

# Indiana University Student Research Symposium

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The following works were accepted for presentation at the Indiana University Student Research Symposium, which serves to highlight student research from all levels of experience in order to ignite interest and support for scientific inquiry in the IUSM medical community.

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## Qualitative Analysis of Syringe Services Program: Using Stories to Foster Changes in Public Health Crisis

◆ Nafisch A

Addiction has impacted populations for centuries, and with the emerging field of narrative medicine, clinicians can address individuals' health and illness accounts in greater depth. By listening to people's stories and interpretations, qualitative researchers and health care professionals can, based on conversations with key participants involved in the situation, foster changes in medical and public health issues, like the opioid crisis in Indiana.

To determine how to most effectively move forward in combatting the challenges that Scott County and Indiana as a whole currently face with opioid addiction and HIV and hepatitis C outbreaks, fifteen interviews were conducted and coded via the qualitative data analysis program, NVivo 10, for recurring themes related to the implementation of syringe services programs. Law enforcement, first responders, and local health department employees were interviewed to discuss their experiences with the programs and working directly with clients dealing with opioid addiction.

Conducting qualitative studies focusing on the community in Scott County allowed researchers to work closely with public health officials and other key figures to attempt to determine how to preserve and refine the current solution of syringe services programs. By asking questions, reviewing responses, and thoroughly discussing themes with a group of researchers from distinctive backgrounds, interviewees' stories are more effectively heard and understood. Examining data obtained from individuals who play significant roles in working with community members impacted by drug abuse and HIV outbreak cases and analyzing a previous study done with community members enrolled in syringe services programs led to new recommendations and treatments to come to light.

## Complex Diagnosis of Tuberculous Meningitis

◆ Roesler A, Christodoulides A, Sandler R, Petruccianni A, Allen D

A 33-year-old woman, 14 weeks pregnant, presented to the emergency room with a four day history of headache with chills, fever, night sweats, nausea, and vomiting. She had several risk factors for TB, including immigrating from Mexico, a weakened immune system, and a recent pregnancy. Meningitis was suspected, however a lumbar puncture was unable to be performed due to patient discomfort. Empiric antibiotics were given and the patient was discharged home after symptoms improved a day later. Following discharge, the patient experienced a spontaneous abortion the next day that was thought to be unrelated to the illness. One week later, she returned to the emergency room with similar symptoms of headache, fever, nausea, and vomiting. During this visit, a lumbar puncture was performed and cerebral spinal fluid analysis revealed aseptic meningitis. Stain and culture were negative but the T-spot returned positive. The health department was contacted and the patient was started on rifampin, isoniazid, pyrazinamide, and ethambutol. As of January, the patient is responding well to therapy.

Pulmonary TB has drastically declined in the United States, however the rate of meningeal TB has not. Early detection is pivotal as 15-40% of cases prove fatal, despite effective treatment. In Indiana alone, there were 116 cases of tuberculosis in 2018, with 16.4% being extrapulmonary. Pregnant women are at significant risk, with tuberculosis being an important contributor to maternal mortality and one of the top three leading causes of death for women aged 15-45 globally.

Disseminated TB has the ability to present in a myriad of manners depending on organ systems being afflicted, making initial diagnosis a challenge. With this being said, early diagnosis and treatment is pivotal to improved patient outcomes as the timeliness of clinical action has been shown to drastically improve patient outcomes.

## Is Sedentary Behavior Associated with Dysglycemia in Youth with Obesity?

◆ Sotomayor AA, El-Mikati H, Yazel-Smith K, Hannon T

**Background:** The childhood obesity epidemic is linked with an increase in dysglycemia and type 2 diabetes (T2D) amongst youth. Adolescence is associated with decreased levels of physical activity, however, there is a paucity of research investigating physical activity measures and dysglycemia in youth. We hypothesize that decreased physical activity and/or increased sitting time is positively correlated with dysglycemia.

**Methods:** Study participants were youth aged 10-21y with a BMI >85th percentile for age and gender. Accelerometers (activPAL) and the FELS Physical Activity Questionnaire (FELS PAQ) were used to assess objective and self-reported physical activity levels. Glucose tolerance was assessed with 2-hour oral glucose tolerance tests (OGTT). Independent t-tests were used to compare physical activity levels for participants with normal glucose tolerance (NGT) and dysglycemia. Correlation analysis was performed to evaluate relationships between measures of physical activity and OGTT measures.

**Results:** Participants with NGT (N=27) and dysglycemia (N=26) had comparable demographics; age, race, and ethnicity. Hemoglobin A1c (HbA1c) (p = 0.002), average fasting glucose (p < 0.00), indices of insulin resistance (HOMA-IR) (p = 0.023), insulin secretion (disposition index, DI, a marker of risk for T2D) (p = 0.008), 2-hour-OGTT measures for glucose (p = 0.004) and insulin (p = 0.002) differed between groups. There were not group differences for objective or self-reported measures of physical activity. For the entire cohort, sitting time was positively associated with OGTT 2hr glucose (r = .38, p = .03). However, a subgroup analysis showed that the association between sitting time and OGTT 2hr glucose was significant in the dysglycemia group only (r = .64, p = .006, vs r = .016, p = .95 for NGT group). Self-reported measures of activity (Likert scores) and OGTT measures for insulin and glucose were positively correlated.

**Conclusion:** Increased sitting time is associated with impaired glucose tolerance in youth with obesity at risk for T2D.

## Low Oxygen Regulates Phenotypic Properties of Hematopoietic Stem Cells

◆ Karlapudi A, Bhagwat M, Pate S, Basile C, Dausinas P, Slack J, O'Leary H

Hematopoietic stem cells (HSCs) reside in bone marrow in specialized low oxygen (O<sub>2</sub>, 1-4%) niches and give rise to all cells of the immune system. However, previous HSC studies have been performed with cells collected in non-physiologic ambient air (O<sub>2</sub>, ~20%). Past publications from our lab have shown that air exposure decreases stem cell number and their ability to engraft. Therefore, we investigated biomarker alterations in HSCs in native low O<sub>2</sub> conditions to understand their phenotype, function, and signaling patterns. One of these biomarkers was dipeptidylpeptidase 4 (DPP4), a serine protease expressed on hematopoietic cells that also has scaffolding functions and regulates, signaling, homing, and engraftment. We hypothesized that expression and activity of DPP4 in HSCs would be modulated by surrounding oxygen levels.

Thus, we isolated populations of HSCs from the bone marrow of C57BL/6 mice, exposed these cells to either normal or air or low oxygen conditions, and then treated these two populations with DPA and an antibody panel. We then collected data using flow cytometry, ImageStream, and a DPP4 activity assay. Results showed that DPP4 enzymatic activity was significantly decreased in HSC populations that were exposed to low oxygen conditions. However, the percent of DPP4+ cells was significantly increased in cells exposed to low oxygen as well. These data suggest that DPP4, a major regulator of HSCs, is modulated by oxygen levels in ambient air. Therefore, DPP4 may serve as a clinical target to mimic the protective effects of low oxygen on HSCs. Further investigations of collaborative mechanistic pathways modulating DPP4 expression and activity may open new avenues in enhancing HSC transplantation.

## Platelet Cryopreservation: A Means of Generating a Standardized In-Vitro Human Blood Clot

◆ Christodoulides A and Alves NJ

**Background:** Numerous models, both in-vitro and in-vivo, exist for the analysis of blood-clotting pharmacodynamics. However, reliance on animal models, fresh blood, or lack of a complete component profile translates to little standardization/reproducibility of clotting parameters. Given the above limitations, the goal of our study was to generate a reproducible, physiologic human blood clot through cryopreservation of platelets. We hypothesized that the cryopreserved platelets would have a prolonged ability to generate reproducible clots from the same blood draw over time.

**Methods:** Initial efforts focused on understanding the metabolic effects of storing platelets, plasma, and red blood cells (RBCs) at either 25 or 4°C over a period of 25-days. Glucose consumption was utilized as a proxy for metabolic activity and assessed using a glucose-hexokinase assay. Secondly: RBCs, platelets, and plasma were stored under their optimal storage conditions to retain functionality over time. RBCs at -4°C+CPDA1, plasma at -20°C, and platelets cryopreserved at -80°C. Stored blood components were assessed over 13 weeks following recombination via Thromboelastographic (TEG) kinetic clotting readouts and compared to Whole Blood+CPDA1 samples stored at 4°C. Blood samples were provided by healthy volunteers (n=5).

**Results:** Utilization of glucose by RBCs and platelets was significantly increased during storage at 25 versus 4°C, with RBCs maintaining very consistent glucose consumption rates compared to platelets. More importantly, storage of platelets at -80°C was shown to preserve clotting function for up to 14-weeks in comparison to WB that only maintained functionality for 2-weeks.

**Conclusion:** We were able to generate a reproducible synthetic human blood clot after 14 weeks of separated blood storage, as determined by TEG. Although not all parameters were preserved, we were able to maintain relative differences, ensuring consistent coagulability even with cryopreserved platelets. This marks a major stride toward the ultimate goal of generating a platform for pharmaceutical testing.

## Utility of SPECT-CT in Localization of Normocalcemic Primary Hyperparathyroidism

◆ Loncharich AJ, Huffman EM, Tann M, McDow AD

**Background:** Normocalcemic primary hyperparathyroidism (nPHPT) is characterized by normal serum calcium levels in the setting of elevated parathyroid hormone, which is unattributable to secondary causes. Prior studies have examined localization accuracy using ultrasonography, scintigraphy, and four-dimensional computed tomography (4DCT), but little is known about the utility of SPECT-CT in this cohort. The aim of this study was to investigate the utility of SPECT-CT in nPHPT patients.

**Methods:** We performed a retrospective analysis of patients receiving preoperative parathyroid localization at a single institution between 2015-2018. Exclusion criteria included patients with renal failure, vitamin D deficiency, malabsorptive disorders, liver disease, hypercalciuria, and certain medications. All patients underwent pre-operative localization with SPECT-CT, which entailed early and late planar images of neck and mediastinum following administration of Tc-99m sestamibi, SPECT, and CT with and without contrast. All patients were evaluated by an otolaryngologist or endocrine surgeon before surgery. Parathyroidectomy was performed with intraoperative PTH monitoring and pathologic confirmation of disease.

**Results:** A total of 783 patients were analyzed with 39 patients meeting inclusion criteria. The mean age of the patient cohort was 63.6+/-11 years and 87.2% were female. The mean preoperative calcium, PTH, and Vitamin D were 10.3+/-0.2 mg/dL, 102.6+/-45.7 pg/mL, and 48.5+/-13.7 ng/mL, respectively. Of the patients undergoing pre-operative bone mineral density scan, 43.3% and 53.3% had osteopenia and osteoporosis, respectively. Kidney stones were present in 25.6% of the cohort. SPECT-CT revealed a single gland in 69.2% and multiglandular disease (MGD) in 7.7% of patients. Pathology revealed 61.5% had a single adenoma and 38.5% had MGD. SPECT-CT determined the correct laterality of disease for 53.8% of patients.

**Conclusion:** SPECT-CT accurately lateralized disease in over half of patients with normocalcemic primary hyperparathyroidism. Compared to prior studies, SPECT-CT is a superior method of parathyroid localization than both ultrasonography and scintigraphy, and is comparable to 4DCT.

## L-Carnitine Deficiency Unmasked After Roux-en-y Gastric Bypass Surgery

◆ Pikus A, Patel P, Carlos WG

**Clinical Significance:** Levocarnitine deficiency is an inherited metabolic disorder consisting of a defect in transport of long chain fatty acids into the mitochondria leading to a buildup of lipids in multiple organs. Patients after gastric bypass are especially susceptible to nutritional deficiencies which may unmask such diseases. Gastric bypass-related hyperammonemia is a known complication with presentation ranging from weeks to years post op and carries 50% mortality, most commonly seen in females.

