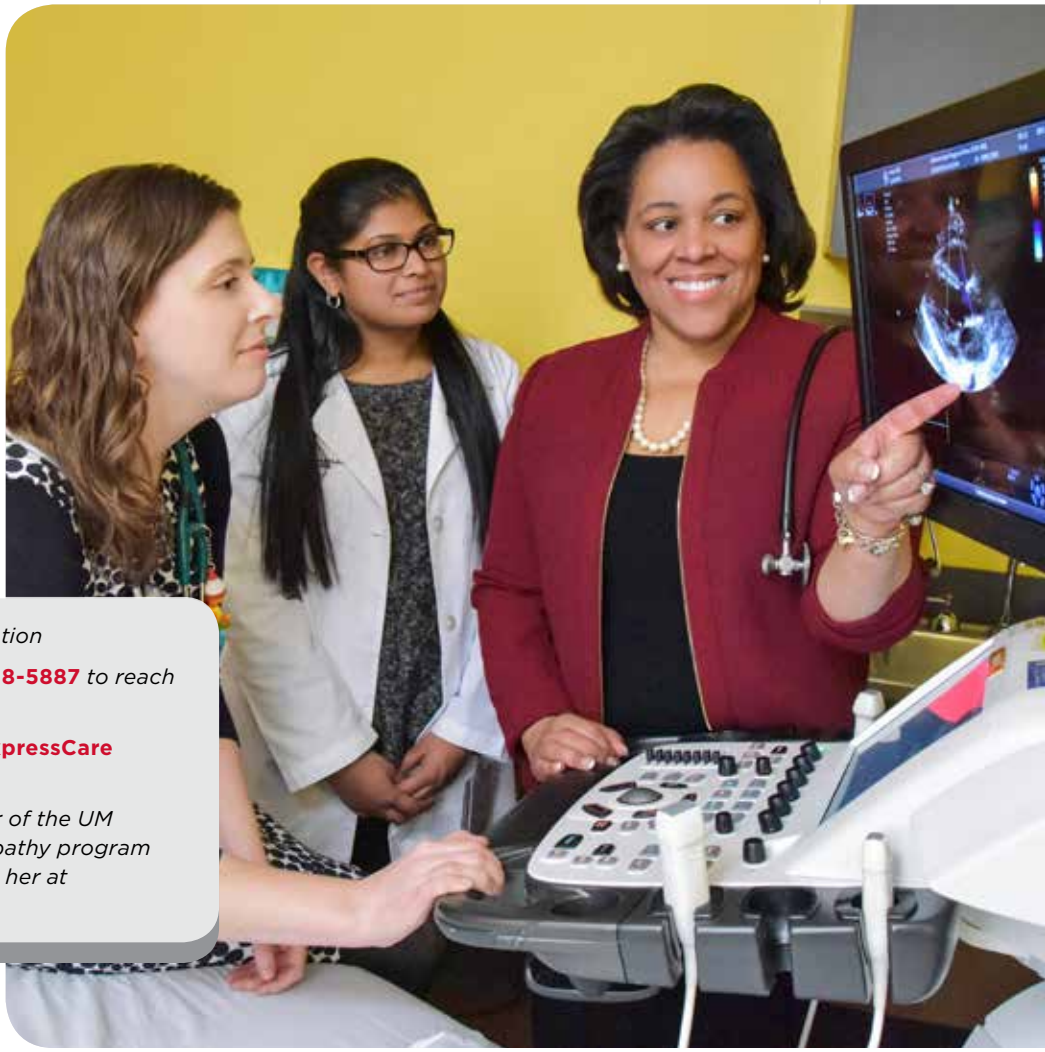
Ever the program-builder, Dr. Heath opened a cardiomyopathy-oncology follow-up clinic in Baltimore for patients at risk of heart damage from chemotherapy received in childhood. More than a third of children treated with high-dose anthracycline develop cardiomyopathy up to 10 years later.

"If we do early detection and treatment, we can cut that number in half," she says.

Now, more people are becoming aware of CHP's strengths. For example, in September, the Children's Cardiomyopathy Foundation recognized UMMC for providing first-rate care.

"What separates us from some of the other big programs in the country is that we are a premier program, but with personal care," Dr. Heath says.

> ***"What separates us from some of the other big programs in the country is that we are a premier program, but with personal care."***



Dr. Heath (right), consults with fellow cardiologist Alicia Chaves, MD, (left) assistant professor of pediatrics at UMSOM, regarding the sonogram of a young patient, while Moli Karsalia, a medical student at UMSOM, observes.

