MEDICAL COLLEGE OF WISCONSIN
DEPARTMENT OF SURGERY

SURGERY UPDATE
LEADING THE WAY

SUMMER 2014 • VOLUME 6, NUMBER 2

Department of Surgery
Dedicated to Clinical Care, Research and Education

- Cardiothoracic Surgery
- Colorectal Surgery
- Community Surgery
- Surgical Education
- General Surgery
- Pediatric Surgery
- Surgical Oncology
- Transplant Surgery
- Trauma and Critical Care
- Vascular Surgery

Leading the Way is published three times yearly by The Medical College of Wisconsin – Department of Surgery, 9200 W. Wisconsin Ave., Milwaukee, WI 53226 © 2014.

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Congratulations and Best Wishes to the Department of Surgery Chief Residents

The featured picture in this issue of *Leading the Way* pays tribute to our departing Chief Residents as we prepare for the annual Eberbach banquet in their honor. We are extremely fortunate to host Dr. John Cameron as this year's Eberbach Visiting Professor. Dr. Cameron holds the Alfred Blalock Distinguished Service Professor of Surgery at The Johns Hopkins University School of Medicine and is a legend in surgery throughout the world.

Congratulations to the graduating Chief Residents. Words cannot express our appreciation for their many extra efforts on behalf of our patients, staff, and faculty. We would also like to recognize the departing Fellows as they move on to their new positions:

CHIEF RESIDENTS (and their fellowship positions)

Irena Gribovskaja-Rupp, MD
Fellowship in Colon and Rectal Surgery, University of Minnesota

Valerie Grignol, MD
Fellowship in Surgical Oncology, The Ohio State University

Shaina Schaetzel, MD
Fellowship in Acute Care Surgery, University of San Francisco-Fresno

Thomas Wade, MD
Fellowship in Minimally Invasive Surgery, Washington University School of Medicine, St. Louis

FELLOWS (and their staff positions in July)

Endocrine Surgery:
Victoria Lai, MD—Virginia Hospital Center, Arlington, Virginia

Adwoa Opoku-Boateng, MD—Ochsner Clinic Foundation, New Orleans, Louisiana

Hepato-Pancreato-Biliary Surgery:
Albert Amini, MD—Chandler Regional Medical Center, Phoenix, Arizona

Minimally Invasive Surgery:
Hassanain Jassim, MD—Prevea Health, Green Bay, Wisconsin

Pediatric Critical Care:
Erica Gross, MD—Pediatric Surgery Clinical Research Fellow, Children's Hospital of Wisconsin, Milwaukee

Pediatric Surgery:
Kathleen Dominguez, MD—Marshfield Clinic, Marshfield, Wisconsin

Jill Whitehouse, MD—Joe DiMaggio Children's Hospital, Hollywood, Florida

IN THIS ISSUE:

Hereditary Breast and Ovarian Cancer Syndrome: Associated Risk and Clinical Management Strategies

ANNABELLE BUTLER, MD
Chief Resident in July

AMANDA L. KONG, MD, MS
Division of Surgical Oncology

Hereditary breast and ovarian cancer syndrome (HBOC) is associated with mutations in the *BRCA1* and *BRCA2* genes. Due to high-profile breast cancer awareness campaigns and *BRCA*-positive celebrities who have undergone highly publicized risk-reducing operations, knowledge of *BRCA* gene mutations has increased. As clinicians, we should have a deeper understanding of *BRCA* mutations and their associated risks to better educate patients for the purpose of making well-informed clinical management decisions.

Hereditary breast cancer accounts for only 10% of all cases of breast cancer. The majority of hereditary breast cancer is due to unknown genetic mutations. *BRCA* gene mutations account for 25% of the known mutations and another 20% are due to mutations in eight other genes known to confer a higher risk of breast cancer.[1–3] In the 1990s, *BRCA1* was discovered on chromosome 17 and *BRCA2* on chromosome 13. Both are tumor-suppressor genes. *BRCA* gene mutations occur in about 1 in 400 individuals or about 0.25% of the population. However, in the Ashkenazi Jewish population, one person in 40 carries a mutation.[4]

BRCA1 and *BRCA2* are each associated with different risks of breast and ovarian cancer. A recent meta-analysis of *BRCA1* and *BRCA2* penetrance found that the mean cumulative cancer risks for mutation carriers at 70 years of age were as follows: a breast cancer risk of 57% for *BRCA1* and 49% for *BRCA2*, and an ovarian cancer risk of 40% for *BRCA1* and 18% for *BRCA2*.[5]

BRCA mutations are also associated with other cancers. There is a 1–3% risk of pancreatic cancer in *BRCA1* mutation carriers and a 2–7% risk in *BRCA2* carriers (Table 1). Males with *BRCA1* mutations have a 30% risk of developing prostate cancer and the risk is slightly higher with *BRCA2* mutation carriers. There are also reports of increased risk for gallbladder, bile duct, and stomach cancer as well as melanoma with *BRCA2* mutations.[2]

The cancers associated with *BRCA1* and *BRCA2* tend to have varying clinical presentations as well. *BRCA1* breast cancers are often of higher histological grade, show an excess of medullary histopathology, and are more likely to be "triple negative" breast cancer, meaning the tumor tests negative for estrogen, progesterone and Her2-neu receptors.[2] Triple negative cancers are associated with poorer prognosis. *BRCA2* breast cancers are generally similar in phenotype and clinical behavior as sporadic breast cancers. Male breast cancer is more commonly associated with *BRCA2* mutations.[2]

Guidelines for genetic assessment referral are available from the National Comprehensive Cancer Network (NCCN). Anyone with a known mutation in the family should be sent for genetic assessment. For patients diagnosed with breast cancer, those who are younger than 50 years of age or those with triple negative disease should be evaluated. Patients with two breast cancer primaries, male breast cancer, or ovarian cancer should also be sent for genetic assessment. In unaffected individuals, certain family history can qualify for further genetic assessment. A complete list can be found on the NCCN website.[6]

For known mutation carriers, NCCN guidelines suggest annual mammogram and breast MRI screening should start at age 25. Practitioners should also begin a discussion of prophylactic bilateral mastectomy. The guidelines recommend risk-reducing salpingo-oophorectomy in *BRCA* patients between the ages of 35 and 40 years old. If a patient elects not to have salpingo-oophorectomy, the recommendation is transvaginal ultrasound and CA-125 testing every six months starting at age 30 years.[6]

The Prevention and Observation of Surgical End Points study group (PROSE consortium) was assembled in the late 1990s by Rebbeck *et al* at the University of Pennsylvania. Their goal was to quantify risk-reduction for women with known *BRCA* mutations who underwent prophylactic surgeries.[7] Domchek *et al* used the PROSE database to differentiate cancer outcomes between *BRCA1* women and *BRCA2* women.[8] They found that risk-reducing mastectomy was associated with decreased risk of first occurrence of breast cancer in both *BRCA1* and *BRCA2* mutation carriers. No breast cancer events were seen in women who underwent prophylactic

Cancer Site	*BRCA1* Mutation	*BRCA2* Mutation
Female breast	50%–80%	40%–70%
Ovarian	<40%	<20%
Prostate	<30%	<39%
Pancreatic	1.3%–3.2%	2.3%–7%

TABLE 1—*BRCA1/2* Cancer Risks[2]

mastectomy in a three-year follow-up compared to about 7% of women who did not undergo mastectomy in a similar follow-up.[8]

Risk-reducing salpingo-oophorectomy was associated with a decreased risk of ovarian cancer in women with both types of *BRCA* mutations. The risk reduction estimate for *BRCA1* carriers expressed as a hazard ratio was 0.31 (95% CI=0.12–0.82). No ovarian cancer events were seen in *BRCA2* carriers who underwent risk-reducing surgery during the six-year follow-up. However, 5.8% of *BRCA* carriers who did not undergo salpingo-oophorectomy over a similar follow-up period were diagnosed with ovarian cancer. Salpingo-oophorectomy was also associated with a decreased risk of breast cancer in both *BRCA1* and *BRCA2* mutation carriers without prior diagnosis of breast cancer. The risk reduction was greater for *BRCA2* carriers than for *BRCA1* carriers, 64% versus 37%, respectively.[8] Compared with women who did not have risk-reducing salpingo-oophorectomy, undergoing salpingo-oophorectomy was associated with lower all-cause mortality, 10% versus 3%; lower breast cancer specific mortality, 6% versus 2%; and ovarian cancer-specific mortality; 3% versus 0.4%.[8]

Hereditary breast cancer is rare. However, there are clear benefits to prophylactic surgery in women with *BRCA* mutations. Clinical management of this syndrome is multifaceted and not as straight-forward as the media may portray it. Our job as practitioners is to properly identify at-risk individuals and help them make these difficult decisions that can ultimately reduce their risk of cancer and potentially prolong their life. •

FOR ADDITIONAL INFORMATION on this topic, see references below, visit mcw.edu/surgery, or contact Dr. Kong at 414-805-5818, akong@mcw.edu.