**Clinical Case Summary:** A 56 year old female with a history of Roux-en-Y gastric bypass presented for a worsening rash. She reported 10 days of a painful sloughing rash in her lower extremities, hands, abdomen, and vulvar/sacral areas. She was suspected to have cellulitis, given IV clindamycin and discharged home with cephalexin. She returned due to rapid spreading of her rash, diarrhea, dysphagia, visual changes, and dysuria. Physical exam was notable for tachycardia, right eye exudate and conjunctival injection, large areas of desquamation, and 2+ pitting edema. Initial workup for SJS was negative. She required MICU transfer due to cardiogenic shock and respiratory distress. Labs were significant for hyperammonemia (>250) and zinc/copper deficiency. She received lactulose with no improvement and was started on continuous veno-venous hemofiltration. She continued to be encephalopathic concerning for a urea cycle enzyme deficiency but the amino acid profile was not consistent with this. Genetics workup was more consistent with a L-Carnitine deficiency. **Conclusions:** This case illustrates the importance of considering a variety of metabolic deficiencies that can fruition after a gastric bypass surgery. Moreover, this case brings awareness to the complex and oftentimes delayed presentation of L-Carnitine deficiency.

## Expect the Unexpected: An Emergent Identification of a Cornual Ectopic Pregnancy

◆ Tenbarge M, Fraser A, Hand B, Shepler C, Underwood A, Thomas C, Benson H

A 36-year-old G5P4004 at 7w4d via LMP presented to OB triage with right sided abdominal pain and vomiting for several hours. She denied vaginal bleeding or passage of tissue. She had no history of prior ectopic pregnancies or abdominopelvic surgeries. BP was 83/49 and HR 80. Physical exam revealed exquisite tenderness to palpation in bilateral lower quadrants with involuntary guarding. Ultrasound demonstrated a left-sided cornual pregnancy measuring 10 weeks gestation with free fluid noted. Due to hemodynamic instability and peritoneal signs, she was emergently taken to the OR for an exploratory laparotomy. Approximately 800 mL of blood was noted upon opening and a left-sided cornual ectopic was confirmed. A left salpingectomy and wedge resection were performed without complication.

Cornual ectopic pregnancies are rare, comprising 2% of all ectopics, and are at high risk of hemorrhagic rupture. Risk factors include prior ectopic, IVF, and history of abdominopelvic surgery. Others include smoking, endometriosis, history of infertility, and history of Chlamydia infection.

Treatment approaches include surgery, methotrexate, or expectant management. Methotrexate is preferred because it is noninvasive and has comparable efficacy, safety, and fertility outcomes as surgery. Surgery is necessary in cases of rupture or large size. Studies appear to show that salpingectomy and salpingostomy lead to similar future fertility outcomes. Approximately 1/3 of women are candidates for methotrexate, while the other 2/3 require surgery.

In terms of future fertility, those with invasive uterine surgeries are at a higher risk for uterine rupture during subsequent pregnancies, a slightly higher risk of delivering preterm, and are more likely to deliver via cesarean section. Women who have had previous ectopics will also be at an increased risk for future ectopic pregnancies. Early identification and emergent intervention were paramount in this case and should help guide patient education on when to seek medical evaluation.

## Early Clinical Predictors for Disease Progression and Severity in Novel Coronavirus SARS-CoV-2 to Guide Patient Triage and Management

◆ **Grisoli A, Fraser A, Turchi AM, VanDeman HR, Koscielski MF, Riordan ND, Zimmer DF, Fraser ME**

The SARS-CoV-2 pandemic has tested the limits of healthcare response systems on a global scale. A novel and rapidly spreading virus creates immediate need for data to predict clinical course and necessary interventions to allow hospital systems and providers to prepare and respond to the pandemic. Prolonged clinical course is common in COVID-19 patients. This has resulted in patients being discharged from emergency departments only to return in more severe disease states. A wide range of clinical severity across a large patient population creates difficulty for clinicians to identify which subsets may benefit from intervention, continued monitoring, hospitalization, or intensive care interventions. Providers require an effective set of criteria to accurately predict which patients will progress in illness to levels requiring inpatient support, ICU level care, or intubation followed by prolonged ventilation. With retrospective chart review of available patient data from Memorial Hospital in South Bend, Indiana, we have analyzed presenting signs, symptoms, quantified analysis of chest radiographs, and existing clinical prediction scoring systems to correlate with patient outcomes. These data may guide screening order sets to more accurately triage patients according to future need and allow for approximation of disease progression for individuals. These results will be vital to more efficiently utilize the available medical resources while minimizing unnecessary resources for patients with more mild progression and optimistic prognosis, throughout the course of this pandemic.

## Dazed and Confused: Overlap Presentation of ADEM and CAPS

◆ **Jacobs A, Bajpai S, Burns C, Tat K, Peterson R**

**Case:** 4-year-old female with periodic fever syndrome presented to emergency department febrile to 103–105F for three days with preceding bilateral leg pain, characteristic of her periodic fevers. However, she did not respond to periodic fever treatment, remaining febrile with emesis, diarrhea and concern for visual hallucinations. Lumbar puncture showed lymphocytic pleocytosis. Empiric meningitis treatment was begun and stopped once ruled out. Hallucinations and altered mental status persisted. MRI showed multifocal hyperintense signals consistent with Acute Disseminated Encephalomyelitis (ADEM). Her ADEM diagnosis was complicated by a concomitant positive NLRP3 gene mutation consistent with Cryopyrin-Associated Periodic Fever Syndrome (CAPS).

**Conclusion:** CAPS is an autoinflammatory disorder in which pediatric patients recurrently present with fever, malaise, rash and arthralgia due to excessive production of IL-1beta. ADEM is a monophasic autoimmune demyelinating disease of the central nervous system associated with heightened expression of IL-1beta and TNF-alpha in response to infection or genetic proclivity. These inflammatory markers are toxic to myelin causing fever, headache and nausea, as well as neurologic symptoms.

**Clinical significance:** Both ADEM and CAPS cause severe immune-mediated responses due to overexpression of IL-1beta. Initial presentation of high fever and leg pain in a child with CAPS strongly suggests the onset of a fever flare. However, worsening GI and neurologic symptoms with refractory fever warrant a wider differential and prompt workup of other etiologies. ADEM must be on the differential for pediatric patients with acutely altered mental status and symptoms of periodic fever syndrome. This case poses a possible synergistic association between ADEM and CAPS due to immune dysregulation. Underlying CAPS and increased IL-1beta may have predisposed the patient to developing ADEM or exacerbated the systemic response.

## Evaluation of Lever-Actuated Resonance Assistance (LARA) Wheelchair Device for Stroke Rehabilitation

◆ **Sedaghat A, Harvey RL**

For those with upper extremity impairment post-stroke, the road to recovery can be daunting. There is evidence that the lower extremity is faster to train and can regain function better than the upper extremity due to the fact that there are more resources available for the retraining of the lower limb. Originally developed at University of California Irvine, the Lever-Actuated Resonance Assistance (LARA) was created to solve these issues. A LARA device uses a lever drive and arm support to provide proper arm positioning and ease of use, as well as mechanical resonance with elastic bands to provide increased ease of mobility as compared to the traditional push rim wheelchair. LARA can be attached to a manual wheelchair and allow patients to rehabilitate their weakened extremity through stationary exercise, self-powered overground propulsion, or through a motor-based electronic interface that allows patients to use their arms to control a video game using the LARA wheelchair lever drives. In this study, the effects of the LARA wheelchair were investigated using post-stroke arm movement recovery with improvement in functioning as the primary outcome, as determined by the Upper Extremity Fugl-Meyer Assessment. Six individuals with a stroke within 30 days of enrollment were recruited from the inpatient Brain Innovation Center at the Shirley Ryan AbilityLab in Chicago, Illinois. Baseline Fugl-Meyer assessments were performed and subsequently compared to post-clinical Fugl-Meyer values after 3 weeks of therapy with LARA. Among these participants, the average increase in UE Fugl-Meyer scores was  $4.3 \pm 7.2$  (95% CI, 4.27–4.3), with current literature citing a clinically significant increase in UE Fugl-Meyer score to be 4.25. It was thus determined that clinically significant improvement was seen among these participants overall. However, meaningful statistical conclusions cannot be drawn from the data at this time given the extremely small sample size.

## Evaluation of Ross Aortic Valve Replacement on Patients Over the Age of 50

◆ **Gilani A, Patel P, Brown J, Herrmann J**

**Background:** The Ross procedure has traditionally been performed in younger patients due to lack of indefinite anticoagulation and long-term reintervention required of mechanical, xenograft, and allograft aortic valve replacement (AVR), respectively. This case series serves as an evaluation of follow-ups from all patients over the age of 50 who have undergone the Ross Procedure at Indiana University School of Medicine and seeks to understand the efficacy of utilizing pulmonary autograft (Ross) in older patients.

**Methods:** From 1995–2019, 71 patients over the age of 50 underwent the Ross Procedure at Indiana University School of Medicine. A retrospective chart review including pre-operative diagnoses, surgical notes, and longitudinal follow-ups were all evaluated in order to understand the long-term efficacy of the Ross procedure in this patient population.

**Results:** Patients in this review receiving the Ross Procedure were between the ages of 50–68, with a mean age of 56.9 years. Among the 71 patients, 58 [81.7%] presented pre-operatively with aortic stenosis while 13 [18.3%] presented with aortic insufficiency. Of the former 58 patients, 35 also presented with concomitant aortic regurgitation ranging from either mild [17], moderate, [11], or severe [7]. Patients had a median length-of-stay (LOS) of 5 days, with a mean of 7.7 days. There were no peri-operative mortalities; however, there were six instances of late mortality post-Ross ranging from two months to 16 years. There was also one instance of early mortality due to cardiac tamponade. Of 71 total patients, 63 (88.7%) experienced lifetime freedom from any valvular reintervention. Of those requiring reintervention, the average time to reintervention was 3.94 years, while 10-year freedom from reintervention was 90%. There were no mortalities associated with reintervention in any of the patients in this study.

**Conclusions:** The Ross Procedure is a viable alternative to mechanical and allograft AVR in individuals over the age 50, effectively alleviating the need for lifelong anticoagulation associated with mechanical AVR, as well as the consistent reintervention required with allograft AVR.

## The Safety of Rituximab for the Treatment of Autoimmune Blistering Diseases

◆ Mohammed A, Li W, Rahnama-Moghadam S

**Background:** The anti-CD20 antibody rituximab has been shown to improve response rates in patients with autoimmune blistering diseases. However, the safety profile of rituximab is unclear. We aimed to systematically evaluate reports of complications.

**Objective:** To evaluate rituximab's safety for the treatment of autoimmune blistering diseases compared to other immunosuppressive agents.

**Methods:** The PRISMA checklist guided the reporting of the data. We searched Ovid MEDLINE(R), PubMed, EMBASE, Cochrane Library, World Health Organization's Global Index Medicus, EBSCO CINAHL Complete, Elsevier Scopus, the Web of Science Core Collection, and grey literature databases between 22 February 2019 and 10 July 2019 concentrating on autoimmune blistering diseases including pemphigus vulgaris, pemphigus vegetans, mucous membrane pemphigoid (cicatricial pemphigoid), bullous pemphigoid, and linear IgA.

**Results:** The literature search identified 4,567 articles. After screening titles and abstracts against the inclusion and exclusion criteria and assessing full texts, 95 articles were finally included in a narrative synthesis. 66 articles were cohort studies and case series which reported adverse effects in 253 patients over a denominator of 1548 patients with autoimmune blistering diseases (16.3%). Adverse events included sepsis, pneumocystis carini, osteomyelitis, phlegmon, cytomegalovirus, alveolitis, cellulitis, community acquired pneumonia, citrobacter, herpes simplex, herpes zoster, neutropenia, hypogammaglobulinemia, brain abscess, and infective endocarditis.

**Conclusions:** The available data suggests that despite the safety of rituximab for autoimmune blistering diseases, its use may be associated with significant adverse effects. Thus, close monitoring of patients treated with rituximab is recommended, along with prophylaxis as necessary.

## A Prototype ECG for Neonatal Resuscitation

◆ Woloshuk A, Sivaprakasam A, Patel N, Warrick A, Witten A, Brennan L, Guckien Z, Diggins N, Garcia L, Wang L, Acchiardo J, Merrell J

**Introduction:** Evaluation of neonates based on cry, muscle tone, and heart rate is essential in triage of resuscitation efforts. In particular, the neonatal heart rate is used to determine the next steps in management. Auscultation or pulse oximetry can be used to assess heart rate, but these methods are often imprecise. ECG remains the gold standard of heart rate assessment. However, a barrier to ECG use during critical and time-sensitive actions is the fact that lead placement currently requires time, expertise, and space. The 2015 Neonatal Resuscitation Program (NRP) suggests that improved technology for rapid ECG assessment may result in better resuscitation outcomes [1].