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To reach Deneen Heath, MD, *director of the UM Children's Heart Program cardiomyopathy program for the National Capital Region, email her at* **dheath@som.umaryland.edu**

Only at UMGCCC: GammaPod Offers Stereotactic Radiotherapy for Early-Stage Breast Cancer

A stereotactic radiotherapy device developed specifically to treat early-stage breast cancer is making its worldwide debut at the University of Maryland Marlene and Stewart Greenebaum Comprehensive Cancer Center (UMGCCC) in Baltimore. The GammaPod aims high doses of external beam radiation at the tumor site with state-of-the-art precision that spares healthy tissue. Compared to other forms of partial breast irradiation, this new approach has the advantage of being noninvasive and faster: Treatment takes days, not weeks.

"With this breast-specific treatment system, we deliver high-dose radiation to a tumor while minimizing damage to normal breast tissue and—even more importantly—to major organs such as the heart and lungs," says **William F. Regine,** MD, FACR, FACRO, the Isadore and Fannie Schneider Foxman Chair and professor of radiation oncology at the University of Maryland School of Medicine (UMSOM). GammaPod was invented by Dr. Regine and colleague **Cedric Yu,** DSc, FAAPM, the Carl M. Mansfield, MD, Professor in Radiation Oncology at UMSOM. Dr. Yu has invented several radiation technologies for treating cancer, including intensity-modulated arc therapy, used daily around the world.

GAMMAPOD DEVELOPED AT UMGCCC

Developing the GammaPod took about 10 years. It started when Dr. Regine, now chief of radiation oncology at UMGCCC, questioned whether one of his post-lumpectomy patients, who was undergoing standard partial-breast radiation, needed to have so much exposure of surrounding normal breast tissue to excess radiation, given the small size of her tumor. Concerned that many women might be receiving more treatment than necessary, he started talking with Dr. Yu.

The professors hoped to harness technology used elsewhere in the body to improve care for early-stage breast cancer. Studies show that, for certain patients, stereotactic body radiation therapy (SBRT) prevents tumor recurrence as effectively as more traditional approaches that require several weeks of daily irradiation. SBRT has long been used to treat tumors of the lung and liver, and even to treat breast cancer metastases, but not within the breast.

That changed when Dr. Regine and Dr. Yu invented the GammaPod. Subsequently, Dr. Yu founded, and now serves as chief executive officer of, Xcision Medical Systems, LLC, which makes the device.

CREATED FOR BREAST CANCER PATIENTS

One of the things that makes the GammaPod special is that it was designed completely around the treatment of breast cancer, says **Elizabeth Nichols,** MD, assistant professor of radiation oncology and clinical director of the UMSOM Department of Radiation Oncology.

"One of the guiding principles behind stereotactic radiosurgery is that we need to know exactly where our target is at all times," Dr. Nichols says. However, breast tissue moves as patients breathe, and large, pendulous breasts might lie differently from one day to the next.

"Part of the reason the GammaPod technology came about and can be successful is that it offers an immobilization device, or a way to fixate the breast so that it doesn't move while we're delivering treatment," says Dr. Nichols.

The GammaPod achieves that with an integrated breast-cup system, consisting of a custom-fitted inner cup, a rigid outer cup, and a silicone flange. The flange connects the two cups and adheres to the skin. A fiducial wire sends coordinates to a computer so it can map the breast. Vacuum pressure pulls the breast into the inner cup and holds it in place.

Cedric Yu, DSc, FAAPM

William F. Regine, MD, FACR, FACRO

"It's not painful," Dr. Nichols says. She tells patients the device applies less pressure than commercial breast pumps.

To keep the heart and lungs away from the gamma rays, the device treats

GAMMAPOD OFFERS STEREOTACTIC RADIOTHERAPY

patients in the prone position. Gravity separates the breast from the chest wall.

On treatment day, patients stand against the GammaPod table wearing the breast cup, which locks into a hole in the device. The table rotates them into a prone position, and a separate computed tomography machine scans the breast. It sends images to the GammaPod treatment-planning system, which uses computational geometry to chart a path that covers the target while avoiding healthy tissue. Once the radiation oncologist finalizes the treatment plan, patients return to the GammaPod, which positions them for treatment.

SAME RADIATION, BUT BETTER AIM AND FEWER SESSIONS

The GammaPod delivers the same effective radiation dose as conventional treatment, but in fewer sessions at a higher dose per session.

"It's the same radiation that we've always given, but it's delivered in a more focused way," says Dr. Nichols. During treatment, 25 rotating sources of cobalt radiation form a limitless number of arcs, all converging within the breast at the planned target.

"We don't see the 'hot spots' that we typically see with whole breast radiation, or even with other forms of partial breast radiation," Dr. Nichols says. "The dose is more uniform throughout the whole target."

BELOW: Dr. Nichols cares for many of the breast cancer patients who will benefit from GammaPod.