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YOU ARE INVITED

Reception at
American College of Surgeons Clinical Congress, San Francisco, CA

October 27, 2014

Plan to join us at the MCW Department of Surgery / Alumni Association reception during the American College of Surgeons 100th Annual Clinical Congress on Monday, October 27, 2014.

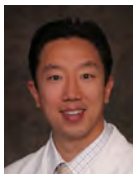
The reception will be held 6–8 p.m. at The University Club of San Francisco, 800 Powell Street.

All those who contribute $100 or more to the **Resident Research Fund** (see page 18) will receive the newly created MCW Department of Surgery *Leading the Way* polo shirt. If you are going to San Francisco, we will present your shirt and a BIG *thank you* to you at the reception.

SAVE THE DATE

Association between Thromboembolic Events Inflammatory Bowel Disease

ANAHITA DUA, MD
General Surgery Resident



CHEONG J. LEE, MD
Division of Vascular Surgery

Thromboembolic events are significant extra-intestinal manifestations of inflammatory bowel disease (IBD). Venous thromboembolism (VTE) is 3–4 times more common in people with Crohn's disease and ulcerative colitis when compared to healthy individuals, regardless of whether IBD pathology is quiescent or in an active state.[1,2] The impact of an IBD patient's procoagulant state, however, has not been well-correlated to the potentially critical arterial thrombotic events (ATE) that this patient cohort may encounter, including myocardial infarction, embolic stroke, and peripheral thromboembolism.[3]

Reasons for increased thrombotic activity are multifactorial; fibrinolytic activity has been shown to be reduced in the systemic circulation while platelet activation is increased in IBD patients, thus amplifying the inflammatory cascade. It has also been demonstrated that defects in the Protein C pathway exist among patients with IBD, leading to enhanced hypercoagulability. Moreover, studies report an increased risk for developing accelerated atherosclerosis in individuals with IBD.[3–8]

Over the last decade, the number of inpatient admissions for IBD has increased steadily. There has also been an increase in the incidence of thromboembolic events (TEE) in the IBD population from 5.65% to 7.17% between 2000 and 2009.[9] This demonstrates that both IBD itself and TEE in patients with IBD are growing problems despite the developments in immune modulation therapy to assist in IBD remission. In fact, studies examining the effect of current IBD therapy may need to expound more greatly on systemic coagulant effects. For instance, the use of prednisone has been shown in animal studies and patients to have a hypercoaguable effect.[10] Infliximab has been associated with acute coronary syndrome in patients with Crohn's disease.[11] The impact of TNF-alpha agents in combination with steroids in the current era may have to be better examined to see if it adversely translates to an acquired procoagulant state. Older age and male gender may be compounding risk factors for developing TEE with IBD. There are inherent risks of having age- and gender-dependent chronic disease processes such as peripheral arterial disease and coronary artery disease. Advanced age has been implicated to be a risk factor in the development of TEE in IBD in the literature.[1–3] The fact that patients may be living longer with fewer IBD flares, helped by potentially procoagulant newer immune modulation regimens, may explain the increasing incidence of IBD admissions with TEE in this older population. Further work is needed to better elucidate the etiology of the increased incidence of TEE among IBD patients related to patient demographics.

Both the arterial and venous system are at increased risk of clot formation in IBD. In a single-institution study from 1970–1980, Talbot *et al* found a TEE incidence of 1.3% among patients admitted with IBD, of which 66% were deep vein thrombosis (DVTs) or pulmonary embolism (PE).[12] Other thromboembolic events in this institutional series included peripheral arterial thrombosis, coronary thrombosis, and mesenteric and portal vein thrombosis. The incidence of ATE was twice as frequent compared to VTE in a study reviewing the incidence of TEE from 2000–2009. Within the ATE subgroup, patients were most likely to develop myocardial infarctions (50%), followed by mesenteric ischemic events (25%), and embolic stroke (22%).[9] Ha *et al* examined patients in the MarketScan Commercial Claims and Encounters database from 2001–2003, and found an increased risk of mesenteric ischemia in patients with IBD compared with non-IBD patients, but did not find an increased risk for transient ischemic attack or myocardial infarction.[5] The difference may be the result of the overall increase in the trend of cardiovascular-related diseases over the past decade in conjunction with the demographics and acuity of the patient population studied. Among the subset of patients with VTE, DVT is the most common VTE (77%) among patients with IBD.[9] A study examining the Canadian cohort of patients in the universal provincial insurance plan of Manitoba from 1984–1987 found that patients with IBD, compared to patients without IBD, had a 3.5-fold increased risk of developing a DVT.[1] Grainge *et al* examined patients in the United Kingdom from 1987–2001 and found a 3.4-fold increased risk of developing a DVT in patients with IBD when compared with non-IBD patients.[2]

The management of patients with TEE in the setting of IBD requires additional study. The current treatment and prophylaxis of IBD patients regarding venous thromboembolism is similar to that of non-IBD patients. Unfractionated heparin may not be enough to address the procoagulant state associated with IBD. Low molecular weight heparin such as enoxaparin is gaining favor due to studies showing anti-inflammatory and immune modulating properties in addition to its anticoagulant effect. Further research is needed to determine the efficacy of newer oral anticoagulants such as rivaroxaban and dabigatran as anticoagulation options for patients with IBD. •

and Patients with

FOR ADDITIONAL INFORMATION on arterial or venous thromboembolic disorders, please see the references below, visit mcw.edu/surgery, or contact Dr. Lee at 414-805-9160, cjlee@mcw.edu.

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Welcome Residents

The Department of Surgery welcomes the incoming 2014–2015 PGY1 Categorical General Surgery Residents:

Jacqueline Blank, MD
Loyola University Chicago–Stritch School of Medicine

Justin Dux, MD
The Medical College of Wisconsin

Charles Fehring, MD
Georgetown University School of Medicine

Stephen Masnyj, MD
University of Cincinnati College of Medicine

Robert McMillan, MD
Creighton University School of Medicine

Thejus Jayakrishnan, MD
All India Institute of Medical Sciences

Lindsey Zimmerman, MD
University of Cincinnati College of Medicine

MEDICAL COLLEGE OF WISCONSIN

Preoperative Localization in Patients with Primary

RYAN W. BERG, MD
General Surgery Resident

TRACY S. WANG, MD, MPH
Division of Surgical Oncology

The increasing incidence of primary hyperparathyroidism (pHPT) in recent years has led to diagnostic and surgical advancements in the treatment of patients with this disease. The gold standard approach to parathyroidectomy is bilateral cervical exploration, with identification of all four parathyroid glands and resection of only abnormal glands. Minimally invasive, or focused parathyroidectomy, defined as identification and resection of a preoperatively identified abnormal gland with intraoperative parathyroid hormone (PTH) monitoring, has become the primary approach for parathyroidectomy in the past two decades. As such, accurate preoperative localization by radiographic imaging has become increasingly important. No longer common is the philosophy shared by radiologist John L. Doppman in 1986 when he said, "The only localizing study indicated in a patient with untreated primary hyperparathyroidism is to localize an experienced parathyroid surgeon."[1]