**Methods:** Two surface electrodes were used to calculate potential differences between either the wrists, shoulders, or chest. The electrode potential difference was amplified and pre-filtered in a custom circuit prototype composed of an instrumental amplifier, a band-pass filter, and a notch filter. This signal was then sent to a computer which used a custom algorithm to further filter noise, create a threshold, and compute heart rate. A housing unit was constructed using computer-aided design (CAD) software to prototype the neonatal heart rate monitor. The housing protects the device power supply and internal hardware, while providing the clinician with easy access to the electric leads.

**Results / Conclusions:** The prototype neonatal heart rate monitor consists of a housing, ECG circuit, and postprocessing algorithm. Data collection from three locations on an adult volunteer suggests the signal collection and processing provides enough information to determine heart rate. Future design considerations involve reducing the size of the circuitry, refining the peak detection algorithm, and performing validation on ECG signals from neonates. Future implementation of this device has the potential to provide hassle-free, fast, and accurate heart rate monitoring in the neonatal resuscitation workflow.

## Assessment of Bone Healing Agents for Promoting Bone Regeneration in Spaceflight

◆ Sun S, Zamarioli A, Dadwal UC, Childress PJ, Chakraborty N, Gautam A, Hammamieh R, Kacena MA

**Background:** When faced with difficult-to-heal bone injuries, orthopedic surgeons may use biological agents to stimulate healing. Bone morphogenetic protein-2 (BMP-2) and thrombopoietin (TPO), an FDA-approved agent and a novel therapeutic alternative respectively, can be used in these cases to stimulate osteogenesis. Additionally, with the growing interest in space exploration and colonization, these agents may be used to treat fractures in astronauts. This study aims to elucidate how the absence of gravity alters the mechanisms and actions of these agents.

**Methods:** 60 C57BL/6 male mice underwent a 2-mm femoral segmental bone defect (SBD) surgery and were treated with either saline, BMP-2, or TPO. These mice were further divided into groups that were either housed on Earth at the Kennedy Space Center (Ground) or in space at the International Space Station (Flight). After 4 weeks, bone regeneration in the femurs was assessed by micro-computed tomography ( $\mu$ CT).

**Results:** BMP-2 treatment induced successful callus formation and bone bridging in both Ground and Flight groups, but usage in flight resulted in lower bone density ( $p=0.08$ ), fewer trabeculae ( $p=0.03$ ), and higher trabeculae separation ( $p=0.04$ ). Comparatively, TPO treatment induced better bone bridging in the Flight group than in the Ground group, with usage in flight resulting in higher bone density ( $p=0.05$ ) and trabeculae connectivity ( $p=0.001$ ).

**Conclusions:** BMP-2 has remarkable bone healing properties, but its mechanism of action is dependent on gravity. Although TPO heals bone more slowly than BMP-2, its mechanism of action does not depend on gravity and new bone is of higher quality. BMP-2 treatment also caused either death or distress (resulting in euthanasia) in 50% of the spaceflight mice, suggesting a possible negative interaction. Understanding this phenomenon further is important for providing safe and efficacious fracture treatments for those living in space for long-term periods.

## Irreversible Gastrointestinal Failure in Necrotizing Pancreatitis Treated with Abdominal Multivisceral Transplant

◆ Bajpai S, Hacker A, Monirian LM, Saldivar R, Zyromski NJ, Maatman TK

**Background:** Necrotizing pancreatitis (NP) develops in 10–20% of acute pancreatitis patients and results in a profound locoregional and systemic inflammatory response. Occasionally, NP causes catastrophic abdominal visceral failure. Irreversible gastrointestinal (GI) failure is increasingly treated with multivisceral transplant (MVT); however, MVT has not previously been described in the NP population. We hypothesized that patients developing GI failure secondary to NP may be successfully treated by abdominal multivisceral transplant.

**Methods:** A retrospective review of patients developing irreversible GI failure from NP treated with abdominal MVT between 2005–2018. In a case report of 647 NP patients, three patients developed irreversible GI failure and were treated with MVT. Two patients were male, and one patient was female. The median age at onset of NP was 49 years. Etiology of NP was biliary ( $N=2$ ) or alcohol ( $N=1$ ). In each case, infected necrosis was treated with repeated open pancreatic debridement and multiple percutaneous drains. Etiology of intraabdominal organ failure included enterocutaneous fistula and multiple small bowel resections in two patients and superior mesenteric vein thrombosis resulting in intestinal ischemia and total enterectomy in one patient. All patients developed short-gut syndrome with total parenteral nutrition induced liver fibrosis. Abdominal MVT was performed a median of 3.3 years after onset of NP and included stomach, small intestine, pancreas, and liver ( $N=2$ ) or small intestine, pancreas, and liver ( $N=1$ ). Median survival after MVT was 3.9 years. Two patients died during follow-up after MVT; one patient died of metastatic lung cancer 6.6 years after MVT and one patient died of angiosarcoma of the transplant liver 3.9 years after MVT. One patient is alive without complication 6.6 years after MVT.

**Conclusion:** Irreversible gastrointestinal failure is a rare complication of necrotizing pancreatitis. In this desperate circumstance, a lifesaving therapy in select patients is multivisceral transplant.

## A Potential Avenue to Atherosclerotic Cardiovascular Disease: An Analysis of the Effect of Genetically-Induced Hypercholesterolemia on Zebrafish

◆ **Bowens J, Macrae C, Kithcart A**

Atherosclerosis is the leading cause of death in the U.S., killing one American every forty seconds, and is a medical nightmare to many. The current understanding is that hypercholesterolemia may play a role. Research has suggested that genetic mutations in low-density lipoprotein receptor (LDLR), apolipoprotein-B (APOB), and apolipoprotein-CII (APOC2) correlate positively with the development of atherosclerosis. On the other hand, alterations in proprotein convertase subtilisin/kexin type 9 (PCSK9), interleukin-1 $\beta$ , and angiotensin-like-3 (ANGPTL3) have correlated negatively. For these reasons, this project seeks to explore novel mechanisms that may link hypercholesterolemia with atherosclerosis.

We utilized the CRISPR-Cas9 system to create null mutants in LDLR, APOB, and APOC2. Guide RNAs were designed and injected into zebrafish embryos at the one cell stage. These fish were then screened using a fluorescent microscope to confirm injection one day after fertilization. The fish were then incubated until the seventh day after fertilization, at which point they were graduated into adult tanks where they were fed under a controlled or high-cholesterol diet. DNA was isolated from fish fin clips and amplified with PCR to confirm the presence of mutation. Cardiovascular-related phenotypes were assessed at several points.

We show that CRISPR-Cas9 technology can be applied to create zebrafish mutants. We found that embryos injected with LDLR and APOC2 CRISPRs often display embryologic deficiencies and were unable to hatch from their respective chorions, even after showing initial signs of life. Enhanced angiogenesis and high levels of cholesterol deposition were found in the dorsal aorta and the caudal vein of APOB mutants under both regular and high cholesterol diet. This was synonymous with wildtype zebrafish fed a high cholesterol diet. Uninjected fish did not display any clear sign of hypercholesterolemia.

Based off this data, it is fair to conclude that LDLR and APOC2 CRISPRs may lead to embryologic development deficiencies in zebrafish. APOB and LDLR mutants display similar characteristics as fish fed a high cholesterol diet. Overall, it was found that genetic manipulation can be used to mimic diet-mediated hypercholesterolemia in zebrafish. This will be useful in the future to study new mechanisms of atherosclerosis and the genetics causes of hypercholesterolemia.

## A Rare Case of Pseudomonas Mendocina Sepsis

◆ **Northquist W, Howley L.**

**Background:** *Pseudomonas mendocina* is a gram negative, aerobic bacteria which rarely causes infection in humans; there have been 14 reported cases of infection worldwide, with only two from the United States. A range of infection types have been caused by *P. mendocina*, including endocarditis, meningitis and wound infections. Different antibiotics have been used to treat the infections, and patients survived the infection with treatment. In all cases, a source of the infection was unable to be identified. However, previous case reports have speculated regarding the possibility of inoculation through the skin as a potential source.

**Case:** A 60 year old male with history of alcoholic cirrhosis, chronic heart failure and recurrent lower extremity cellulitis presented with 1 day of fever to 103.2, shortness of air and increasing drainage and pain from LLE wound. He was admitted to the hospital with septic shock likely from a left leg cellulitis as the source of infection, and was started empirically on IV Vancomycin and IV Piperacillin-Tazobactam. On hospital day 3, the admission blood cultures were positive for *P. mendocina*. He was transitioned to oral Levofloxacin on day 4 and completed a 14 day total antibiotic course with resolution of the infection.

**Discussion:** *Pseudomonas mendocina* very rarely causes infection in humans. The infection discussed here presented with acute fever, which rapidly responded to antibiotic treatment. *P. mendocina* is susceptible to a multitude of antibiotics. Consistent with previous reports, this patient had significant co-morbidities, suggesting that patients with co-morbidities may be at increased risk. Previous reports have also suggested the possibility that the bacteria may be introduced through the skin. The fact that this patient with *P. mendocina* bacteremia had a chronic lower extremity wound provides additional support to the idea that the bacteria can cause sepsis via introduction through the skin.

## Characterization of Medical Malpractice Lawsuits Relating to Dermatologic Emergencies in the Inpatient and Emergency Setting

◆ **Rumancik B; Keele BJ; Rahnama-Moghadam S**

**Introduction:** Characterization of malpractice lawsuits can help improve patient safety and reduce medical liability. Little information is available regarding dermatologists' potential to alleviate legal burdens facing hospitals and physicians in the hospital setting.

**Objective:** We sought to characterize malpractice lawsuits filed against physicians or hospitals for dermatologic emergencies in the inpatient or emergency setting.

**Methods:** In September 2019, we conducted a search for malpractice lawsuits using a national legal research database, Lexis Advance®. To be included, the lawsuit must describe a plaintiff claim originating from an inpatient or emergency department occurrence directly related to a dermatologic emergency. **Results:** From the years 1987 to 2018, 158 lawsuits met inclusion criteria. Sixty-five lawsuits resulted in plaintiff verdicts or settlements for a total monetary recovery of \$221,032,728. Ninety-three lawsuits resulted in defendant verdicts or outcomes with no reported monetary recovery. Stevens-Johnson syndrome/toxic epidermal necrolysis (SJS/TEN) was the most common diagnosis with 73 cases. Total monetary recovery from the 27 SJS/TEN plaintiff verdicts or settlements was \$153,367,500. Delayed diagnosis, misdiagnosis, or failure to diagnose was the cause of 77% of the lawsuits included in this study. Wrongful death was the injury for 48% of the lawsuits that defined an injury. Of identified physician specialties, emergency medicine was named most commonly (n = 37); however, 54 lawsuits originating from an inpatient setting named the hospital exclusively or did not explicitly identify the specialties involved. Dermatologists were never identified as defendants. Only 7 cases described dermatology involvement in the care of the plaintiff.

**Conclusion:** This study underlines the value inpatient dermatology has in protecting hospital systems and non-dermatologists from legal and financial harm in addition to protecting patients.

## Stunning (and Yet Unnecessary) Diagnostic Imaging of an Aspirated Foreign Body - Case Report and Clinical Images

◆ **Marsec M, Collins S**

**Introduction:** Pediatric foreign body aspiration is a common cause of emergency room visits. Despite the high sensitivity and specificity of a thorough history and physical exam, such cases often involve expensive and invasive procedures including bronchoscopy and/or clinical imaging as part of the diagnostic process. In cases where the aspirated foreign body is located in the upper airway, and can be visualized using direct laryngoscopy, such expensive and invasive procedures may be wasteful, unnecessary, and even harmful.

**Case Report:** A 5 year old was brought to the emergency department in moderate distress with complaints of difficulty breathing. Her parents reported that she had swallowed a toy doll approximately 15 minutes earlier. Besides mild difficulty breathing, a thorough history and physical revealed no signs of any immediate threat to life or acute decompensation. Using direct laryngoscopy, the emergency physician was able to visualize the feet of the toy doll hooked on the child's arytenoids, with the body extending down into the child's trachea. The physician decided not to attempt intubation due to the location of the foreign body. The physician then ordered several imaging tests and a consultation to the on call gastroenterologist who performed esophagoscopy. All three imaging modalities confirmed what was previously found on direct laryngoscopy: a toy doll in the child's upper trachea. Ultimately, the on-call otolaryngologist was consulted, was able to visualize the toy using direct laryngoscopy, and removed the toy using a pair of children's size larynx foreign body removal forceps.