KEY POINTS

- Two UMSOM professors invented and developed the first stereotactic radiotherapy system optimized for early-stage breast cancer. GammaPod received US Food and Drug Administration clearance in 2017.
- The new GammaPod delivers higher doses of the same, effective radiation typically used for breast cancer, but focuses it with greater precision on the planned treatment site.
- Many patients need only one to five of the noninvasive treatments, an advantage over other forms of partial breast irradiation.
- Prone positioning of patients and a breast immobilization unit help the gamma rays reach their target, while protecting healthy breast tissue and nearby organs.
- Currently, only UMGCCC offers GammaPod treatment, although other hospitals will follow.

GOOD EARLY OUTCOMES

The GammaPod received US Food and Drug Administration clearance in 2017, based on findings from a clinical trial conducted at the UMGCCC. Dr. Nichols, a lead investigator in that trial, said radiation devices go through a different process than do chemotherapy drugs.

The study enrolled 17 patients, age 60 and over, who had undergone lumpectomy for stage 1 or 2 breast cancer. Study personnel were able to fit 15 of them with the immobilization unit. Those patients received one boost to the tumor bed from the GammaPod before receiving their regular whole-breast radiation.

"What that trial showed is that the device is safe and feasible to use," says Dr. Nichols. Furthermore, a survey found patients to be highly satisfied with GammaPod treatment.

"One of the biggest things that patients really appreciated was the fact that it was shortening the overall treatment course," she says.

"Women undergoing traditional radiation typically need 16 to 35 sessions," says Dr. Yu. "The GammaPod has the potential to significantly shorten the treatment time to a few sessions or possibly even one treatment, saving patients time and saving health care dollars."

Dr. Nichols notes that all of the preclinical studies that compared GammaPod radiation plans to other radiation plans deemed the GammaPod better for delivering radiation to the

> ***"If we're using the same type of radiation, we have no reason to think that local control should be different than with our other therapies," Dr. Nichols says. Furthermore, in studies, partial breast radiation compares favorably with whole breast radiation for preventing recurrence.***

target and not to the remaining normal breast tissue, heart and lungs. Moreover, the device dispenses much less radiation to the skin than brachytherapy does.

Researchers have not yet determined how well the GammaPod controls local recurrence.

"If we're using the same type of radiation, we have no reason to think that local control should be different than with our other therapies," Dr. Nichols says. Furthermore, in studies, partial breast radiation compares favorably with whole breast radiation for preventing recurrence.

BENEFICIAL EFFECT ON QUALITY OF LIFE

Dr. Nichols does not expect the GammaPod to improve the already high survival rate for early-stage breast cancer, but it should enhance patients' quality of life in multiple ways. First, it may lessen fatigue and skin reactions. Second, fewer treatments means less time off from work and other activities, reducing stress for patients. Third, because some women choose mastectomy to avoid disruptive daily radiation treatments, the shorter course of GammaPod care offers an important option that might help them keep their breast.

While UMGCCC is the first to offer this treatment, three other hospitals in the United States and Canada plan to offer it in the near future. Meanwhile, UMSOM has launched the GammaPod Consortium, a group of institutions, chaired by Dr. Nichols, that will collaborate on GammaPod research.

A TARGETED APPROACH FOR THE RIGHT PATIENTS

"The GammaPod is not going to be the right treatment for all breast cancer patients," says Dr. Nichols. It cannot replace whole breast radiation, nor can it help everyone who qualifies for partial breast radiation.

According to Dr. Nichols, women who have a single tumor less than about 3 centimeters in size are eligible for GammaPod treatment. The device might not fit those with very small or very large breasts, although Xcision wants to add cup sizes. Women who are extremely obese or who cannot lie comfortably on their bellies cannot undergo GammaPod treatment.

PARTNERING WITH REFERRING PHYSICIANS

Patients who want to receive GammaPod treatment need not give up their primary breast-health team.

"We want to develop great partnerships with our referring physicians, and we're happy to work with them as part of their team," says Dr. Nichols.

Whether the GammaPod will transform care for early-stage breast cancer remains to be seen, but early results bode well.

"I've been involved in this project for years and years. To finally see it come to fruition gives all of us a big sense of accomplishment and excitement, too. I think this is going to be a great therapy for a lot of women," Dr. Nichols says.

To read more, including a video showing GammaPod in use, as well as published clinical and research trials, visit our page for physicians: umgccc.org/GammaPodMD

BELOW: Patients lie in prone position on the GammaPod, allowing gravity to separate the breast from the chest wall.

Advanced Fetal Therapy Rescues Imperiled Pregnancies

At the University of Maryland Center for Advanced Fetal Care, having a healthy baby starts with expert screening to diagnose problems in time to prevent irreparable harm to the fetus. Specialists then target treatable fetal anomalies with advanced remedies, including some that are not widely available.

The center offers fetal therapy, a fetal heart program and genetic counseling. Fetal therapy treats conditions that endanger unborn babies. **Ozhan M. Turan,** MD, PhD, FACOG, associate professor of obstetrics, gynecology and reproductive sciences, says fetal therapy sometimes involves giving the mother medicine, which reaches her fetus through the placenta. Other examples include transfusing an anemic fetus with blood and performing surgery on either the fetus or placenta.