Preoperative Imaging Techniques

Successful preoperative localization studies are critical in the ability to perform a minimally invasive parathyroidectomy (MIP). Current techniques include cervical ultrasonography, technetium 99m-sestamibi, most commonly performed with single photon emission computed tomography (SPECT), and angiographic CT scans, based on infusion of contrast over time. Sestamibi scans rely on the uptake of technetium 99m-sestamibi; the sestamibi isotope is retained within hypermetabolic (abnormal) parathyroid glands. The addition of SPECT enhances the detection of abnormal parathyroid glands, although sensitivity remains low for patients with thyroid nodules and those with multiglandular disease. Ultrasonography is non-invasive and has the additional advantage of detecting thyroid nodules that may require further evaluation prior to surgery; however, it is operator-dependent and is less sensitive in patients with multigland hyperplasia and with ectopic glands. More recently, angiographic ("4D") CT, using multiplanar images and perfusion techniques (Figure 1), has become increasingly utilized, due to improved sensitivity compared to the aforementioned modalities. These scans have been shown to be particularly useful in localizing abnormal parathyroid glands in patients with persistent or recurrent hyperparathyroidism.[2,3]

However, the sensitivity of these techniques, separately and in combination, are variable. A recent meta-analysis of preoperative localization techniques demonstrated that ultrasonography had pooled sensitivity (SN) and positive predictive value (PPV) of 76.1% (95% CI = 70.4–81.4%) and 93.2% (95% CI = 90.7–95.3%); sestamibi-SPECT had pooled SN and PPV of 78.9% (95% CI = 64–90.6%) and 90.7 (83.5–96.0%). The SN and PPV of angiographic CT in this study were 89.5% and 93.5%, respectively.[2] Cost-effectiveness studies have also suggested that use of more than one imaging study prior to parathyroidectomy is a more cost-effective strategy than a single imaging study due to decreased likelihood of bilateral exploration, with the optimal algorithm dependent on the institutional experience in technique and interpretation of imaging and also in surgical outcomes.[3-4]

Preoperative Imaging at the Medical College of Wisconsin

The Endocrine Surgery program at the Medical College of Wisconsin began performing MIP in 1999. At that time, an institutional parathyroid imaging protocol was established, which included same-day cervical ultrasonography and technetium 99m-sestamibi for all patients. This protocol was revised in 2009, with incorporation of SPECT images to planar sestamibi images, as this combination of studies has evidence of improved localization of parathyroid adenomas.[2,5] If these studies proved to be discordant, CT angiography of the neck was performed.

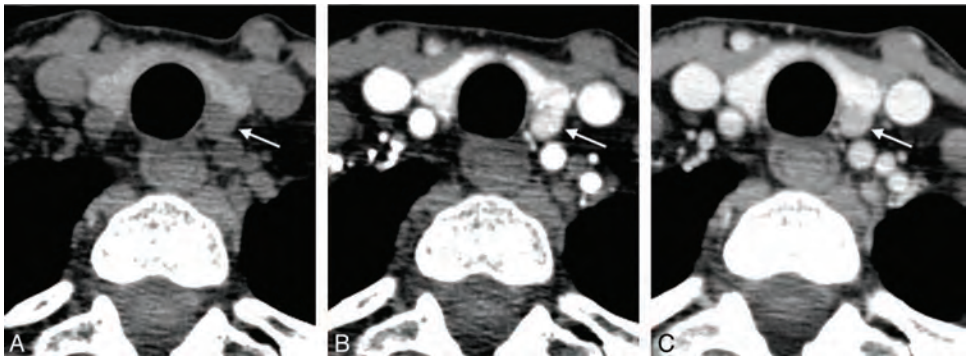

FIGURE 1—Axial noncontrast (A), axial early phase postcontrast (B), and axial delayed phase postcontrast (C) images show a hypoattenuated hypodense nodule contiguous with the left posterior thyroid gland, which demonstrates avid early contrast enhancement and washout. Pathology revealed a 600-mg parathyroid adenoma.[3]

Hyperparathyroidism: A New MCW Protocol

	All Patients (n = 518)		Single-Gland Disease (n = 409)		Multi-Gland Disease (n = 88)	
	# of studies	Sensitivity	# of studies	Sensitivity	# of studies	Sensitivity
Sestamibi-SPECT	433	57%	348	64%	85	35%
Ultrasound	464	63%	377	72%	87	41%
CT	269	74%	210	84%	59	51%

TABLE 1—Sensitivity of localizing the side of abnormal parathyroid gland for individual imaging modalities at MCW from March 2009–April 2013.

In 2013, this protocol was analyzed in order to determine whether further refinements in our preoperative imaging protocol could be achieved. The analysis included 518 patients with primary hyperparathyroidism who underwent curative parathyroidectomy between March 2009–April 2013. The overall sensitivity of preoperative localization studies to identify the correct laterality of parathyroid disease in these patients was 57% (Sestamibi-SPECT), 63% (ultrasound), and 74% (angiographic CT); in patients with single-gland disease, the sensitivity improved to 64%, 72%, and 84% respectively (Table 1).

In an effort to determine an optimal imaging algorithm, the sensitivity of a combination of multiple imaging modalities was performed. The combination of ultrasound and sestamibi-SPECT had a SN of 88%, as did the combination of sestamibi-SPECT and angiographic CT. However, the SN of the combination of ultrasound and angiographic CT was highest, at 91%. Importantly, of the 33 patients who had false negative findings on both ultrasound and sestamibi-SPECT, 24 (73%) had abnormal findings on angiographic CT. In contrast, of the 14 patients in which ultrasound and angiographic CT did not localize the side of parathyroid disease, only five (36%) were identified on Sestamibi-SPECT, suggesting that the routine use of sestamibi-SPECT did not significantly enhance the current localization protocol.

A multidisciplinary conference of parathyroid surgeons, radiologists, and endocrinologists was utilized to review these findings and refine the current MCW imaging protocol for patients with parathyroid disease. As of November 2013, preoperative localization for patients with primary hyperparathyroidism who are undergoing evaluation for parathyroidectomy includes same-day cervical ultrasonography and angiographic CT; Sestamibi-SPECT is reserved for patients with contrast allergies, renal insufficiency, and at the discretion of the surgeon, if the initial two studies are discordant. •

FOR ADDITIONAL INFORMATION, please contact Dr. Tracy Wang at 414-805-5755, tswang@mcw.edu. Patients with primary hyperparathyroidism can be referred to the Endocrine Surgery program at the Medical College of Wisconsin by calling New Patient Coordinator Marissa Grimm at 414-805-0993 or contacting Dr. Wang directly.

	# of studies	Sensitivity	False negatives
Sestamibi-SPECT and Ultrasound	331	88%	CT localized 24/33 (73%)
Sestamibi and CT	182	88%	CT localized 24/33 (73%)
Ultrasound and CT	189	91%	SS localized 5/14 (36%)

TABLE 2—Sensitivity of localizing the side of abnormal parathyroid gland for combined imaging modalities at MCW from March 2009–April 2013.

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Management of Malignant Peritoneal Mesothelioma:

JOHN MIURA, MD
General Surgery Research Resident

FABIAN JOHNSTON, MD, MHS
Division of Surgical Oncology

KIRAN TURAGA, MD, MPH
Division of Surgical Oncology

Arising from the mesothelial cells that line the pleura, peritoneum, tunica vaginalis, and pericardium, malignant mesothelioma is an uncommon, but aggressive malignancy that leads to an overall poor life expectancy of 4–12 months in untreated cases.[1] Although most commonly found in the pleural region, malignant peritoneal mesothelioma (MPM) is the second most common location with an annual incidence in the United States of 200–400 new cases.