**Conclusion:** Aspiration of a foreign body in a child can be an anxiety-provoking experience. However, unless the child presents with immediate threat to life, clinicians should use careful judgement when considering expensive, harmful, and possibly unnecessary diagnostic imaging.

## Neonatal Lupus with Left Bundle Branch Block and Cardiomyopathy

◆ Rumancik B, Haggstrom AN, Ebenroth ES

A 4-week-old female, born to a mother with anti-Sjögren's-syndrome type A/Ro (anti-SSA/Ro) and anti-Sjögren's-syndrome type B/La (anti-SSB/La) autoantibodies, presented with a 2-week-long rash consistent with neonatal lupus (NL). Screening fetal echocardiograms showed no abnormalities. After discovery of her rash, a screening electrocardiogram revealed left bundle branch block (LBBB) and echocardiography found severely dilated cardiomyopathy with a 25% ejection fraction and a thin echogenic dyskinetic ventricular septum. Serum testing revealed elevated antinuclear, anti-SSA/Ro, and anti-SSB/La antibody titers. Other than the rash, she was asymptomatic and treated with medical management for heart failure. At 3 months of age she was admitted for intermittent tachypnea. Cardiac catheterization revealed patent coronary arteries, and endomyocardial biopsy showed no abnormalities. During catheterization she developed pulseless electrical activity requiring extracorporeal membrane oxygenation (ECMO). While on ECMO, she was treated with biventricular pacemaker placement, plasmapheresis, and intravenous immunoglobulin (IVIG). ECMO was weaned off after 7 days, and she was discharged with improved systolic function (30% ejection fraction). Outpatient follow up at 8 months of age revealed narrower LBBB paced rhythm, normal left ventricular volume, 70% ejection fraction, and age appropriate weight and height percentiles.

Cardiac structural abnormalities, most often associated with histologic inflammatory signs, are well-described in NL. This patient's thin, dyskinetic ventricular septum is an abnormality not previously reported in NL. This patient's lack of histologic inflammatory signs contributes to growing evidence of a possible "late-onset" subtype of NL-related cardiomyopathy. "Late-onset" cardiomyopathy may be due to an ongoing postnatal autoimmune process, as was concerning for our patient given her negative fetal cardiac screenings. Given the possible postnatal immune process, IVIG and corticosteroid regimens have been attempted in other case reports. Our case provides further anecdotal evidence for IVIG, plasmapheresis, and biventricular pacemaker use in NL-related cardiomyopathy. Lastly, LBBB is a manifestation rarely reported in association with NL.

## Asthma in Indiana: Using a Community Health Matrix to Determine Asthma Health Factors for Indiana Counties

◆ Burrell M, Casey R, Savaiano D

**Background:** Asthma and its appropriate treatment are public health issues in Indiana that Indiana Joint Asthma Coalition (InJAC), a partnership within CTSI, is attempting to address. This is done through state-wide coalition building, which unifies efforts regarding asthma health and education and promotes interprofessional collaboration. Because time and resources are limited, InJAC must choose the areas that would benefit most from their focused work. A matrix was developed to establish the 10 counties with poorest asthma health and high vulnerability to social determinants to aid in this choice. We hypothesize that the 10 counties with the highest vulnerability to social determinants of health will have the worst asthma health.

**Methods:** Asthma health outcomes, contributing asthma-related variables, and social determinants of health were identified in all 92 counties in Indiana. Counties were compared by composite z scores to determine the top 10 counties with the poorest health statistics for asthma and social determinants. In addition, qualitative data will be used to identify local health coalitions that have the capacity and desire to work with InJAC to improve asthma treatment. InJAC will begin sessions with these counties to determine if long-term, sustainable, health promotions are feasible.

**Results:** The top 10 counties that were identified as having the poorest asthma health and factors were Lake, Grant, Madison, Marion, Huntington, Vanderburgh, Howard, La Porte, Blackford, and Noble. The top 10 counties with highest vulnerability to social determinants were Owen, Ripley, Daviess, La Grange, Fayette, Wayne, Elkhart, Newton, Switzerland, and Marion.

**Potential Impact:** The data from this matrix will help direct InJAC to the areas of Indiana with the greatest need for asthma coalition efforts. This will be done through improvement on education, awareness, and quality of care based on the Indiana State Asthma Plan.

## Causes of Infant Mortality in Indiana, 2013-2017

◆ Cummiskey CA

**Background:** Indiana has a high infant mortality rate compared to the rest of the country, which is driven in part by stark racial disparities. There is a lack of reported data on causes of infant death in Indiana.

**Methods:** Indiana causes of deaths were analyzed using data from ISDH mortality and natality data sets from years 2013-2017. National data was analyzed from comparable data from the CDC WONDER Online Database. All deaths for individuals less than 1 year of age were included. Cause of death was determined by standardized underlying cause of death. Rates of death were determined by taking total number of infant deaths and dividing by the total number of live births in the same time period. Mortality rates for each cause of death were compared between Indiana and the United States, and within Indiana by single race.

**Results:** Indiana had significantly higher than national infant mortality rates for 7 of the top 15 causes of infant death, including all of the top 4 causes of infant death. Indiana had significantly lower than national average infant mortality rates for 2 of the top 15 causes of infant death. Within Indiana, Non-Hispanic (NH) black infants had an increased relative risk compared to NH white infants for 9 of the top 14 causes of infant death.

**Discussion:** Indiana has higher infant mortality rates compared to national for diverse causes of death. This poor overall infant mortality rate is driven by stark disparities between NH white and NH black infant mortality rates. NH black infants have worse mortality rates in most of the causes of death analyzed. Efforts to improve Indiana's infant mortality as a whole and should take an approach that addresses all of the diverse causes of death and that specifically addresses the disparities that disproportionately affect NH black infants.

## An Orthoplastics Approach to Complex Soft Tissue Defects Around the Hip

◆ Speybroeck J

**Objective:** Hip soft tissue defects, dead space and degloving injuries are rare, but challenging cases. Exposed bone and/or hardware require coverage with high rates of wound complications and infection. Various reported treatment algorithms exist without a defined gold standard. An orthoplastics approach can be successful to management of these defects at institutions lacking adjunctive soft tissue experts.

**Methods:** We retrospectively reviewed two patients (1 traumatic, 1 recurrent abscess) with complex lateral hip soft tissue defects requiring coverage after multiple surgical debridements. Intraoperative laser angiography using the SPY Elite system (Stryker, Kalamazoo, MI) confirmed the perfusion of the proposed adjacent soft tissue flap following intravascular injection of indocyanine. Keystone perforator island flaps (KPIF) were designed for a flap-to-defect ratio 1.5 to 1 by incorporating pedicle perforating vessels and surrounding fasciocutaneous tissue. Flaps were mobilized by previously described principles. De-epithelization of the more medial flap edge was used to decrease dead space over exposed hardware or bone. Closure was accomplished over multiple deep suction drains with monofilament inverted suture for the deep dermal layer and nylon suture for the epidermis. Laser angiography was used again after closure to assess perfusion of flap edges. Appropriate antibiotic coverage was used without purposeful prophylaxis.

**Results:** Both wounds healed without dehiscence, infection, or need for secondary intervention. At one year follow-up, satisfactory soft tissue integrity, osseous healing and functional status were observed in both cases.

**Conclusion:** Intra-operative laser angiography perfusion assessment can help guide local tissue rearrangement by KPIF to provide durable coverage of complex soft tissue defects around the hip. With experience and discretion this technique can be applied by the orthopedic trauma surgeon who may not have robust plastic surgical services readily available.

## A 6 Month Retrospective Analysis of the Clinical Results of Arthroscopic Rotator Cuff Repairs Between Standard Population and Diabetes Group

◆ McKeeman J, Sassmannshausen G

Rotator cuff tear is a common shoulder injury typically resulting from overuse or trauma. Diabetes is a possible risk factor for rotator cuff tears although current research has been inconclusive. This study explores the outcomes of rotator cuff repair surgery in a population with a history of Type II diabetes and a standard population. From July 2017 to December 2017, Dr. Sassmannshausen performed 43 rotator cuff repair surgeries. This clinical study demonstrates consistent success in the rotator cuff repair as well as establishes that there is no significant difference in the outcome of rotator cuff surgery in patients with a history of diabetes when compared to the standard population. This was achieved through data collection through voluntary survey following the surgery. Patients filled out three separate surveys: the Simple Shoulder Test, the UCLA shoulder test, and the ASES shoulder test. These tests give insight into the success rate of surgery by revealing patient percent recovery in specific objective and subjective categories, as well as an overall average score for each test. This particular analysis compares the standard population to patients with a history of diabetes. From the data gathered, it was concluded that none of the tests had statistical difference between the diabetes population and the standard at a level of  $p < .05$ . The data set is relatively small at 20 patients and continued research is being done to draw more solid conclusions, but from the data gathered in this study it can be concluded that Dr. Greg Sassmannshausen's rotator cuff repair surgeries are consistently successful between both groups.

## Disseminated Blastomycosis in an Immunocompetent Female

◆ Okoye C, Vinson W, Hoffman K

**Introduction:** Blastomycosis is caused by *Blastomyces dermatitidis*, a dimorphic fungus that can be found in soil and is endemic to North America, particularly the Mississippi and Ohio river valleys, Great Lakes region, and southeastern states. The lungs are typically the first site of infection, via inhalation of organisms; however, extrapulmonary dissemination to the skin, central nervous, and bone can occur. Cutaneous involvement commonly occurs in disseminated disease.

**Case Presentation:** We report a case of a 35-year-old African American female admitted with a six-week history of subcutaneous tender nodules. The first nodule appeared on her left clavicle. She subsequently developed similar lesions on her mid lower back, breasts, legs, and lastly, her face. The lesions were painful on palpation and would occasionally drain yellow to brown thick fluid. She had been seen in the emergency department on two separate occasions and received courses of clindamycin and augmentin as well as incision and drainage with no improvement. No cultures were collected at the time. Upon admission, the patient was found to have positive *Blastomyces* antigen. Chest CT demonstrated multiple consolidations and a CT scan of the neck demonstrated an enhancing mass overlying the left clavicle. FNA of the mass overlying the left clavicle showed a granulomatous inflammation with suppurative for which fungal culture was positive for *Blastomyces*. A punch biopsy of a lesion on the cheek showed intraepidermal microabscesses containing the walled fungal spore suggestive of blastomycosis. GMS stain demonstrated broad-based budding, consistent with blastomycosis. She denied any history of being immunocompromised and HIV testing was negative.

The knowledge that *Blastomyces* spp. can disseminate in both the immunocompromised and the immunocompetent is imperative. For physicians in endemic areas, characteristics such as simultaneous pulmonary and cutaneous infection should raise clinical suspicion. Diagnosis of blastomycosis involves the use of culture and non-culture diagnostic methods.

## Folliculotropic Mycosis Fungoides in a Peculiar Distribution

◆ Okoye C, Hooper P, Hoffman K

**Introduction:** Folliculotropic mycosis fungoides (FMF) is a variant of cutaneous T-cell lymphoma. FMF is unique in its tropism for the follicular epithelium. The infiltrate is mostly seen in the follicular epithelium with less cases showing epidermal involvement. This correlates with the predilection to localize to areas where pilosebaceous units are greatest which includes the head, neck and upper torso. It also accounts for the wide spectrum of clinical presentations seen with FMF.

**Case Presentation:** We describe a case of a 72-year-old male who presented with a 10-year-history of pink, scaly, pruritic patches and plaques scattered over the scalp, cheeks, and nose. Lesions were also present on the back, abdomen, bilateral hips, and thighs, but were morphologically different as they appeared as erythematous papules coalescing into plaques. He had a presumed diagnosis of psoriasis made many years prior. Histopathological analysis of the right frontal scalp revealed an atypical T-lymphocyte infiltrate with focal folliculotropism, concerning for mycosis fungoides. Sections demonstrated a relatively dense superficial to mid dermal perivascular infiltrate of small to medium sized lymphocytes with rare mixed large cells. Immunohistochemical staining showed that the infiltrate was composed of predominant CD3-positive T lymphocytes. A diagnosis of folliculotropic mycosis fungoides was confirmed.