Dr. Turan, who directs the Program in Fetal Therapy and Complex Obstetric Surgery, says back in the 1970s, doctors were more likely to treat fetal abnormalities by opening the mother's belly and uterus, operating on the fetus, and placing it back inside the mother. Now, minimally invasive procedures such as fetoscopy extend treatment to more patients, with fewer risks.

"Now we are actually able to identify patients who are at risk for any problems, and we have tools to fix them with fairly low complication rates," Dr. Turan says. Some of the most common conditions diagnosed and treated at the center include twin-to-twin transfusion syndrome, lower urinary tract blockage, and fetal anemia.

TWIN-TO-TWIN TRANSFUSION SYNDROME

When the womb holds twins, the risk of problems rises. It goes up even more for identical twins who share a chorion, the outermost membrane around the fetus.

For example, twin-to-twin transfusion syndrome (TTTS) affects about 1 in 10 monochorionic pregnancies. In TTTS, connected blood vessels carry blood from one fetus, called the donor, to the recipient twin, leaving the donor with too little blood and the recipient with a glut. Left untreated, at least 7 out of 10 fetuses with this condition will die before or during childbirth.

"It's very important to identify twin-to-twin transfusion syndrome as early as possible," Dr. Turan explains.

The University of Maryland Medical Center (UMMC) is one of a select group of sites nationwide that treat TTTS with fetoscopic laser therapy, the standard of care. Delivered via a tube with a small camera, a laser beam breaks the ties between blood vessels and halts the errant blood flow.

With that approach, Dr. Turan says, the center has seen both twins survive in about 70 percent of cases of TTTS, and at least one twin survive in 90 percent of cases.

Some TTTS cases prove even trickier. In a condition called proximate cord insertion, the twins' umbilical cords lie close together. Some centers and publications have declared treating this problem futile and recommend ending the pregnancy. However, Dr. Turan has developed a way to successfully treat such cases without complications.

TINY BLADDERS BLOCKED

In rare cases, a blockage in the lower urinary tract traps urine inside the fetus, decreasing the amniotic fluid in which the baby floats. That derails lung development.

"When the mother pushes out the baby, there is no developed lung; with the first breath, the baby will die," Dr. Turan notes. The center can implant a fetal bladder shunt, enabling urine to flow into the amniotic sac as it should.

Ozhan M. Turan, MD, PhD, FACOG

While shunts may boost the chance of a live birth, a randomized trial found that they do not prevent kidney damage. The newborn still will need dialysis and a kidney transplant.

Nevertheless, "we have cases in which these children are 5 or 6 years old, and they're all doing fine following a kidney transplant," Dr. Turan says.

FETAL ANEMIA

The Rho(D) immune globulin has prevented many cases of fetal anemia, which typically arises when the mother develops antibodies to specific antigens, such as Rh factor, on fetal red blood cells. Fetal anemia may also occur when the mother becomes infected, such as with parvovirus.

Whatever the cause, it carries big risks. The lack of oxygen-carrying red blood cells prompts the heart to pump more blood. That may cause it to enlarge or even fail. Blood transfusions, however, can keep the baby alive.

"If this is because of antibody, we need to continue treating the baby until birth; sometimes we give 10 transfusions,"

Dr. Turan says. In contrast, just one transfusion may fix anemia caused by infection.

OTHER CONDITIONS

"We do lots of transplacental drug treatment to treat abnormal fetal heart rate," says Dr. Turan. For instance, the team diagnosed long QT syndrome in a 27-week-old fetus with an irregular heartbeat. To treat it, they gave the mother multiple antiarrhythmic agents. After birth, the newborn received a pacemaker and a defibrillator.

When an airway problem threatens the baby's ability to breathe independently, UMMC specialists can perform ex utero-intrapartum treatment. In a special cesarean section, they deliver the baby's head, while the body remains attached to the placenta. The pediatric anesthesiologist then intubates the baby, creating a working airway before the umbilical cord is cut.

"That way, if the baby has a compromised airway, we have a much better chance of intervening," Dr. Turan says.

Kimberly Monagle, RDMS, fetal ultrasound coordinator, with a patient.