Once considered a lethal disease, advancements in treatment strategies and improved understanding in the disease biology of MPM over the last two decades has resulted in dramatic improvements in patient survival. While systemic therapies have maintained a narrow role secondary to the lack of sensitivity of MPM to available cytotoxic agents, the emergence of loco-regional therapies in the form of cytoreductive surgery (CRS) combined with hyperthermic intraperitoneal chemotherapy (HIPEC) has proven to be an effective treatment alternative for MPM management. Recent prospective series have demonstrated improvements in patient survival that have ranged from 34–92 months following this approach.[2–4]

The effectiveness of CRS plus HIPEC rests in its ability to take advantage of the unique disease biology of MPM, whereby tumor extension beyond the peritoneal cavity, namely lymph node and extra-abdominal metastasis remains uncommon. Through CRS, which incorporates peritonectomy procedures with multivisceral resections, surgeons are able to minimize residual intraabdominal disease, ultimately creating the optimal environment for intraperitoneal chemotherapy delivery. A recent systematic review, that included 19 studies that investigated the role of CRS plus HIPEC for MPM, indicated numerous chemotherapeutic agents utilized during HIPEC.[5] To date, single agent cisplatin has demonstrated the best results when compared to the other regiments (five-year overall survival: 49%, Table 1). Despite the lack of uniformity in treatment protocols, the study by Helm underscores the survival benefit that patients derive from CRS combined with HIPEC for MPM.[5]

To highlight the progress in the management of MPM over the last two decades, a population based analysis utilizing the Surveillance, Epidemiology and End Results (SEER) database was recently conducted.[6] From 1973–2010, a total of 1,591 U.S. patients with MPM were identified from the SEER registry. When stratified by year of diagnosis, patients with MPM in the contemporary cohort that underwent CRS experienced the greatest improvement in median overall survival (1991–1995: 15 months, 1996–2000: 28 months, 2001–2005: 30 months, 2006–2010: 38 months, $p = 0.08$, Figure 1B). Although unable to account for the number of patients that may have received HIPEC due to the limitations of the registry, the improved survival experienced by patients in the later years highlights the advancements and experience with procedural techniques for MPM.

Despite studies demonstrating the survival benefit achieved from aggressive loco-regional therapies for MPM, results from the SEER analysis also identified that approximately three of every five patients with MPM in the U.S. do not receive surgery. According to the SEER registry, there has been a temporal decrease in the proportion of patients with MPM managed non-operatively (1973–1980: 72.4%, 1981–1985: 63.7%, 1986–1990: 62.3%, 1991–1995: 55.8%, 1996–2000: 63.3%, 2001–2005: 63.1%, 2006–2010: 56.8%, $p < 0.01$). However, a significant number of patients with MPM that are not offered treatment still remain. The reasons for this practice pattern could be varied, including nihilism for disease or treatment, misinformation, host of disease characteristics precluding therapy, or data collection bias. Moreover, concerns for morbidity from such a radical procedure often preclude a referral or evaluation by a peritoneal disease program. However, recent improvements in surgical therapies have resulted in lower morbidity of cytoreductive procedures with rapid return of quality of life. Widespread adoption of this technique in the armamentarium of treating MPM patients has been proposed.

While not all patients with MPM are candidates for loco-regional therapies, any chance for a durable survival benefit is predicated by the patient being first evaluated at a center with expertise in treating peritoneal malignancies. The Regional Therapies Program at the Medical College of Wisconsin specializes in the treatment of rare, aggressive regional diseases. Utilizing a multidisciplinary approach, the Regional Therapies Program provides each patient with individually

A Missed Opportunity to Impact Survival

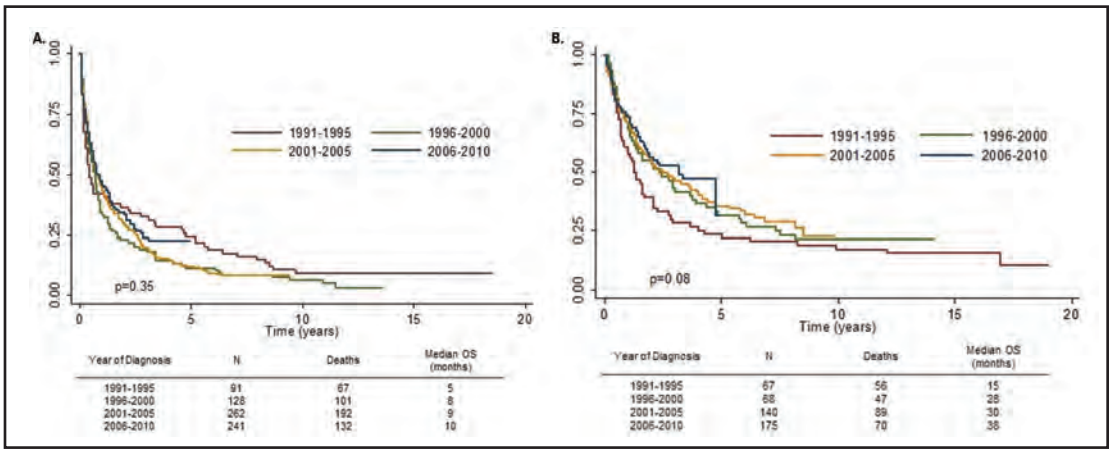

FIGURE 1—Kaplan Meier survival curves of overall survival for malignant peritoneal mesothelioma patients who received (A) no surgery vs. (B) surgery stratified by year

tailored care, while delivering current treatments using state-of-the-art techniques. Although the management of MPM continues to evolve, CRS plus HIPEC has afforded patients with MPM the opportunity to maintain a meaningful life that was once considered an intangible goal. •

FOR ADDITIONAL INFORMATION on this topic, see references below, visit mcw.edu/surgery, or contact Dr. Johnston at 414-805-5828, fjohnston@mcw.edu, or Dr. Turaga at 414-805-5078, kturaga@mcw.edu.

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Chemotherapy Agent Used	Number of Studies	Mortality Rate	5-year survival
Mitomycin-C only	1	0.24	30%
Cisplatin only	3	0.14	49%
Doxorubicin+Cisplatin	3	0.23	32%
Docetaxel+Cisplatin	1	0.35	17%
Drug combinations including doxorubicin, mitomycin-C, cisplatin	11	0.16	45%

TABLE 1—Survival estimates based on chemotherapy used for HIPEC in patients with MPM

Current and Future In-Utero Manager

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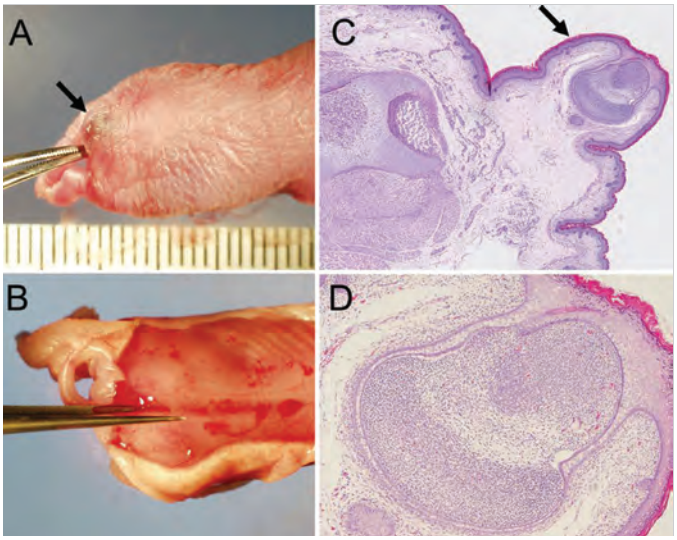
Myelomeningocele, or spina bifida, is a congenital defect resulting from incomplete closure of the neural tube during development. This results in an open spinal canal with exposed nervous tissue and leakage of cerebrospinal fluid throughout gestation. The incidence of neural tube defects decreased when the United States mandated fortification of grain products with folic acid, but myelomeningocele (MMC) continues to be the most common congenital birth defect of the nervous system and the second most common birth defect. Myelomeningocele is a major cause of disability in 70,000 to 100,000 people in the United States due to paralysis often requiring a wheelchair, fecal and urinary incontinence and limb abnormalities.[1]

The mechanism of injury and disability in MMC is hypothesized to be secondary to the abnormality of the neural placode itself and also from the exposure of neural tissue to the caustic effects of amniotic fluid and intrauterine trauma throughout fetal development. Ultrasound studies in both animal models and humans with MMC have substantiated this hypothesis as normal hind limb movement is seen early in gestation and abates near term. This is the rationale for in-utero repair of MMC.[2–4] In addition, virtually all newborns with MMC develop hindbrain herniation, Arnold-Chiari II malformation. More than 90% of patients with an Arnold-Chiari II malformation develop hydrocephalus requiring a ventriculoperitoneal (VP) shunt. Even with relief of hydrocephalus, children remain at risk of cerebellar and upper cervical nerve injury that can lead to dysfunctional swallowing, central hypoventilation or death.