**Discussion:** Due to variable presentation and histopathologic findings the diagnosis can be difficult. These presentations include follicular based patches and plaques, keratosis-pilaris like lesions, acneiform eruptions, and alopecia. One study showed an average mean time of 2.84 years between onset of rash and diagnosis. With a delay in diagnosis, a delay in proper treatment ensues. We highlight the importance of placing FMF in the differential diagnosis in patients presenting with those various presentations as mentioned above even with a deviant presentation that includes lesions on the extremities.

## Oral Facial Digital Syndrome Type 1 with Features of Nevus Comedonicus Syndrome in a Fourteen-Month Old Female

◆ Bittar N, Okoye C, Mannam H, Skillman S

**Introduction:** Oral-facial-digital syndromes (OFDS) represent a heterogeneous group of rare neurodevelopmental disorders associated with malformations of the face, oral cavity, and digits. Here we present a case of OFDS type 1 with features of nevus comedonicus syndrome in a fourteen-month old female.

**Case Presentation:** A 14-month-old girl presented to the dermatology clinic with her mother for concern of "spots" on her daughter's face since birth. On physical exam, the patient had hypertelorism, a depressed nasal bridge, natal teeth, and a bifid tongue. Additionally, multiple white pin-point cysts on her central forehead, nose, medial cheeks, and chin. Scaly pink patches were present on her scalp, arms and legs. Numerous closed comedones and prominent pores were in her left axilla. Further laboratory studies revealed low hemoglobin of 12.9 and slightly elevated creatinine 0.55. Genetic studies revealed a likely pathogenic variant in OFD1 gene. An MRI showed agenesis of the corpus callosum. A renal ultrasound demonstrated no significant findings, and a foot X-ray revealed a duplicated right 1st metatarsal. Based on the physical exam findings, in conjunction with the laboratory, genetic, and imaging results, the diagnosis of OFDS type 1 was made. The patient is being followed by Neurology, Ophthalmology, Pulmonology, Orthopedics, and Dentistry, who noted additional findings of optic nerve hypoplasia and moderate sleep apnea.

**Discussion:** Of the OFDS group, type 1 is most commonly associated with cutaneous findings, as in this patient. OFDS type 1 patients can develop a wide range of neurological, ophthalmologic, renal, and skeletal abnormalities. This patient's particular presentation shows overlap with another rare condition, known as nevus comedonicus syndrome, which is the presence of nevus comedonicus with extracutaneous findings of the bones, eyes, and brain. The relationship between the OFD1 gene and nevus comedonicus syndrome is unclear but may offer an avenue for future research.



## Dyskeratosis Congenita Presenting as Hypopigmentation and Nail Dystrophy in Siblings

◆ Bittar N, Okoye C, Broussard-Steinberg C, Haggstrom A

**Introduction:** Dyskeratosis Congenita (DC) is a rare telomere disorder with an incidence of approximately 1 in 1 million. DC has a large spectrum of mucocutaneous features and is associated with high risk of hematologic and solid malignancies as well as bone marrow failure. The classic triad of reticular skin pigmentation, dysplastic nails, and oral leukoplakia is diagnostic of DC. Here we present two unique cases of DC in siblings.

**Case Presentation:** Two siblings, a 9-year-old male and six-year-old female, presented to the dermatology clinic with nail and skin changes of several years duration. There is no known family history of skin conditions, nail disorders, or similar symptoms. On physical exam, both patients show variable reticulate hypopigmentation involving the neck, arms, wrists, palms and fingertips. Nail thinning, splitting, and dystrophy were also noted in both patients. Dermatoglyphics were intact in both patients and there were no mucosal lesions or plaques present. A complete blood count (CBC) was within normal limits for the male and mild leukopenia without neutropenia for the female. Further testing included telomere length quantification testing which revealed very short telomeres in comparison to age and sex matched controls. Based on these findings, the diagnosis of Dyskeratosis congenita was made.

**Discussion:** Dyskeratosis Congenita patients are at a high risk for multiple systemic complications from an increased incidence of malignancies to avascular necrosis of the hips and shoulders, to liver disease, pulmonary fibrosis and stenosis of the lacrimal ducts, esophagus and urethra. DC is thought to be due to genetic mutations in genes regulating telomere production. For these reasons it is critical to recognize the triad of cutaneous findings as early as possible in order for the appropriate follow-up assessments to be made. Routine monitoring of blood counts and bone marrow is key to monitor progression of cytopenias.

## Does a Robotic Approach to Adrenalectomy Improve Outcomes?

◆ Regele EJ, Steward JE, Sundaram CP

**Introduction:** A minimally invasive approach has become the standard of care for most cases requiring adrenalectomy. Both laparoscopic and robotic methods are currently used. We compare outcomes of these two surgical techniques for adrenalectomy.

**Methods:** A retrospective review of minimally invasive adrenalectomy cases conducted from 2009 to 2020 at a single academic institution was completed after Institutional Review Board approval. The daVinci Surgical system was used for the robotic procedures. Outcomes evaluated for comparison included length of hospital stay, operative time, readmission rate, and complications. The Clavien-Dindo Classification system was used to categorize complications. Independent samples T-tests and Pearson Chi-square analyses were used to assess for statistical significance.

**Results:** Of 138 patients included in the study, 82 underwent laparoscopic adrenalectomy and 56 underwent robotic adrenalectomy. The mean length of hospital stay for the laparoscopic and robotic groups was 2.05 (SD = 1.63) and 2.21 (SD = 1.33), respectively. The mean operative time in minutes was 119 (SD = 34) in the laparoscopic group and 145 (SD = 36) in the robotic group. In the laparoscopic group, five patients had a Grade  $\geq$ II complication. There were nine patients in the robotic group that had a Grade  $\geq$ II complication. Readmissions in the laparoscopic and robotic groups were eight and six, respectively. Operative time in the laparoscopic group was significantly shorter than in the robotic group ( $p=0.001$ ). There was no statistical significance between the laparoscopic and robotic groups in terms of length of stay ( $p = 0.52$ ), complication rate ( $p = 0.06$ ), and readmission rate ( $p = 0.85$ ).

**Conclusions:** The laparoscopic approach to adrenalectomy was significantly faster than the robotic approach. However, there was no statistical difference in length of hospital stay, complication rate, or readmission rate between the two groups.

## The Impact of Palliative Care on End-of-Life Characteristics in Pediatric Hematopoietic Cell Transplant

◆ Achiko FA, Levine DR, Wilcox R

Hematopoietic cell transplantation (HCT) is an intensive, curative, therapeutic procedure offered to patients with high risk-malignancies and non-malignant illnesses. Transplant recipients are, however, at risk of increased morbidity and mortality. Pediatric oncology patients (POP), despite therapeutic interventions, experience traumatic characteristics that impair their quality of life (QOL), especially at the end-of-life (EOL). While recent studies show that POPs benefit from early palliative care (PC), research on the outcomes of integration of PC in pediatric transplant patients EOL care is scarce. We sought to identify differences in EOL characteristics of pediatric HCT patients based on PC involvement. Retrospectively, we reviewed electronic medical records of all HCT patients at St. Jude Children's Research Hospital (SJRH), who unfortunately died between March 2008 and October 2017 ( $n=160$ ). Charts were mined for specific variables of interest that included patient demographics, clinical and EOL characteristics, PC consultations, and symptom recognition. Data was organized using excel and analyzed using descriptive statistics. Of 160 deceased HCT patients, 114 (71.3%) had PC team involvement, and 46 (28.8%) did not. There was no difference between the two patient groups concerning demographics and the cause of death. The average time between the last transplant received, and death was 309 days (IQR, 9-2,834) in the PC group, and 232 days (IQR, 13-1,1444) in the non-PC (NPC) group. PC consultation occurred approximately 190 days (IQR, 0 to 3,760) post-transplantation, with the most commonly discussed goal of care in these consultations being the goal of cure (56%). The symptom burden at EOL was high for all HCT patients; however, the PC group had increased recognition of every symptom assessed. Patients on the PC team were more likely to have documentation on resuscitation elections (PC, 65%; NPC, 28%), less likely to have cardiac resuscitation (CPR) attempted (PC, 10%; NPC, 17%) and less likely to be intubated in the last 24 hours of life (PC, 28%; NPC 44%). With matters concerning EOL care patterns such as location of death, compared to NPC, PC patients were more likely to die at home (PC, 18%; NPC, 15%) or inpatient settings (PC, 30%; NPC, 24%) and least likely to die in intensive care units (PC, 34%; NPC, 46%). Patients who had PC involvement were also more likely to have hospice involvement (PC, 20%; NPC, 7%). Incorporating PC in pediatric HCT does not lead to shorter life spans for patients. It may enhance patient outcomes, and EOL experiences through early discussions and documentation on EOL care preferences, decreased exploration of extreme interventional focused care, increased symptom recognition, and increased hospice support.

## Combined Mitral Papillary Muscle Avulsion with Pericardial Rupture and Cardiac Herniation due to Blunt Thoracic Trauma-Induced. Difficult and Delayed Diagnoses

◆ Sharif F, McCauley R, Steinberg M, Patel J, Thompson M, Lesh C, Walsh M, Evans E

**Clinical Significance:** We describe the first case of combined pericardial tear with cardiac herniation and ruptured mitral papillary muscles following Blunt Thoracic Trauma (BTT). Surgeons must be vigilant for cardiac and pericardial injury post-BTT even without traditionally suggestive clinical, physical, and radiological findings.

**Case:** A 40-year-old female presented to the ED following a high speed MVC. On exam, HR 107, RR 30, BP 141/108, and oxygen saturation of 92% RA. Cardiovascular exam revealed no murmurs, gallops, rubs, or JVD. EKG demonstrated no significant findings. Chest CT revealed fractured left ribs 2-7, sternum, mediastinal hematoma, left pneumothorax, grade III splenic laceration, and left pleural effusion. Transthoracic echocardiography was normal. Three days later, the patient developed rapidly worsening SOB and bilateral opacification on CXR consistent with acute cardiogenic pulmonary edema confirmed by CT. There was a new 3/6 holosystolic heart murmur heard best at the apex with crackles two-thirds of the way up the lung fields bilaterally. A transesophageal echocardiography (TEE) demonstrated a normal-sized LA, severe 4+ mitral regurgitation, anteromedial mitral papillary muscle avulsion, normal ventricular function, and no pericardial effusion. Cardiac catheterization confirmed these diagnoses and an intra-aortic balloon pump was placed. Patient underwent a sternotomy and surgery for mitral valve replacement. Findings included (1) full-thickness pericardium rupture from apex to the left atrium with pronounced cardiac herniation leftward, (2) anterior mitral papillary muscle avulsion, abnormally positioned riding up towards the mitral valve apparatus (3) large septal hematoma, and (4) mid-sternal fracture. A 25 Hancock II porcine prosthesis was placed and the pericardial tear repaired. The patient tolerated this procedure well and was discharged to a rehabilitation facility with uneventful recovery.

**Conclusions:** The holosystolic murmur with coinciding pulmonary edema guided the clinician to the diagnosis of mitral papillary muscle avulsion using TEE leading to the intraoperative diagnosis of pericardial rupture and cardiac herniation.

## Shock and Awe: Surprise Medical Bills and Seeking Care

◆ Schultheis P, Haddad A, Chiang J, Khan M, Rohr-Kirchgraber T

**Case:** 61yo woman presented with palpitations and dyspnea. After observation and general workup, she was diagnosed with new-onset atrial fibrillation and treated. She returned a year later with similar symptoms and was observed overnight with a negative workup, including a nuclear stress test. The visits accumulated over \$24,000 of healthcare costs, of which insurance covered \$10,000. She agreed to a \$200/month interest-free payment plan for the remaining \$14,000. The hospital sent \$6,500 to collections, requiring a \$2,100 immediate payment to protect her credit score. She has since restructured her debt and delayed her retirement to ensure payment; another hospitalization at the time would have resulted in bankruptcy.

**Conclusions:** A surprise medical bill affects 1 out of 6 insured, hospitalized patients and occurs when patients have care that is uncovered or done by an out-of-network physician. The patient is unaware of the cost upfront and is left to pay. Surprise billing is an increasingly urgent national political issue as the financial risk surrounding hospitalization plays a systemic role in delayed medical care and negative health outcomes.