LONGSTANDING EXPERIENCE

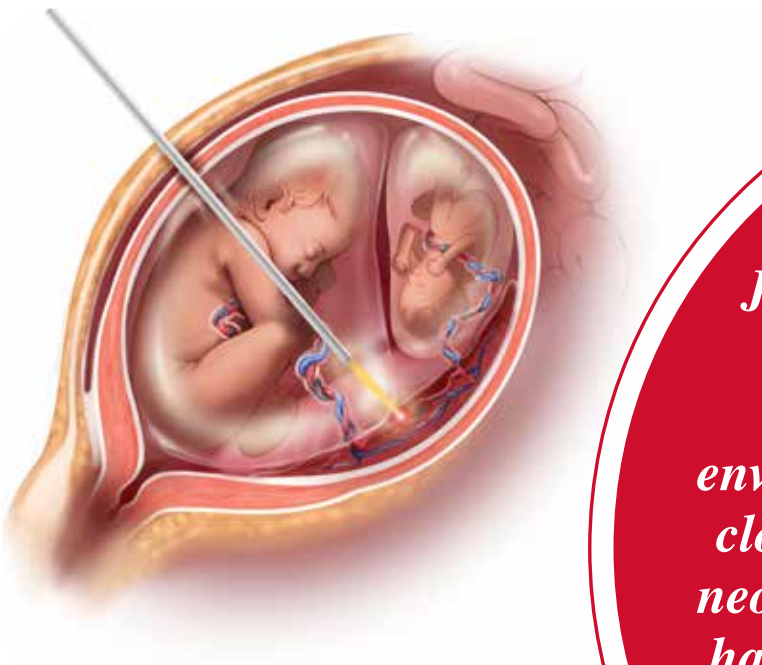
UMMC's fetal therapy program began in 2007. Dr. Turan considers his team's experience in fetal therapy and neonatology one of its prime strengths.

"We've been doing these things a long time," he says.

Dr. Turan certainly has. He left Istanbul for a fetal medicine fellowship at King's College Hospital in London. There, he trained with professor Kypros Nicolaides, MD, a co-inventor of fetal laser therapy. After conducting research at Yale University, Dr. Turan came to University of Maryland Medical Center, where he repeated his residency and fellowship before joining the faculty.

He praises his team,

An illustration depicts intrauterine intervention with fetoscopic laser therapy to correct the errant flow of blood in twin-to-twin transfusion syndrome.



The Level IV Drs. Rouben and Violet Jiji NICU at the UM Children's Hospital was built in 2016 and designed to emulate the environment in a mother's womb as closely as possible. Research from neonatology faculty at the UMSOM has shown that lighting and sound levels matter for neonates, many of whom are struggling to survive.

"We'll schedule immediately, probably same day or next day," says Dr. Turan. They try to schedule all of each patient's consults for the same day, so she can see all relevant specialists in one trip.

including sonographers trained to identify pregnancy-related problems, and designated surgical nurses who perform procedures with him at any time, day or night. Every newborn fetal therapy patient goes to what Dr. Turan calls the "wonderful" family-centered neonatal intensive care unit (NICU). Case managers and chaplains help patients through ups and downs, and the clinical staff includes highly experienced and board-certified nurses, nurse practitioners, respiratory therapists, pharmacists and dietitians.

In fact, the Level IV Drs. Rouben and Violet Jiji NICU at the UM Children's Hospital was built in 2016 and designed to emulate the environment in a mother's womb as closely as possible. Research from neonatology faculty at the UMSOM has shown that lighting and sound levels matter for neonates, many of whom are struggling to survive.

SPECIALIZED CARE FOSTERS HEALTHIER BABIES

"The experience of sonographer and physician is the most important element for early, accurate diagnosis," Dr. Turan explains. Therefore, he urges general practices in obstetrics and gynecology that use radiology scanning centers to refer all monochorionic twins to a fetal therapy center. In addition, all TTTS cases require immediate referral.

"We'll schedule immediately, probably same day or next day," says Dr. Turan. They try to schedule all of each patient's consults for the same day, so she can see all relevant specialists in one trip.

Center specialists co-manage cases with outside doctors. They deliver the baby only when medically necessary.

Either way, "it's a rewarding experience for us," Dr. Turan says.

KEY POINTS

- Fetal therapy modalities include medicating the mother and, hence, the baby, transfusing the fetus with blood, and performing fetal surgery.
- UMMC provides the most advanced forms of fetal therapy, including treatments available at only a few centers nationwide.
- Early detection and treatment of fetal anomalies help prevent lasting harm to the fetus and optimize outcomes.
- Identical twins, more prone to complications than fraternal twins or singletons, need extra screenings to detect treatable disease.
- UMMC can successfully treat twin-to-twin transfusion syndrome using fetoscopic laser surgery.

Clinical and administrative staff at the Center for Advanced Fetal Care

To refer a patient, physicians may phone the coordinator nurse for fetal therapy at **410-328-3865.**

Hyperbaric Chamber Team Studies Traumatic Brain Injury Patients at Shock Trauma Center

In the spacious and versatile hyperbaric chamber at University of Maryland Medical Center (UMMC), as many as 23 patients at a time share the oxygen-rich environment that hastens recovery from surgical wounds, skin ulcers, soft-tissue infections, decompression sickness or radiation injuries. One of the best and largest such chambers in the country, it is now involved in clinical trials to evaluate the effectiveness of hyperbaric medicine for the treatment of traumatic brain injury (TBI).