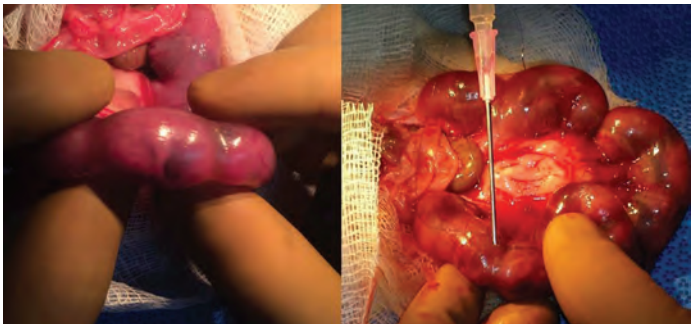
Induction of neural tube defects with retinoic acid treatment. (A) External view of rat pup in which a midline posterior area of protrusion and discoloration is evident (arrow). Histological evaluation of these areas (C,D) reveals immature subcutaneous space. Other treated rat pups did not display external abnormalities, but did show defects in the closure of the posterior vertebral arches (B), consistent with spina bifida occulata.

Traditional management of neonates with a myelomeningocele has been operative repair within 24–48 hours. However, the Management of Myelomeningocele Surgery (MOMS) trial randomized patients to *in utero* surgery or standard postnatal repair.[4] This trial found that fetal repair of MMC was associated with decreased hindbrain herniation, decreased need for VP shunting, and improved motor function with 42% of those in the fetal surgery group walking independently by age three compared to only 21% in the postnatal surgery group.

However, despite the benefits of fetal surgery for MMC, there is substantial risk to both the fetus and the mother. The fetal surgery requires a maternal laparotomy and hysterotomy between 19–26 weeks gestation. The MOMS trial reported uterine dehiscence in 36% of patients, which has significant ramifications for the remainder of the pregnancy and for the entire reproductive life of the mother as she is never to labor again because of the risk of uterine rupture. Additional risks include maternal chorioamniotic separation, oligohydramnios, intraoperative uterine hemorrhage, preterm rupture of membranes and preterm delivery (79%).[4] This has inspired further research to develop less invasive methods to repair or protect the myelomeningocele in utero to provide the same advantages seen in the MOMS trial while minimizing the associated complications.

Our lab is working on developing a minimally invasive method to cover the myelomeningocele by injecting maternally-derived blood patch through a needle inserted into the uterus under ultrasound guidance. An autologous, blood-component derived material has shown promising results with in vitro studies using either platelet-rich plasma (PRP) or concentrated platelet-poor plasma (cPPP). PRP and cPPP are generated by centrifuging whole blood to separate out the red blood cells. The remaining solution is separated into the platelet rich and poor fraction. The PRP and cPPP are activated with calcium and thrombin. These membranes are currently used in adults as a biologic dressing to aid in wound healing. Additionally, PRP has been found to promote wound healing by recruiting mesenchymal stem cells from amniotic fluid. The proteomic profile of PRP includes numerous

ment of Myelomeningocele



In utero rat pup during dam laparotomy (left). Needle introduction of coverage material over fetal back with purse-string closure of the needle hole (right).

potentially beneficial molecules for angiogenesis and wound healing including PDGF, VEGF, MMP-9, angiopoeitin-1 and angiogenin.[5] In vitro testing has shown both PRP and cPPP create a cohesive membrane when deployed in amniotic fluid that remains impermeable for several days.

The future direction of this project will test PRP and cPPP in a rat model of myelomeningocele. This model uses retinoic acid to induce myelomeningocele in rat pups. The rat pups will undergo in utero surgery to apply the PRP and cPPP over the myelomeningocele defect to create a protective covering over the exposed spinal tissue and potentially promote growth of fetal epidermis resulting in epidermal coverage of the lesion. This minimally invasive approach shows promise to provide the benefits of in utero closure while minimizing the risk and long-term affects to the mother. •

FOR ADDITIONAL INFORMATION on this topic, see references below, visit mcw.edu/surgery, contact Dr. Wagner at 414-266-6550, awagner@chw.org, or the Fetal Concerns Center of Wisconsin at 414-805-4776.

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First Annual Mobile App Challenge

by Jeremy Juern, MD

Earlier this year, the Medical College of Wisconsin partnered with the University of Wisconsin-Milwaukee (UWM) and UWM's App Brewery to hold the First Annual Mobile App Challenge. MCW faculty, staff, and students were invited to submit proposals to create an app for mobile device technology related to MCW's mission. Jeremy Juern, MD, and John Weigelt, MD, DVM, from the Division of Trauma/Critical Care and Acute Care Surgery, submitted a proposal for an app that helps learners and clinicians troubleshoot the base deficit result. Base deficit is a measure of the degree of metabolic acidosis. The initial base deficit in trauma patients correlates with severity of injury. Base deficit is affected by a number of factors, and in a critically ill patient, those factors may be confusing. The app, called the Friendly Base Deficit Analyzer, was a result of a review article they had published about base deficit. Dr. Juern had entered some basic calculations into a spreadsheet and used those calculations on his patients. When they heard about the App Challenge, they realized the spreadsheet would be translatable to an app platform.

Of approximately 80 entries, the selection committee chose the top 20 app proposal creators/teams to do a live, 10-minute presentation in February. Drs. Juern and Weigelt were among these finalists. Following the pitch event, the judging panel decided on the top eight proposals to proceed with development. The Friendly Base Deficit Analyzer was among those selected! Drs. Juern and Weigelt will be working with UWM students over the summer, with the goal of developing an app that could easily be used by healthcare professionals.

This app will help physicians sort through a patient's information and help them make the correct decision regarding patient care. Drs. Juern and Weigelt hope that this app and future innovations by their team will help physicians who care for critically ill patients. •

Jeremy Juern, MD

John Weigelt, MD, DVM

Immunopathological Response to Severe Trauma Changes in Platelet Activity in Acutely Burned Pa

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With co-authors:
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Department of Surgery at University of Texas Health Science Center at San Antonio

Injury causes a sterile inflammatory response. Dysregulation of this response can lead to a systemic inflammatory response and subsequent organ dysfunction, nosocomial infection, and multisystem organ failure. A favorable outcome depends on the ability of the body to terminate the inflammatory response and return to a pre-injury state. The mechanisms of this process are poorly understood. The injury-induced alterations in coagulation and inflammation are interrelated and could reveal potential therapeutic targets. Cytokines and other factors, such as damage-associated molecular patterns (DAMPs), can act as initiators of inflammation and coagulation. Data has shown that burn and trauma are accompanied by elevated plasma levels of cytokines and DAMPs. There are limited data integrating these mediators of inflammation with coagulation (vWF, D-dimers etc).