**Clinical Significance:** The medical and financial health of women are inextricably linked. Surprise medical billing drives patients away from physicians to avoid financial ruin. This delay in care poses a risk for advanced disease and poor prognosis. A recent study in JAMA Oncology found non-Hispanic black, American Indian, and Hispanic women are among those at highest risk for late-stage breast cancer diagnosis secondary to being uninsured. Late-stage diagnosis increases time away from work due to increased prevalence of treatment-related illness, further impacting her ability to afford appropriate care. Increased physician literacy on this matter will improve the physician-patient relationship through empathic care and, hopefully, increased physician advocacy around surprise medical billing.

## Obesity Decreases the Contribution of Kv Channels to Hypoxic Coronary Vasodilation

◆ Clark HE, Baker HE, Goodwill AG, Blaettner BS, Kozlowski MC, Tune JD

**Background:** Our group previously demonstrated that reductions in the functional expression of voltage-dependent Kv channels contribute to impaired metabolic control of coronary blood flow in the setting of obesity. This study tested the hypothesis that obesity diminishes the contribution of Kv channels to coronary vasodilation in response to hypoxemia.

**Methods:** Control lean (n = 7) and obese (n = 5) swine were anesthetized and the heart exposed via left lateral thoracotomy. Coronary blood flow was measured in response to hypoxemia, before and after inhibition of Kv channels by 4-aminopyridine (4-AP; 0.3 mg/kg, iv), by a flow probe placed about the left anterior descending coronary artery. Hypoxemia was induced by progressive increases in the amount of nitrogen introduced into the ventilator. Arterial blood samples were obtained at each reduction in arterial oxygenation via a catheter placed in the femoral artery.

**Results:** Blood pressure decreased from  $\sim 88 \pm 5$  mmHg to  $\sim 68 \pm 6$  mmHg (P = 0.01) as arterial PO<sub>2</sub> was reduced below 50 mmHg in both lean and obese swine (P = 0.51). In lean swine, coronary flow progressively increased from  $\sim 0.6$  to  $>3.0$  ml/min/g as arterial PO<sub>2</sub> was reduced. This response was decreased by  $\sim 40\%$  in obese swine and by  $\sim 30\%$  in lean swine treated with 4-AP. Administration of 4-AP had no effect on coronary flow in obese swine.

**Conclusion:** These data support that Kv channels contribute to increases in coronary flow in response to hypoxemia in lean swine and that reductions in Kv channel function contribute to impaired hypoxic coronary vasodilation in obese swine. We propose that therapeutic targeting of obesity associated pathways (angiotensin-aldosterone system) known to influence K<sup>+</sup> channel expression could improve coronary microvascular function and cardiovascular outcomes in subjects with obesity.

## Predictors of Patient Satisfaction Following Primary Total Knee Arthroplasty: Results from a Traditional Statistical Model and a Machine Learning Algorithm

◆ Farooq H, Deckard ER, Ziemba-Davis M, Madsen A, Meneghini RM

**Background:** It is well-documented in the orthopedic literature that 1 in 5 patients are dissatisfied following total knee arthroplasty (TKA). However, multiple statistical models have failed to explain the causes of dissatisfaction. Further, payors are interested in using patient-reported satisfaction scores to adjust surgeon reimbursement rates without a full understanding of the influencing parameters. The purpose of this study was to more comprehensively identify predictors of satisfaction and compare results using both a statistical model and a machine learning (ML) algorithm.

**Methods:** A retrospective review of consecutive TKAs performed by two surgeons was conducted. Identical perioperative protocols were utilized by both surgeons. Patients were grouped as satisfied or unsatisfied based on self-reported satisfaction scores. Fifteen variables were correlated with satisfaction using binary logistic regression (BLR) and stochastic gradient boosted ML models.

**Results:** 1,325 consecutive TKAs were performed. After exclusions, 897 TKAs were available with minimum one-year follow-up. 85.3% of patients were satisfied. Older age generation and performing surgeon were predictors of satisfaction in both models. The ML model also retained CR/CS implant; lack of inflammatory conditions, preoperative narcotic use, depression and lumbar spine pain; female sex, and a preserved PCL as predictors of satisfaction which allowed for a significantly higher area under the ROC curve compared to the BLR model (0.81 vs. 0.60).

**Conclusion:** Findings indicate patient satisfaction may be multifactorial with some factors beyond the scope of a surgeon's control. Further study is warranted to investigate predictors of patient satisfaction particularly with awareness of differences in results between traditional statistical models and ML algorithms.

## Thumb Metacarpophalangeal Hyperextension in an Arthritic Population

◆ Acott TR, Farooq H, Merrell GA, Peck KM, Sparks D, Smetana BS

**Purpose:** To study the correlation between passive MP hyperextension, dynamic MP position, and pinch strength in patients with concurrent CMC arthritis.

**Methods:** Cross-sectional analysis of patients with thumb CMC arthritis was performed. Measurements of passive thumb MP hyperextension and dynamic thumb MP position during lateral key pinch, jar grasp, and cap grasp were collected. Additionally, pinch strength and level of pain at rest and during pinch activity using a VAS scale were recorded. Subgroup analysis was performed for patients with passive MP hyperextension  $<30$  and  $\geq 30$  degrees.

**Results:** Thirty-three patients were enrolled in our observational study. Average passive MP hyperextension was 28 degrees (range 5 flexion – 88 hyperextension). A poor correlation was appreciated between passive MP hyperextension and MP position during dynamic activities. No difference was seen between the two subgroups ( $<30$  and  $\geq 30$  degrees passive hyperextension) when comparing average MP joint position during dynamic key pinch and dynamic jar grasp. However, there was a significant difference between the two subgroups when comparing average MP joint position during dynamic cap grasp, though both positions were in flexion (m=24° and m=6°). Poor correlation was also seen between MP position during dynamic pinch activity and pinch strength. Furthermore, no difference in pinch strength was seen between patients with and without dynamic control (dynamic MP position  $\leq 0$ ). Finally, there was no difference seen in pinch strength between patients with passive MP joint hyperextension  $<30$  vs  $\geq 30$  degrees.

**Conclusions:** Passive MP hyperextension had little correlation with both dynamic MP position and pinch strength. Majority of patients in our study functionally position their thumb MP in position of flexion, despite an average passive hyperextension of 28 degrees. Passive MP hyperextension may not be the optimal parameter to indicate the need for MP stabilization in patients undergoing treatment for CMC arthritis.

## Efficacy of a Single Image-Guided Corticosteroid Injection for Glenohumeral Arthritis

◆ Metzger CM, Farooq H, Merrell GA, Kaplan FT, Greenberg JA, Crosby NE, Peck KM, Hoyer RW

**Background:** It remains unclear how severity of radiographic GHOA, OSS, and VAS scores impact the effect and longevity of single, image-guided corticosteroid injections. We hypothesize that patients with more severe radiographic GHOA and poor baseline shoulder function would require earlier secondary intervention with repeat injection or surgery.

**Methods:** Patients with GHOA who received a single, image-guided corticosteroid injection for primary intervention were enrolled. Phone interviews were conducted to record OSS and VAS scores at baseline and months 1, 2, 3, 4, 6, 9, 12. Endpoints were designated when patients required second injection, surgery, or reached month 12. Patients were grouped by respective baseline OSS (mild, moderate/severe) and Samilson-Prieto classification (mild, moderate, severe) for analysis.

**Results:** 64.7% of the mild group and 50% of the moderate/severe group completed 12 months without secondary intervention. No significant difference was seen in overall survival between these groups: 87.5%, 46.2%, and 62.5% of the mild, moderate, and severe classes, respectively, completed 12 months without secondary intervention. No significant difference was seen in survival between these classes. OSS and VAS scores at each follow-up were compared to baseline. Increase in OSS from baseline to month 1 was significantly higher in the moderate/severe group than the mild group. As an entire cohort, significant difference was seen between baseline and months 1-4 for OSS and between baseline and months 1-4, 6,9, and 12 for VAS, both above MCID.

**Discussion:** We established, patients with more severe shoulder dysfunction may experience a statistically significant greater symptomatic relief compared to patients with milder dysfunction. Additionally, we demonstrated that following a single injection, patients may experience statistically and clinically relevant improvements in shoulder function up to 4 months post-injection. Lastly, following a single injection, patients may experience statistically and clinically relevant improvements in VAS pain scores up to 1 year.

## Unilateral Expandable Interbody Cage Placement in Minimally Invasive Midline Fusion

◆ Sharma I, Krzyskowski M, Khanna N

**Introduction:** Minimally invasive midline approach utilizing cortical screws has grown in popularity due to its familiar anatomy, limited dissection, and associated decreased morbidity. This approach is well-suited for bilateral "inline" cage placement after bilateral facetectomies. Many surgeons prefer to utilize a single cage, TLIF, for midline fusions to optimize time, decrease exposure, and lower costs. This novel study assessed cage position for a unilateral cage utilizing the minimally invasive midline approach.

**Methods:** Retrospective chart and radiograph review was performed on 25 consecutive patients who underwent a midline lumbar fusion utilizing a single expandable interbody cage. Post-operative radiographs were examined to determine cage position relative to the vertebral bodies. Cage positioning was graded A, B, or C based on its midline position relative to the medial, middle, or lateral third of the superior vertebral body.

**Results:** Surgeries were performed by a fellowship-trained orthopedic spine surgeon. 25 patients (48% male; 26 cages, n=26) underwent a lumbar fusion utilizing a single, expandable interbody cage using a midline approach. 24 patients had one-level fusions, while 1 patient had a two-level fusion. 18 devices were graded "A"; 8 devices were graded "B". None received a grade of "C."

**Conclusion:** Ideal cage position for midline lumbar fusion is the middle-third of the superior vertebral body to allow for symmetric distraction and load sharing. This can be difficult to accomplish when utilizing a single cage, as it can be difficult to maintain the necessary 30-45-degree insertion angle in order to position the cage. With technical modifications to disc preparation, retractor considerations, and facetectomy we can obtain the necessary angles for cage placement without the need to increase exposure. The cage position was further optimized through radiographic imaging prior to the expansion of the lordotic oblique cage, highlighting another advantage to the expandable technology with this procedure.

## A 6 Month Retrospective Analysis of the Clinical Results of Arthroscopic Rotator Cuff Repairs Between Standard Population and Smoker Group

◆ McKeeman J, Sassmannshausen G

Rotator cuff tear is a common shoulder injury typically resulting from overuse or trauma. Smoking status is a known risk factor for rotator cuff tears and this study explores the outcomes of rotator cuff repair surgery in a population with a history of smoking and a standard population. From July 2017 to December 2017, Dr. Sassmannshausen performed 43 rotator cuff repair surgeries. This clinical study demonstrates consistent success in the rotator cuff repair as well as establishes that there is no significant difference in the outcome of rotator cuff surgery in patients with a history of smoking when compared to the standard population. This was achieved through data collection through voluntary survey following the surgery. Patients filled out three separate surveys: the Simple Shoulder Test, the UCLA shoulder test, and the ASES shoulder test. These tests give insight into the success rate of surgery by revealing patient percent recovery in specific objective and subjective categories, as well as an overall average score for each test. This particular analysis compares the standard population to patients with a history of smoking. From the data gathered, it was concluded that none of the tests had statistical difference between the smoking population and the standard at a level of  $p < .05$ . The closest to a significant difference was the simple shoulder test at a level of .056. The data set is relatively small at 20 patients and continued research is being done to draw more solid conclusions, but from the data gathered in this study it can be concluded that Dr. Greg Sassmannshausen's rotator cuff repair surgeries are consistently successful between both groups.

## Angioedema Associated With Clozapine and Olanzapine

◆ Bittar NM, Bittar JM, Fretwell H

**Background:** Drug induced angioedema is a rare cutaneous drug reaction that has primarily been associated with betalactam antibiotics and anti-inflammatory drugs. However, angioedema associated with antipsychotics is a much more rare side effect, with only a few reported cases. To date, there are only three reports in the literature of angioedema associated with clozapine or olanzapine.

**Objective:** This report serves to add to the literature on the association of clozapine and olanzapine with angioedema.