The Center for Hyperbaric and Dive Medicine at the R Adams Cowley Shock Trauma Center is a crucial participant in the Hyperbaric Oxygen Brain Injury Treatment Trial (HOBIT). HOBIT is a multicenter nationwide trial funded by the National Institutes of Health and designed to examine the role of hyperbaric oxygen therapy (HBOT) in the treatment of patients suffering severe traumatic brain injury.

While normal room air is 21% oxygen, patients inside the hyperbaric chamber breathe 100% oxygen. HBOT medicine – long used to treat decompression illness in divers and external wounds — is gaining momentum in the treatment of traumatic brain injury. A Department of Defense-funded clinical trial recently found encouraging results in the use of HBOT on mild traumatic brain injury, specifically in treating concussion in soldiers. The HOBIT trial is aimed at more severe cases. UMMC is among 14 participating institutions around the country capable of providing the level of critical care to safely treat these patients in the hyperbaric environment.

Enrollment in the HOBIT trial began in November. The principal investigators for UMMC's contribution to the HOBIT study are **Kinjal Sethuraman,** MD, MPH, and **WanTsu Wendy Chang,** MD, both assistant professors of emergency medicine at the University of Maryland School of Medicine (UMSOM). Dr. Sethuraman also is associate director of hyperbaric medicine at Shock Trauma.

The HOBIT study will investigate different doses of HBO, in addition to standard care, for victims of traumatic brain injury.

"Hyperbarics, I think, is medicine's best-kept secret," Dr. Sethuraman says. "We need to do more to teach our colleagues about the many uses of HBO treatments available to their patients."

Robert Rosenthal, MD, professor of emergency medicine and anesthesiology at UMSOM and director of hyperbaric medicine at Shock Trauma, lauds UMMC's ongoing commitment to his field and team, which in turn has made the hyperbarics program ready for HOBIT.

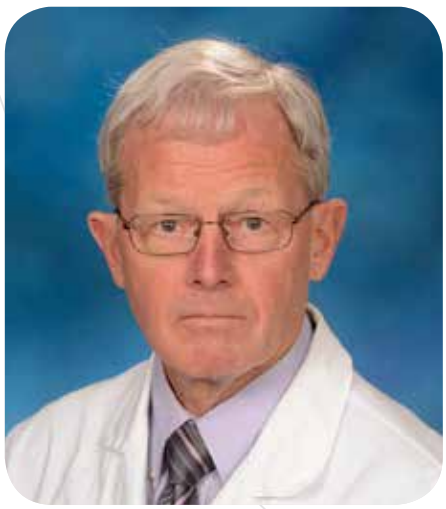
"Virtually everything we have over in Shock Trauma is chamber-compatible, and that is not easy to do," Dr. Rosenthal says. "Our pumps, our monitors can go straight from bedside into the chamber." Hyperbaric medicine's full integration with Shock Trauma provides for a robust environment beneficial to the variety of patients necessarily delivered to its door.

"We take pride in being able to treat patients other places can't treat," Dr. Rosenthal says, "and being able to provide care to those who need our services the most. "

UNIQUE POSITION TO INVESTIGATE HBOT POTENTIAL

UMMC's multiplace hyperbaric chamber can treat up to 23 patients simultaneously, and its integration into Shock Trauma allows for 24/7 emergent care, in addition to the non-emergent treatment of chronic illness. There is arguably no chamber in the country better situated to promote the ongoing research necessary to fully understand hyperbaric oxygenation across its existing and potential indications.

Kinjal Sethuraman, MD, MPH



Stephen R. Thom, MD, PhD

The Center for Hyperbaric and Dive Medicine holds a staff of five physicians, five respiratory therapists and a team of critical care nurses formally trained in hyperbarics. In May, the hospital hosted the International ATMO 40-hour Primary Hyperbaric Medicine Course at UMMC's chamber. International ATMO is a leading provider of hyperbaric medicine and wound care services and professional education.

CO POISONING VICTIMS TREATED

This kind of readiness proved to be particularly beneficial in July when 12 construction workers were rushed to Shock Trauma for carbon monoxide poisoning due to a leak at a bank worksite. Carbon monoxide (CO) poisoning is one of the primary emergency indications for hyperbaric treatment. Hyperbaric oxygen treatment has been shown to prevent many of the long-term effects of CO poisoning. The hyperbaric chamber at the R Adams Cowley Shock Trauma Center is the receiving facility for victims of carbon monoxide poisoning for the state of Maryland as well as surrounding states and the District of Columbia.

Hyperbaric medicine has always been an integral part of the Shock Trauma Center at UMMC. This strong connection, both functionally and in line with a larger historical ethos, enables the research and emergent capacities of hyperbarics at UMMC. The multiplace chamber at Shock Trauma is one of three in the region, but not all three are involved in the HOBIT trial, says **Stephen Thom,** MD, PhD, professor and director of research in the Department of Emergency Medicine at UMSOM and formerly chief of hyperbaric medicine at the University of Pennsylvania.