The aim of this study was to correlate changes in circulating cytokines and DAMPs with coagulation and coagulopathy in burn patients and others with severe trauma (ISS >15). Both blunt and penetrating trauma patients were included. The study excluded all patients who received blood products prior to enrollment, patients on therapeutic anticoagulation, prisoners and patients admitted directly to the ward. Admission blood samples were drawn from trauma (n = 10) and burn (n = 10) patients before transfer to the intensive care unit. DAMPs, D-dimer, vWF and cytokines (IL-17A, IL-21, IL-22, IL-23, IFN, TNF, IL-1, IL-4, IL-6, IL-10, IL-17F, IL-25, IL-31, IL-33, sCD40L) were measured by ELISA or Bioplex assay.

The average age of the subjects was 38.7 ±7.1 years and 48.8 ±4.7 years, for trauma and burn patients, respectively (p = 0.25). All values stated as mean ± SEM. Injury Severity Scale score (ISS) was 18 ±5.8 for trauma patients, and the burn size was 41.6 ±4.5%. Burn patients had a longer ICU length of stay (41 vs. 2 days, p = 0.02), hospital length of stay (49 vs. 6 days, p = 0.009) and increased time spent on the ventilator (31 vs. 0 days, p = 0.01). Burn patients also were more likely to develop a hospital acquired infection (p = <0.001), likely due to their prolonged hospitalization. IL-33 (667 ±152 vs. 127 ±49 pg/ml, p = 0.006), IL-22 (200 ±62 vs. 19 ±10 pg/ml, p = 0.02) and HSP-72 (151 ±22 vs. 59 ±9 ng/ml, p = 0.001) were higher in the trauma group. In contrast, platelets (295 ±16 vs. 234 ±17, p = 0.02) and vWF (4393 ±450 vs. 2045 ±275, p <0.001) were elevated in burn patients. sCD40L, a marker of platelet activation, and IL-17A were similar for both trauma and burn patients (115 ±33 burn vs. 187 ±40 pg/ml trauma, p = 0.185 and 31 ±13 burn vs. 64 ±15 pg/ml trauma, p = 0.115, respectively.) A strong correlation (R = 0.79) between sCD40L and IL-17A was observed in burn patients.

Although we have identified a new link between platelets and IL-17A, there are limitations to our study. These include limited power and single time point analysis. However, these results suggest that

	Trauma (Mean ±SEM)	Burn (Mean ±SEM)	n	*p*-value
Age	39 ±7	49 ±5	20	0.25
M/F	9/1	8/2	20	
Weight	72 ±4	87 ±6	20	0.06
ISS	18 ±6	15	12	
TBSA		42 ±5	10	

TABLE 1—Demographics

and Burn:
tients

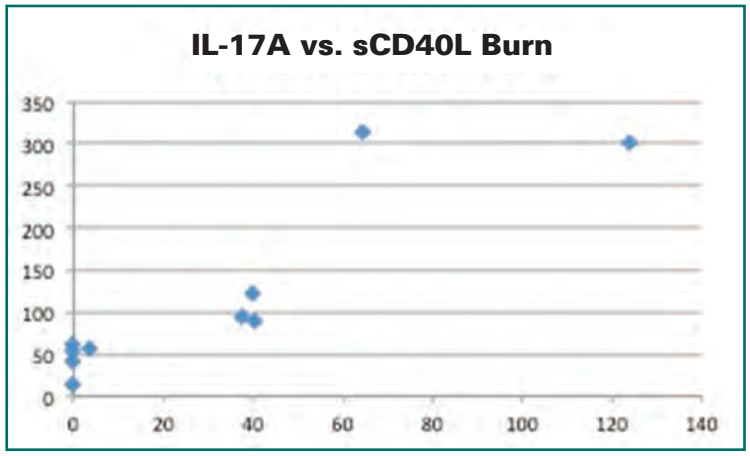

FIGURE 1—Correlation between IL-17A and sCD40L in burn patients.

although trauma patients have higher levels of select cytokines and DAMPs, a unique interrelationship between platelet activation and IL-17A may exist in burn patients involving lymphocyte activation through sCD40L release. Further work is needed to examine this possibility. If established, future studies are indicated to investigate whether IL-17A contributes to thromboembolic complications in such patients and represent a potential target for therapeutic intervention. •

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Dr. Morris is in her third year of research under the direction of Dr. Martin Schwacha, Professor, Department of Surgery at University of Texas Health Science Center at San Antonio.

About This Issue: *Leading the Way*

All the clinical and research articles in this issue of *Leading the Way* were written by MCW surgical residents. Manuscript preparation and submission involve many of the skills necessary to be a good doctor—hard work, attention to detail, and a complete knowledge of the topic!

MCW T. Michael Bolger Standing Ovation Awards

David Gourlay, MD

Amy Leisten

This year's **T. Michael Bolger Standing Ovation Award** winners include David Gourlay, MD, Associate Professor of Surgery (Pediatric Surgery) and Amy Leisten, Medical Education Coordinator II in the Department of Surgery.

Nominations for the T. Michael Bolger Standing Ovation Awards for excellence in service to the students of MCW are solicited from all faculty, staff and students. In addition to two winners, the Department of Surgery had a total of six nominees this year: Terry Derks, MS, PA-C (Pediatric Surgery); Andrew Kastenmeier, MD (General Surgery); Gregory Larrieux, MD (PGY1); and Brian Lewis, MD (Vascular Surgery).

Complete Transection of the Common Bile Duct and

KATHLEEN O'CONNELL MD
Chief Resident in July

JOHN WEIGELT, MD, DVM, MMA
Chief, Division of Trauma/Critical Care

LEWIS SOMBERG MD
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The incidence of extrahepatic biliary tract injuries is estimated at 3–5% of all abdominal traumas, with 85% resulting from penetrating wounds.[1] The vast majority of traumatic injuries to the extrahepatic biliary tract occur to the gallbladder alone (80%), followed by the common bile duct (CBD), confluence of left and right hepatic ducts, and the hepatic ducts themselves.[2] Injury to the CBD from blunt abdominal trauma is exceedingly rare, especially complete transection of the duct. In a retrospective review of blunt abdominal trauma over a 20-year span, 7 out of 1,873 cases (0.3%) suffered bile duct rupture.[2] Despite proximity to the extrahepatic bile duct, portal vein and hepatic artery injuries are not coincident with blunt CBD injuries. We report a unique case of blunt common bile duct and gastroduodenal artery transection.

Case

A 48-year-old woman was the restrained driver in a high-speed motor vehicle collision where her car was T-boned on the driver's side. The patient was initially evaluated at a referring institution, and subsequently transferred to our trauma center with multi-system injuries. She arrived six hours after the collision, and her injuries included a grade one liver laceration, a grade one aortic injury, bilateral rib fractures, and a myriad of orthopedic injuries to three of her extremities. The patient was admitted and underwent a repeat CT abdomen/pelvis to evaluate a possible pancreatic injury, which demonstrated increased peripancreatic fluid, necessitating operative exploration.

A moderate amount of hemoperitoneum was discovered without active hemorrhage. A Kocher maneuver was performed and the head of the pancreas was exposed. The common bile duct was found dissected from its retroperitoneal attachments with a surrounding hematoma, and a small amount of free bile was appreciated. Complete examination of the pancreatic head revealed no pancreatic transection. A cholecystectomy with intraoperative cholangiogram was performed, demonstrating a distal CBD leak. Further exploration indicated that the CBD was avulsed from the ampulla and the gastroduodenal artery had been transected. A retrocolic Roux-en-Y end-to-side choledochojejunostomy was constructed without the use of an anastomotic stent. A drain was placed in the right upper quadrant.

During her post-operative course, liver enzymes remained within normal limits and the drain was removed. Her diet was slowly advanced as tolerated. She was discharged to a subacute rehab facility six weeks after the time of injury. The patient has been followed for 11 weeks and continues to have no evidence of complications from her biliary or duodenal repairs.

Discussion

Repair of CBD injuries poses a significant surgical challenge as experience with this type of injury is infrequent. Overall clinical stability of the patient, associated injuries, time since injury, and experience of the surgeon must be taken into consideration when deciding how to repair a CBD injury. Surgical and non-surgical options are reviewed.