**Results:** A 69 year old male with a history of schizophrenia presented to the emergency department on 9/30/2016 for altered mental status. Medical workup was unremarkable and he was transferred to inpatient psychiatry service. Patient was being managed by outpatient psychiatry for schizophrenia with clozapine 450 mg total daily dose for many years, however stated he had not been taking his medications. His other medications included sertraline 50 mg, buspirone 10 mg, and bupropion 150 mg. Upon admission, his sertraline and bupropion were held and he was restarted on buspirone 150 mg, and clozapine 25 mg BID for 3 days with a plan to increase by 25 mg every 3 days until back to 450 mg total daily dose. He developed facial and bilateral arm swelling on 10/14/2016. Clozapine was discontinued and diphenhydramine was initiated. Internal medicine team was consulted. CBC was notable for eosinophilia at a level of 1.1. Physical exam significant for induration of both arms and desquamation, mild erythema of the upper chest, no urticaria. He was diagnosed with allergic form of angioedema and his diphenhydramine was changed to hydroxyzine. After discontinuation of clozapine, his angioedema resolved however his psychosis worsened. The patient was subsequently started on olanzapine on 10/23/2016 and developed facial angioedema with eosinophilia two days later on 10/25/2016. Olanzapine was discontinued, haloperidol was initiated and his facial edema resolved. The patient is still being followed by outpatient psychiatry and has not had a recurrence of the angioedema since discontinuing the olanzapine and clozapine.

**Conclusions:** This case report adds to the literature on the adverse effects of clozapine and olanzapine and suggests the need for physicians to be aware of the possible side effect of angioedema secondary to clozapine and olanzapine use when treating patients with psychotic disorders.

## Dermatofibrosarcoma Protruberans Treated with Mohs Micrographic Surgery: Risk Factors, Tumor Characteristics, and Treatment Outcomes

◆ **Bittar, Julie M.;** Xiao, Honglin; Garcia-Dehbozorgi, Sara; Bittar, Noor M.; Somani, Ally-Khan B.

**Introduction:** Dermatofibrosarcoma Protruberans (DFSP) is a rare, low-grade neoplasm that occurs in the dermis and subcutaneous tissue with the propensity for subclinical spread. Diagnosis is difficult given the early clinical signs are nonspecific. Treatment for this tumor varies widely with both surgical and non-surgical treatment options and recurrence rates in published literature are highly variable.

**Objective:** To evaluate the risk factors, tumor characteristics and local recurrence rate after MMS for DFSP.

**Methods:** This IRB approved retrospective cohort study identified fourteen patients with the diagnosis of primary DFSP treated with MMS at our institution between 2010 and 2019. We defined local recurrence as biopsy proven DFSP arising with the scar of MMS. Tumor characteristics were obtained through chart review. Follow up data was based on review of electronic medical records and telephone calls to patients.

**Results:** Fourteen patients consented to participate in this study. Our cohort had a mean age of 38 years (median: 36 years, range: 28–50 years), was comprised of 57% males (8/14) and 43% females (6/14). The most common site of DFSP was the trunk (50%, 7/14), followed by the head/neck (21%, 3/14), lower extremity (14%, 2/14), and upper extremity (14%, 2/14). The mean preoperative tumor size was 3.32 x 2.21 cm and mean postoperative size 7.59 cm x 6.17 cm. Tumors were treated with a mean of 2.93 stages. On review of pathology: 100% of tumors stained positive for CD34, 7% (1/14) showed fibrosarcomatous change, 14% (2/14) had 17:22 translocations, and 14% (2/14) showed PDGFB rearrangements. Assessment of patient postoperative management showed that 36% (5/14) followed up with oncology. No patients (0/14) experienced a local recurrence with a mean follow up time of 17.9 months (median: 13.5 months, range: 1–57 months).

**Conclusion:** This retrospective study provides support for the use of MMS for treatment of primary DFSP given its very low local recurrence rate (0/14 patients). The 17:22 and PDGFB rearrangements seen in a subset of our cohort may indicate that patients with these genetic translocations may be at higher risk for developing DFSP. Postoperative referral to oncology for observation and follow up may be indicated given DFSP's propensity for subclinical spread.

## Utilization of Thromboelastography with Platelet Mapping to Guide Perioperative Management of Intravenous Immunoglobulin, Steroids, and Blood Component Therapy in a Patient with Immune Thrombocytopenia Purpura Requiring Emergency Coronary Artery Bypass Grafting

◆ **Hatch J,** Marsee M, Speybroeck J, Grisoli A

The perioperative management of patients with immune thrombocytopenic purpura (ITP) who require intravenous immunoglobulin (IVIG), steroids, and blood component therapy (BCT) is a challenging clinical scenario which requires an understanding of the delicate balance between hypercoagulability and hypocoagulability in the perioperative setting. This is especially true for those patients undergoing coronary artery bypass grafting (CABG). Common coagulation tests (CCT) do not adequately predict hemostatic integrity of patients undergoing CABG and modified thromboelastography with platelet mapping (TEG/PM) has been shown to reduce BCT as well as provide better survival for patients undergoing this surgery. We present a patient with immune thrombocytopenic purpura (ITP) who received 48 hours of low osmolality IVIG with successful raising of his platelet counts to safe levels which allowed for successful CABG without platelet transfusion and without complications related to the well described post-IVIG hypercoagulable state.

## Viscoelastic Testing in Orthopaedics and Trauma: Past, Present, and Future

◆ **Hatch J,** Speybroeck J, Marsee M, Grisoli A

Viscoelastic tests (VETs), such as thromboelastography (TEG) and rotational thromboelastometry (ROTEM), are practical, cost-effective assays that provide a comprehensive evaluation of whole blood coagulation. VETs have several advantages over conventional coagulation assays, including activated partial thromboplastin time (aPTT) and prothrombin time (PT)/International Ratio Normal (INR), which depict only the coagulation cascade's initial fluid phase (the ability to initiate clot formation). VETs are gaining popularity among non-orthopaedic trauma physicians as an assessment of comprehensive coagulopathy from clot formation through clot stability versus fibrinolysis, and as an adjunct to guide blood component therapy resuscitation. Additionally, VETs are useful in monitoring post-operative coagulation status, predicting the risk of venous thromboembolism, and evaluating the clinical inhibition for patients on anticoagulants and antiplatelet agents. Despite these applications, the discussion of VETs remains sparse in orthopaedic literature. This review familiarizes orthopaedic surgeons with the usefulness of VETs in orthopaedic trauma and elective surgeries and highlights emerging research into orthopaedic specific applications of VETs.

## Posterior Tibial Slope in Patients Undergoing Anterior Cruciate Ligament Reconstruction (ACL) with Patellar Tendon Autograft: Analysis of Subsequent ACL Graft Tear or Contralateral ACL Tear

◆ **Shelbourne KD,** Benner RW, Jones JA, Gray T

**Objectives:** To examine the relationship of posterior tibial slope and rate of graft tear or contralateral anterior cruciate ligament (ACL) tear among patients undergoing primary or revision ACL reconstruction with patellar tendon autograft.

**Methods:** From June 2001 to 2015, 2,796 patients received primary or revision ACL reconstruction with patellar tendon autograft (PTG) and were followed prospectively to determine rate of graft tear and contralateral ACL tear. Minimum follow-up for study inclusion was 4 years. Posterior tibial slope (PTS) was measured preoperatively on digital lateral view radiographs with knee flexion between 30° and 45°. Intersecting lines were drawn along the medial tibial plateau and the posterior tibia; the value of the acute angle at the lines' intersection was then subtracted from 90° to obtain the PTS. This procedure was carried out by a clinical assistant with interrater reliability of 0.89. Chi-square analysis, Pearson correlation, and t-tests were used to determine relationships between rate of graft tear or contralateral ACL tear and PTS, age, and sex among primary and revision surgery groups. A threshold of PTS  $\geq 10^\circ$  was used for analysis.

**Results:** The mean age of patients was 24.3 $\pm$ 10.2 years for patients undergoing primary ACL reconstruction (n=2472) and 24.3 $\pm$ 8.8 years for revision ACL reconstruction (n=324). The mean follow-up time was 11.6  $\pm$  4.0 years. The rate of primary graft tear was 5.1% (n=126), and primary contralateral ACL tear rate was 4.9% (n=121). The rate of revision graft tear was 5.9% (n=19), and revision contralateral tear rate was 1.9% (n=6). Among primary reconstructions, the mean surgery age of patients who experienced graft tear (19.2  $\pm$  6.3 years) or contralateral tear (21.5  $\pm$  9.5 years) were significantly younger (P<.001, P=.0011, respectively) than patients who did not suffer a subsequent tear (24.7  $\pm$  10.3 years). The mean PTS among primary graft tears was 5.4  $\pm$  3.1°, which was statistically significantly higher than the mean of 4.8  $\pm$  2.9° for patients without tear (P=.041). The mean PTS was 4.9  $\pm$  3.3° for patients with contralateral tears, which was not statistically significant different than other groups. Furthermore, primary reconstruction patients with PTS $\geq 10^\circ$  had a significantly higher rate of graft tear (9.6%) than patients with PTS  $\leq 9^\circ$  (4.7%) (P=0.004), but not a higher rate of contralateral tear. Among patients undergoing revision surgery, there were no statistically significant differences between graft tear, contralateral tear, and no tear groups with relation to age, PTS, or PTS  $\geq 10^\circ$ . Among all patients (primary or revision group), there was no difference in PTS between sexes (P=0.278), nor was surgery age significantly correlated to PTS (R=0.0226).

**Conclusion:** Higher PTS appears to be correlated to higher rates of ACL graft tear in patients undergoing primary ACL reconstruction with PTG, particularly when PTS is greater than 10°. However, rate of graft tear remains low (5.1% overall, 9.6% with PTS $\geq 10^\circ$ ). Furthermore, for patients undergoing revision surgery, there is no significant association between PTS and rate of subsequent tear. Therefore, caution should be exercised when considering more radical interventions, such as osteotomy, to prevent re-tear in patients with high PTS.

## Utilization of Extracorporeal Membrane Oxygenation for Pulmonary Toxicity Caused by Inhaled Synthetic Cannabinoid. A Harbinger of Future Complications Associated with Inhaled Cannabinoid Products

◆ Speybroeck J, McCauley R, Hatch J, Betts A, Mark N, Keenan M, Jones J

Emergencies related to synthetic cannabinoids (SC) have increased recently in the United States. The legalization of marijuana in states such as Nevada, Maine, Colorado, and California has increased accessibility of SC leading to the presentation of medical complications related to SC. The most common adverse presentations of SC use include nausea, vomiting, anxiety, psychosis, paranoia, and agitation. In addition, there are case series and case reports of stroke, hypertension, cardiac toxicity, and encephalopathy related to SC inhalation. Specifically, there has been a recent increase in reports of respiratory pathology such as acute respiratory distress syndrome (ARDS), diffuse alveolar hemorrhage (DAH), and chronic pulmonary findings associated with inhaled SC use. The acute and chronic findings of direct pulmonary toxicity do not include the depression of respiratory drive caused by SC. In addition to SC induced respiratory depression, there has been a recent increase in cases due to direct pulmonary toxicity not related to aspiration or infection. In all the reported cases, alveolar hemorrhages developed within 48 hours after SC inhalation suggesting a temporal relation.

Direct pulmonary injury by SC leading to the development of ARDS and DAH requiring endotracheal intubation has been reported infrequently. Failure to successfully treat respiratory insufficiency, ARDS, and DAH caused by SC with endotracheal intubation and mechanical ventilation is even more rare. The utilization of Extracorporeal membrane oxygenation (ECMO) to treat such a patient has been reported on only one occasion in abstract form. In this first full case report we describe a 21-year-old woman who developed interstitial pneumonitis which required endotracheal intubation and immediate utilization of ECMO in order to ensure proper gas exchange.

## How Do Preoperative Patient Characteristics Affect Clinical Outcomes for Partial Nephrectomy?

◆ Krishnan N, Zappia J, Steward, JE, Sundaram CP, Boris RS

**Introduction:** Few studies have investigated how preoperative patient and tumor characteristics affect clinical outcomes for patients undergoing robotic-assisted laparoscopic partial nephrectomy (RPN). The objective of this study is to evaluate how these characteristics influence operative time, estimated blood loss (EBL), and length of hospital stay (LOS).