"That is because participation in the trial requires not only the hyperbaric chamber but also close coordination between neurosurgeons involved with trauma and hyperbaric oxygen, and all the ICU requirements for these patients. UMMC is uniquely positioned because of the close interaction among the different groups," Dr. Thom says.

In addition to studying the use of hyperbaric chambers in TBI treatment, Dr. Rosenthal and Dr. Sethuraman continue to explore its benefit for other patient populations, hoping to inform practitioners in the region of its potential as an adjunctive treatment.

RAISING AWARENESS OF AMONG PRIMARY CARE AND SPECIALISTS ABOUT HBOT INDICATIONS

"We're hoping to raise awareness among primary care doctors and other practitioners who care for the diabetic patients with a foot ulcer, or cancer survivors with radiation soft-tissue injuries, as examples of conditions that can benefit from HBO therapy," says Dr. Rosenthal.

Another potential area of research is in the field of ischemia-reperfusion injury. When blood flow is interrupted to the brain, for example, reperfusion with oxygen can actually further damage brain lipids and proteins. Laboratory research suggests that HBOT may minimize such injury. Dr. Sethuraman hopes to eventually conduct a study looking specifically at the use of HBOT for stroke patients.

All of these benefits, from highly trained staff to deep integration with Shock Trauma, position UMMC's Center for Hyperbaric and Dive Medicine for continuing on the front lines of investigation and development of standards for HBOT.

Patients with chronic illness, or those recovering from some sort of trauma, can receive adequate HBO treatment in the more common monoplace (one patient at a time) chambers in the region. Still, at UMMC, Dr. Rosenthal says, "the biggest safety measure, and the best thing about the multiplace chamber is that you are never unaccompanied, you are never without a staff member."

NEWLY DISCOVERED EFFECT ON STEM CELLS AND BENEFIT FOR RADIATION INJURY

All of these benefits, from highly trained staff to deep integration with Shock Trauma, position UMMC's Center for Hyperbaric and Dive Medicine for continuing on the front lines of investigation and development of standards for HBOT.

The treatment of radiation injury, for example, via HBOT has proven effective, but is underutilized. Recent advancements in understanding the relationship between HBOT and stem cells has allowed for a greater understanding of hyperbaric dosing, with deeper pressure providing benefits for patients with radiation injury.

"Dr. Thom's research has shown us that hyperbaric oxygen actually causes a release of stem cells, and as you increase the pressure, you get greater release of stem cells," says Dr. Rosenthal. "That's affected the way we practice here because we used to treat people who have radiation injuries by using a certain pressure, and now we treat them at a little bit deeper pressure because there's probably a greater release of stem cells."

In the lab, Dr. Thom and his team continue to push beyond measures of efficacy and into the larger questions of why HBOT works the way it works. In decompression sickness, for example, past research has already found that changes in microparticles precede bubble production, leading to decompression sickness symptoms. Recently, Dr. Thom has observed a more

> ***As a cohesive institution for the furthering of hyperbaric medicine across all types of treatment, the methodology at UMMC is one of an elaborate coordination of steel parts, dedicated people, and increasing potential.***

direct relationship between HBOT and microparticles.

"It turns out that it changes the nature of the microparticles; they are still there in the animal model, but [after treatment] they no longer have the inflammatory components in them that render the microparticles so damaging," Dr. Thom says.

Because microparticles are correlated with a number of different disorders, this deeper understanding only widens the treatment potential for HBO therapy.

"Microparticles drive brain damage as well as other tissue damage in carbon monoxide poisoning in the animal model," Dr. Thom says. "We have also published that microparticles are elevated in carbon monoxide-poisoned patients and in divers who suffer decompression sickness."

Hyperbaric medicine at UMMC is more than the sum of its research, clinical services and emergent care. As a cohesive institution for the furthering of hyperbaric medicine across all types of treatment, the methodology at UMMC is one of an elaborate coordination of steel parts, dedicated people, and increasing potential.

"When I first came here, somebody gave me this book," Dr. Rosenthal says, gesturing with his hands, "and it listed the medical indications for hyperbaric, and it was yay thick. You know, half an inch thick. One of the interesting things is, it was from the National Academy of Sciences, and one of the authors was R Adams Cowley, so there's been a history of hyperbarics in this institution from the 1960s on."

What was once just half an inch thick continues to grow larger due to the research, care and clinical education happening at UMMC and the Shock Trauma Center founded by and named for the late **R Adams Cowley,** MD, a pioneering surgeon who advanced trauma care worldwide and coined the phrase "golden hour" to describe the increased chances of survival when patients are stabilized within one hour of injury.