Patients in extremis should not have immediate biliary reconstruction, rather temporizing measures congruent with the guidelines of damage control laparotomy. Simple external drainage as the sole intervention for a complete CBD transection has a reported mortality rate of 100%, and has not been used since the late nineteenth century.[3] Ligation of the CBD with either placement of a T-tube or cholecystostomy tube allows biliary drainage which can be followed by a staged definitive repair as the patient's physiology improves.[4]

In hemodynamically normal patients, initial laparotomy provides the safest opportunity for definitive repair. Intraoperative cholangiogram is performed to delineate the biliary anatomy and clearly identify the area of injury. Simple partial transections without significant tissue loss are primarily repaired with placement of a T-tube through the injury or via a separate choledochotomy across the area of injury.[4] Similarly, patch ductoplasty for lateral wall injuries is described, with conduit harvested from the gallbladder, cystic duct, vein segment or bowel serosa.[5] Intrapancreatic bile duct injuries can be addressed with a sphincteroplasty via a duodenotomy with T-tube placement across the ampulla.[6]

The use of a T-tube to stent across the injured segment after primary repair is controversial. Placement of this tube is either via a separate choledochotomy (through a normal area of bile duct, above or below the area of injury) or via a duodenotomy with insertion through the ampulla. Supporters of stenting cite the benefits of post-operative biliary decompression, ease of post-operative radiographic follow up, and decreased collagen contracture.[7] The length of time prior to T-tube

removal is also debated and is highly variable in the literature, with reports of continuous tube drainage up to one year post-operatively.[3] Opponents argue the use of T-tube stenting increases unnecessary complications including stent dislodgement, and occlusion, with subsequent cholangitis.

Complete CBD transections are managed with end-to-end anastomoses, with emphasis on debridement of devitalized tissue and creation of a tension-free anastomosis.[2] Although successes are reported, there are multiple reports of nearly 100% stricture rate using this approach.[7] The hypothesis is that strictures occur secondary to disruption of the axial blood supply in the nine and three o'clock positions on the duct during mobilization. Patients with a biliary stricture require a second operation with creation of a biliary-enteric anastomosis.

Similar to repair of iatrogenic bile duct injuries, the most widely accepted approach to a complete CBD transection is a biliary-enteric anastomosis.[8] Depending on the location of the injury along the extrahepatic bile duct, various reconstructions are used: choledochoduodenostomy, loop choledochojejunostomy, cholecystojejunostomy, and Roux-en-Y choledochojejunostomy or hepaticojejunostomy. Most authors recommend a Roux-en-Y duct to jejunum anastomosis, citing the benefit of a completely tension-free anastomosis, no risk of duodenal fistula, and best long-term drainage results.[9] The ductal anastomosis is technically more difficult compared to non-traumatic reconstructions due to the smaller caliber of the normal duct. Even so, the tension-free anastomosis results in decreased stricture formation, with reported rates of only 3.6%.[10] Concomitant cholecystectomy is performed as bypass of the ampulla with biliary-enteric reconstruction increases the risk of stasis cholecystitis.

When a distal CBD injury is suspected, a duodenotomy allows cannulation of the ampulla and distal CBD. Some authors report not locating the distal duct or simply leaving it alone with the addition of wide external drainage. After review of these reports, Turney *et al* cited no increase in complications when no intervention to locate the distal duct was undertaken, other than placement of a drain in the area.[11] As such, creation of a duodenotomy to cannulate the distal duct may not be warranted, as this maneuver is not without complications.

The use of endoscopic retrograde cholangiopancreatography (ERCP) in the treatment of iatrogenic extrahepatic ductal injuries is well described. Recently, ERCP was used in hemodynamically normal patients for management of isolated traumatic bile duct injuries. Jaik *et al* cited 19 cases of extrahepatic ductal injuries due to blunt trauma in which ERCP was used for diagnostic or therapeutic purposes.[12] These authors suggest that ERCP may also be used in patients who underwent celiotomy for associated injuries with a missed diagnosis of CBD injury. Re-exploration in the immediate post-operative period carries increased risk of enterotomy and bile duct devascularization, in effect augmenting the difficulty of biliary reconstruction. Clearly, judicious patient selection for endoscopic intervention of traumatic bile duct injuries is key to successful implementation of this modality.

In conclusion, this unique case of a complete CBD and GDA transection is, as far as we know, the first reported in the literature to date. The incidence of CBD transection secondary to blunt trauma is extremely rare, and in combination with suboptimal imaging and severe associated injuries, the diagnosis and treatment remains challenging. Reconstruction of biliary-enteric continuity with a Roux-en-Y duct to jejunum anastomosis is the preferred approach with the best long-term results. The role of non-operative interventions such as ERCP is evolving, and may be especially advantageous in post-operative patients with a missed CBD injury. •

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SCORE: A Web-Based, Competency-Based Curriculu

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SCORE'S History, Organizational Structure, and Mission

The Surgical Council on Resident Education (SCORE) is a consortium of seven US-based surgical organizations: the American Board of Surgery (ABS), American College of Surgeons (ACS), American Surgical Association (ASA), Association of Program Directors in Surgery (APDS), Association for Surgical Education (ASE), Accreditation Council for Graduate Medical Education (ACGME), and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES).[1] Led by the ABS, SCORE was established in 2004 and set forth two goals: (1) to develop a standardized, competency-based curriculum for general surgery residency training that addresses the six ACGME competency areas; and (2) to develop a Web portal to deliver this content to general surgery residents.

SCORE is led by Dr. Mary Klingensmith at Washington University and Dr. Mark Malangoni, associate executive director of the ABS. The SCORE council is composed of representatives from each of the seven member organizations. An eight-member editorial board (which includes numerous general surgery residency program directors) oversees the development of all content for the Web portal. A seven-member resident advisory group provides input on the most desired methods to present and deliver the content. This diverse group of stakeholders, educational experts, and end-users ensures that the SCORE curriculum and Web portal remain current, relevant, and user-friendly.[1]

Curriculum Outline

Through an iterative process that involved SCORE council representatives and general surgery program directors, an initial curriculum outline addressing the competency of patient care and operative skills was developed between 2004–2006.[2] This initial outline has expanded to include the competencies of medical knowledge, systems-based practice, professionalism, and interpersonal skills and communication. The curriculum outline is reviewed and updated annually according to the recommendations made by various stakeholder groups which are coordinated by the ABS. The 2013–2014 SCORE curriculum outline is publicly available on the SCORE Web portal (www.surgicalcore.org/public/curriculum), as well as in a print version.

SCORE Web Portal

The initial SCORE curriculum outline served as the basis for the early content that was delivered on the SCORE Web portal, which was piloted to 33 selected general surgery residency programs in 2008.[3] The SCORE Web portal (www.surgicalcore.org) was initially made available to all residency programs free of charge in 2009 and became a subscription-only resource the following year. In 2012, 96% of general surgery residency programs subscribed to the SCORE Web portal. In addition, surgery residencies in Canada and other nations, as well as more than half of all osteopathic surgery training programs are current subscribers.[1]

TABLE 1—Patient care competency organizational structure and definitions[4]

Patient care competency	Graduating resident expectations
Diseases/conditions modules	
Broad	Able to provide comprehensive management for all aspects of the disease.
Focused	Able to make a diagnosis and provide initial management and stabilization but should not be expected to provide comprehensive care.
Operations/procedures modules	
Essential-common	Competency is required for these frequently performed operations in general surgery.
Essential-uncommon	Specific procedure competency is required (but may not be obtained by case volume alone) for these uncommon, often urgent operations seen in general surgical practice but not typically done in significant numbers by residents.
Complex	Generic experience is required for these procedures that are not consistently performed by general surgeons in training or not typically performed in general surgery practice. Some residency programs may provide sufficient experience for competency by their graduates.