In front of the hyperbaric chamber are team members (L to R) Brian Trentham, RN; Douglas Sward, MD, clinical assistant professor of emergency medicine; Dr. Rosenthal; Dr. Sethuraman; Greg Fulmer, RRT; Patricia McCray, RN; Bryan Garrard, RN; and Gail Pulford, RRT.

Rounding Out Care & Research

NEW OBSTETRIC CARE UNIT OPENS AT UMMC

The University of Maryland Medical Center (UMMC) opened its new Obstetric Care Unit in October at its downtown campus on Greene Street. The new unit covers 30,500 square feet, nearly three times the size of the old labor and delivery unit, and is fully equipped for both uncomplicated births and high-risk deliveries.

More than 1,900 infants are born each year at UMMC, and the new unit allows that number to grow by as much as 590 more per year.

About 80% of the women who deliver at UMMC are referred because of high-risk pregnancies or infants who will need intensive care. The hospital's Neonatal Intensive Care Unit (NICU) is staffed by pediatric specialists and subspecialists.

Patients labor, deliver and recover in one room that includes a couch and recliner for the mother's partner or other support person. Each room has a private bathroom and shower, and many also have a tub for hydrotherapy. The unit includes three surgical suites for cesarean births and complex obstetric surgeries.

"Whether a mother is low risk and having an uncomplicated delivery, or the most high-risk, our teams have the expertise and services to address her needs," says **Christopher Harman,** MD, the Sylvan Frieman, MD, Endowed Professor in Obstetrics, Gynecology and Reproductive Sciences and chairman of that department at the UM School of Medicine.

MULTICENTER TRIAL SUPPORTS USE OF TOPICAL ANTIBIOTICS IN NICU BABIES

Karen L. Kotloff, MD, professor of pediatrics at the University of Maryland School of Medicine (UMSOM), has led the first multicenter randomized controlled clinical trial testing the effectiveness of topical antibiotic mupirocin for prevention of Staphylococcus aureus (SA) infection in babies in the neonatal intensive care unit (NICU). The study was released online December 2018 and published in the January 2019 issue of the journal *Pediatrics.* (1)

Dr. Kotloff is head of the Division of Pediatric Infectious Disease and Tropical Pediatrics at UMSOM and associate director for clinical studies at its Center for Vaccine Development and Global Health (CVD).

In this study, between 10% and 45% of infants became colonized with SA in the eight NICUs across the country that participated in this study, including at the University of Maryland Medical Center. A five-day course of mupirocin was applied to the skin and nasal passages of the infants in the NICU who tested positive for SA.

More than 90% of the treated infants tested negative for SA after treatment, indicating effective decolonization in response to mupirocin. "Staph aureus is a leading cause of sepsis in young children admitted to the NICU. Sepsis, which is systemic infection, can be fatal in infants. Thus, preventing these infections is very important in managing risk for babies in the NICU who are fragile and struggling with multiple medical problems," said Dr. Kotloff.

Reference: 1. Kotloff KL, Shirley DT, Creech CB, et al. Mupirocin for *Staphylococcus aureus* Decolonization of Infants in Neonatal Intensive Care Units. *Pediatrics.* 2019;143(1):e20181565

UMSOM IS NEW HOME TO JOURNAL OF CARDIOTHORACIC MINIMALLY INVASIVE SURGERY

The University of Maryland School of Medicine (UMSOM) is now home to the medical journal *Innovations: Technology and Techniques in Cardiothoracic and Vascular Surgery,* published by the International Society for Minimally Invasive Cardiothoracic Surgery (ISMICS). The journal *Innovations* highlights advances in technology and techniques that lead to less invasive treatment of cardiothoracic and vascular disease. The editor-in-chief and president of ISMICS, **Niv Ad,** MD, has been named adjunct professor in the Division of Cardiac Surgery at UMSOM.

Dr. Ad is an acclaimed cardiac surgeon and world-renowned expert in the surgical treatment of atrial fibrillation. He is the principal investigator of the multicenter ICE-AFIB trial, in which UMSOM is participating. This trial will be a prospective investigation of a tightly controlled surgical approach to the treatment of atrial fibrillation.

"His work has been crucial to delineate outcomes, predictors of success, optimal post-treatment algorithms, and fundamental mechanisms of atrial fibrillation," says **James Gammie,** MD, professor of surgery and head of cardiac surgery at UMSOM. "As you know, atrial fibrillation is the most common arrhythmia diagnosed in clinical practice and is estimated to affect between 6 and 12 million people in the USA by 2050."

"I believe that Dr. Ad's vision for evolving the journal is a compelling one, and that it will grow to be seen as the leading journal of our specialty, with a focus on novel and less invasive therapies for heart disease," Dr. Gammie says.

With the recent addition of Dr. Ad, the UMSOM Division of Cardiac Surgery continues to enhance its international reputation as a leader in clinical research and groundbreaking innovator in the advancement of the surgical treatment of heart disease.

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