The content addressing patient care competency is organized in 28 categories and presented in individual content areas, termed "modules".[4] These modules are divided into two areas: (1) diseases/conditions; and (2) operations/procedures. Each area is further subdivided according to the level of proficiency a general surgery residency graduate is expected to possess, thereby allowing the residents to tailor their learning experience (Table 1). For diseases/conditions areas, modules are defined as either "broad" or "focused." For example, in the abdomen-biliary module, acute and chronic cholecystitis and choledocholithiasis are "broad" categories while gallbladder cancer and bile duct neoplasms are "focused" categories. Operations/procedures topics are classified into one of three areas: (1) essential-common; (2) essential-uncommon; and (3) complex. For the abdomen-biliary module, "essential-common" operations include laparoscopic and open cholecystectomy with or without cholangiography; "essential-uncommon" operations include open common bile duct exploration and choledochoscopy; and "complex" operations include operations for bile duct cancer and laparoscopic common bile duct exploration. All classifications are reviewed annually to determine their continuing relevance to a given category, acknowledging changes over time as technology and disease management evolve.[5]

um for General Surgery Residents

The SCORE Web portal content is organized into several different areas: modules, textbooks, videos, self-assessment questions, and supplemental resources. This multi-modality format provides an integrated, comprehensive site for both program-directed and self-directed learning.

Modules—A module defines a specific disease/condition or operation/procedure in the curriculum outline. Each module follows a specific outline, ensuring consistency in the learner's experience, and includes: (1) defined learning objectives to focus the residents' learning and mastery of the material; (2) open-ended questions which may be used by learners and faculty to assess knowledge; (3) links to chapters from major surgical texts; and (4) relevant videos. Currently, approximately 650 modules on patient care, medical knowledge, and systems-based practice competency are available, and approximately 150 additional modules are in production. Once these remaining modules are posted, which is expected by mid-2014, the current curriculum outline will be complete. The task of reviewing existing modules began in 2014, with the goal of revising and updating all modules on a three-year cycle.

TABLE 2—Surgical textbooks and supplemental resources available on the SCORE Web portal

Textbooks	
ACS Surgery: Principles and Practice *Greenfield's Surgery: Scientific Principles and Practice* *Fischer's Mastery of Surgery* *Surgery: Basic Science and Clinical Evidence* *Surgical Pitfalls: Prevention and Management* *The Physiologic Basis of Surgery*	*The SAGES Manual: Fundamentals of Laparoscopy, Thoracoscopy, and GI Endoscopy* *The ASCRS Textbook of Colon and Rectal Surgery* *Pediatric Surgery* *Ethical Issues in Clinical Surgery* *Surgical Palliative Care: A Resident's Guide*
Supplemental Resources	
StatDx	An online decision-support system that provides an overview of an extensive breadth of topics with differential diagnoses, anatomic drawings, and radiologic images.
CURRICULUM TOOLS	
The ACS Surgery Weekly Curriculum	Features a short, multiple-choice quiz on a selected topic each week that is indexed to the SCORE curriculum outline.
The American Society of Transplant Surgeons Academic Universe	In-depth exposure to selected topics in solid organ transplantation.
JOURNAL CLUB	
The ACS Evidence-Based Reviews in Surgery (EBRS)	An evidence-based curriculum that teaches skills in the critical appraisal of the literature.
The Annals of Surgery Journal Club	An interactive resource to discuss and critically evaluate published articles.
The Comprehensive Online Archived Care Heuristic (COACH)	An online multimedia educational resource which includes training videos, articles, and simulations that are intended for resident review prior to exposure to real-life situations.

Textbooks—With the permission of their publishers, the Web portal features chapters from 11 major surgical textbooks to supplement the learning experience (Table 2). Textbook chapters are linked to each specific learning module.

Videos—The video library includes >250 videos, which cover a broad range of topics, from bedside procedures and endoscopy to minimally invasive and open operations.

Self-Assessment Questions—The popular self-assessment area features >2,000 multiple-choice questions that cover all content areas on the curriculum outline. Each question is accompanied by a detailed explanation of the correct and incorrect answers, allowing residents to assess their knowledge and tailor their learning.

Supplemental Resources—This area comprises several important adjuncts to the learning experience (Table 2).[1] Available resources include radiology images, curriculum tools, journal club, and patient scenarios and simulations.

Future of SCORE

The SCORE curriculum outline is recognized as an essential resource for resident education and evaluation; the ABS has recently started to use the curriculum outline to construct questions for its examinations.[1] The SCORE Web portal has been recognized as a successful tool to deliver educational content. Through partnerships with multiple specialty boards and societies, SCORE is in the process of developing specific curricula for pediatric surgery, vascular surgery, surgical oncology, and surgical critical care.

The Web portal remains an extremely dynamic and rich resource that is constantly evolving and improving with input from SCORE's diverse organizational structure and its users. Planned new features include improved navigation to self-assessment content, more robust reporting and tracking features, and expanded content to support all six of the competency areas.[1] The SCORE Web portal is a robust, comprehensive, multimedia resource and adjunct for the education and training of general surgery residents. •

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Resident Research Fund

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

I have had the opportunity to speak with many of the faculty in the Department of Surgery who agree that their experience as a resident or fellow was invaluable; it probably shaped their medical career. Most former residents realize that their residency experience at the Medical College of Wisconsin (MCW) was the pinnacle of their medical and surgical training.

The Department of Surgery at MCW has long been a national leader in teaching, academic achievement, and patient care. Over the years, the Department alumni include a number of distinguished graduates who have gone on to become very successful clinicians, educators, scientists, and administrative leaders. However, some of the attributes that have made our program so successful in the past are now threatened by financial constraints. That's why Dr. Douglas Evans, Professor and Chair, Department of Surgery, and so many other members of our faculty are supporting efforts like the **Resident Research Fund** to promote continued academic achievement.

The Resident Research Fund provides surgical residents an opportunity to initiate and complete research projects related to their professional interests. The objective of the research experience is to create opportunities for residents to gain an understanding of basic, clinical, and translational research methods that inspire them to pursue opportunities for career development as investigators.

The Resident Research Fund insures that research will enhance the Department of Surgery's existing programs with a dedicated laboratory experience. This allows residents to experience the process of translating scientific knowledge from the bench to bedside. "The research fellowship I completed between my clinical years dramatically changed my career outlook, and gave me a competitive edge with interviews for fellowships and jobs," said Ryan Groeschl, MD, a PGY IV in the Department of Surgery. One of our incoming Administrative Chief Residents, Dr. Groeschl is currently applying for a fellowship in Hepato-Pancreato-Biliary Surgery, advanced training in the field of liver, pancreas, and biliary surgery.

"The research fellowship I completed between my clinical years dramatically changed my career outlook, and gave me a competitive edge with interviews for fellowships and jobs."

Ryan Groeschl, MD

You can participate in furthering science and advancing the field of surgery by giving our residents the skills they need to be tomorrow's outstanding physicians and scientists. For more information, contact Meg Bilicki at (414) 805-5731 or mbilicki@mcw.edu. We are deeply grateful to every individual who supports the MCW's Department of Surgery. Thank you for your thoughtful commitment to our future, and if you would like to contribute to the Resident Research Fund, please refer to the enclosed giving envelope. •

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Upcoming Events

September 5: Fall Pancreatic Cancer Symposium

This half-day symposium will focus on multimodality therapy with special emphasis on innovative molecular-based neoadjuvant treatment sequencing.

September 30: Anna Ledgerwood, MD—Schroeder Visiting Professor

The Department of Surgery is honored to welcome Anna Ledgerwood, MD, as the 28th Annual C. Morrison Schroeder Memorial Lecturer. Dr. Ledgerwood is currently professor of surgery at Wayne State University and Trauma Director of Detroit Receiving Hospital. She is one of MCW's most distinguished alumni and is current President of the American Surgical Association.

October 11: First Annual Foregut Symposium

This day-long educational activity is to familiarize the audience with the current status and future directions of treatments for common and uncommon diseases of the foregut.

Please contact Dana Schmidman (dschmidm@mcw.edu) for more information on any of these events.

For a listing of select ongoing case conferences, please see
www.mcw.edu/FileLibrary/Groups/Surgery/CaseConferences1262010.pdf.