**Methods:** We conducted a retrospective review of a prospectively collected cohort of patients who underwent RPN by two experienced robotic surgeons between 2013 and 2019. Preoperative patient and tumor characteristics were collected. The cohort was divided into tertiles based on operative time (the 25th percentile and faster, the 25th to 50th percentile, and the 50th percentile and slower). Univariate analysis was performed to compare the patient characteristics among the tertiles. A multivariable linear regression model was developed to examine the impact of these factors on EBL and LOS.

**Results:** A total of 410 patients who underwent RPN were included in the study. On univariate analyses, tumor dimension, perirenal fat thickness, LOS, and EBL were all significantly related to longer operative time (Table 1). On multivariate analysis, tumor dimension significantly affected EBL in the fastest 25th percentile group, and RENAL Nephrometry Score significantly impacted EBL in the greater than 50th percentile group (Table 2 and 3). There were no other preoperative characteristics that significantly affected EBL or LOS among the tertiles. **Conclusions:** Tumor dimension and perirenal fat thickness have a significant influence on operative time. Longer operative time is associated with increased EBL and LOS. Overall, in the hands of an experienced robotic surgeon, preoperative patient and tumor characteristics have minimal impact on EBL and LOS.

## All that Hurts isn't Appendicitis: A Case of Cecal Volvulus in Pregnancy

◆ Burgett KM, Pandita P, Smith C, Waller S, Menchaca A

**Clinical Significance:** Acute abdomen in pregnancy (AAP) represents a diverse range of etiologies, including obstetrical and non-obstetrical causes. Regardless of the etiology, management of AAP first begins with accessing the patient's hemodynamic stability. Hemodynamically unstable patients require fluid resuscitation and emergent exploratory surgery. On the other hand, hemodynamically stable patients may be classified as either urgent or non-urgent based on signs of sepsis, peritonitis, or deteriorating signs. Urgent cases warrant surgical intervention. Non-urgent patients are assessed via physical exam, lab work, and/or imaging to determine the most likely etiology, and if appropriate may trial conservative therapy first.

**Case:** A 24-year-old G3P2 female at 18 weeks gestation presented to the ED with severe right lower quadrant abdominal pain that was exquisitely tender to palpation. Abdominal ultrasound and MRI to rule out appendicitis were both inconclusive. She was taken to the OR for exploratory laparoscopy and possible appendectomy. However, intra-operatively she was found to have a cecal volvulus. Endoscopic detorsion was therefore performed. The cecum was examined and showed no signs of ischemia. Given the high risk of further intervention, definitive repair with resection or cecopexy was deferred until after pregnancy.

**Conclusions:** This case demonstrates the importance of prompt decision making when confronted with the acute abdomen in pregnancy. Normal physiologic and anatomic changes of pregnancy may make a diagnosis difficult, and physicians may be hesitant to operate on a pregnant patient. However, the use of decision-making algorithms based on hemodynamic stability and urgency may aid physicians in their decision of when to operate on a pregnant patient.

## The Effects of Propofol of the Human Blood Brain Barrier

◆ Lewis KA, Hughes JM, Canfield SG

**Background:** Recently, the safety of repeated and lengthy anesthesia in young children has been called into question. Previous studies have shown propofol, an anesthetic, can diminish blood-brain barrier (BBB) properties. However, the underlying cellular mechanisms are relatively unknown. The BBB is critical in ensuring that potentially harmful circulating factors are impermeable to the brain. Previous animal studies models have shown that propofol increases the levels of matrix metalloproteinases (MMPs), which have independently been shown to degrade the extracellular matrix and breakdown tight junctions, a critical component of the BBB. Hypothesis: Propofol exposure to a human induced pluripotent stem cell (iPSC)-derived BBB model increases MMP activity ultimately contributing to a leaky barrier phenotype.

**Methods:** This study utilized human iPSCs differentiated into brain microvascular endothelial cells (BMECs), the barrier forming cell type of the BBB. iPSC-derived BMECs were exposed to propofol (50 $\mu$ M) for three hours and barrier properties were monitored. Barrier tightness was monitored using trans-endothelial electrical resistance (TEER) and sodium fluorescein permeability assays. Tight junction localization was determined with immunocytochemistry. MMP activity was determined with Sensolyte<sup>®</sup> assay kits. To determine the role of MMPs, a broad spectrum MMP inhibitor, GM6001, was utilized and barrier properties were monitored.

**Results:** Propofol treatment significantly reduced TEER and increased sodium fluorescein permeability, indicative of a leaky barrier. Propofol treatment increased levels of MMP-2 activity but not MMP-9 when compared to non-treated BMECs. Inhibition of MMPs by GM6001 prior to propofol treatment appeared to partially restore barrier integrity as monitored by sodium fluorescein permeability.

**Conclusion:** These results indicate that increased MMP-2 activity levels could be in part responsible for diminished BBB properties. Inhibition of MMPs protected barrier integrity from propofol treatment. A further understanding of the underlying mechanisms of anesthetic-induced damage can potentially improve anesthesia safety.

## Boerhaave Syndrome: an Emphasis on Early Detection and Intervention

◆ Comer L, Campbell N, Bozell H, Ivaturi S, Bona A

A 93-year-old male presented to the ED with fever, abdominal pain, and hematemesis. He was previously treated for pneumonia and had no history of alcohol use or liver disease. He denied chest and back pain. Physical exam was unrevealing. CXR showed a left lung opacity and pleural effusion, but no mediastinal air. CT with IV contrast exhibited a large hiatal hernia with air foci within the intrathoracic gastric wall, and presence of a posterior mediastinal mass. Further CT with oral contrast confirmed a paraesophageal hiatal hernia with perforation but showed no extravasation of oral contrast.

The leading diagnosis for this patient was Boerhaave syndrome (BS) secondary to perforation within a hiatal hernia. Treatment included broad spectrum IV antibiotics. There was no stent-requiring esophageal tear identified on Esophagogastroduodenoscopy. His condition gradually improved and he was discharged with a proton pump inhibitor, IV meropenem, and a G-J tube.

We present this case of BS, a rare phenomenon of esophageal perforation with diverse presentations and a high mortality of 40% if untreated. The pathophysiology of BS includes elevated intra-abdominal pressure progressing to transmural tears in the esophageal-gastric junction. Presentation depends on the location of the tear. Cervical tears typically present with pain radiating to the back, dysphagia, crepitus, and infection while thoracic tears can present with pneumothorax, pleural effusion, empyema, and/or mediastinum crepitus. Differential diagnoses typically include: aortic dissection, acute pancreatitis, MI, and pneumothorax. Imaging studies can help confirm BS through CXR/CT showing air in soft tissues and widening of the mediastinum as well as esophagogram with water-soluble oral contrast for location of the tear. Early antibiotic and surgical intervention are critical to prevent fatal infection. Given its rare prevalence and high mortality without time-sensitive treatment, providers must remember to consider this dangerous differential for hematemesis and/or chest pain.

## Brain Metastasis Epidemiology Over a 20-year Period at a Tertiary Care Institution in Indiana

◆ Lorentz S, McVeigh L, Williams A, Smith T, Monaco G, Shah M

**Introduction:** In comparison to the past twenty years, patients with metastatic cancer have multiple treatment options available today. As a result, many patients are now living longer with cancers that were previously associated with extremely poor prognoses. Prolonged survival rates have increased the percentage of cancer patients with brain metastases. However, it is unknown if the primary tumor epidemiology is changing. Such information could contribute towards research efforts in brain metastasis prognosis and treatment.

**Methods:** The neuropathology database at Indiana University, the state's only National Cancer Institute-designated institution, was queried from the years 1997 - 2017; brain metastasis samples were recorded along with demographic, treatment, and survival data in conjunction with available primary sample pathology. Pediatric data and spinal metastases were excluded.

**Results:** Diagnosis of brain metastasis at our institution is increasing, occurring almost 2 years after diagnosis of primary cancer, including patients with brain metastases on initial cancer diagnosis. Median survival after brain metastasis diagnosis is 9.3 months, which is consistent with other population data. Synchronous brain metastases presentations were 292 out of 688, a high percentage of 42.3%. The five cancers that preferentially metastasize to the brain (breast, lung, melanoma, renal, and gastrointestinal) are unchanged; lung cancer is commonest (29.5% of cases). Relative to national averages previously reported, melanoma has surpassed breast cancer in our area.

**Conclusions:** This epidemiologic study of brain metastases is the first to include Indiana data. The observation of patients whose initial cancer presentation includes synchronous brain metastases may reflect the health of the region. Since advances in oncology have increased survival, the risk for developing brain metastases has increased. With this knowledge, efforts should continue to focus on the main cancer subtypes with a particular emphasis on lung cancer treatment and screening for brain metastases.

## Diameter Dependence of Dual-Wavelength Retinal Oximetry

◆ Rowe LW, Arciero J, Harris A, Siesky BA, Verticchio-Vercellin AC, Mathew S; Beach JM

**Purpose:** Retinal vessel oxygen saturation obtained by dual-wavelength oximetry shows a dependence on vessel diameter with measured saturation increased in smaller vessels. This is considered an artifact of measurement as hemodynamic considerations cannot explain it. This study aims at understanding the artifact as a consequence of vessel light transmission and reflectance from retinal tissue.

**Methods:** Retinal oximetry data were compared with outcomes from a model of tissue reflectance (Kubelka Munk, KM). KM considers only double-pass transmission (transmission to and from retina behind vessel) and back-scatter by luminal blood. KM predicts that vessel reflectance, and ultimately measured saturation, follows a nonlinear (hyperbolic) relationship with vessel diameter. Light intensity returned from first and higher-order vessels ( $I_v$ ) and from adjacent retina was extracted (Oxymap Analyzer) from dual-wavelength oximetry images. Vessel reflectance ( $R_v$ ) was defined by the relationship  $R_v = I_v / I_o$ , where illumination intensity  $I_o$  was determined such that for large vessel diameter (>150  $\mu$ m), vessel reflectance matched the theoretical reflectance predicted by KM.

**Results:** At the oximetry measurement wavelength (600 nm), there was close agreement across the sampled diameter range (20–200  $\mu$ m) between KM reflectance and experimental arteriolar and venular reflectance. At reference wavelength (570 nm), for diameters below 90  $\mu$ m, the experimental reflectance from both vessel types exceeded by as much as 1.4x the model prediction.

**Conclusions:** Agreement between oximetry data and KM supports the role of double-pass transmission as a source of diameter sensitivity. As diameter decreases, reflectance behind the vessel becomes important, increasing  $I_v$  which ultimately raises measured saturation. Smaller diameter also allows single-pass transmission through the vessel which is a departure from the KM model. At low absorption (600 nm) the contribution is weak since there is nearly equal light return inside and outside vessels. At high absorption (570 nm), single-pass transmission raises vessel reflectance above the model prediction.

## Insulin Receptor Substrate 1 (IRS-1) Regulates Circadian Rhythm of Retinal Period 2

◆ Arif M, Mathew D, Luo Q, Bhatwadekar AD

**Background:** The mammalian circadian rhythm regulates many physiological processes. The circadian rhythm at a molecular level is controlled via a complex set of clock proteins, such as Period1 (Per1), Period2 (Per2), CLOCK, and BMAL1, among others, interlock and form autoregulatory feedback loops that oscillate. It has been found that even many peripheral tissues such as retina, liver, pancreas also exhibit their own circadian rhythms. Dysregulated circadian rhythm has been implicated in the development of a variety of diseases, including diabetes. IRS-1 is a critical downstream regulator of insulin's action. We explored the hypothesis that inhibition of IRS-1 using a pharmacological inhibitor SecinH3 would alter the biorhythm of clock protein Per2 in the retina.

**Method:** Using mPer2Luciferase knockin mice, we utilized isolated cultured retinas and used 100 $\mu$ M SecinH3 to inhibit IRS-1 and mimic the diabetic condition of impaired insulin signaling. We performed real-time bioluminescent recording of circadian rhythms using a Lumicycle luminometer. We also created a cDNA library from treated harvested retinas and measured mRNA expression of specific clock genes by quantitative PCR.

**Results:** Our results demonstrate that IRS-1 inhibition by 100 $\mu$ M SecinH3 created a prominent increase in the period lengths and induced an apparent phase shift when compared to control. Gene expression studies also showed a difference in expression profiles of clock genes Per1 and Cry1.

**Conclusion:** Our findings demonstrate the impact of insulin signaling in retinal circadian rhythm and provide another temporal dimension to view ocular complications of diabetes, such as diabetic retinopathy. Ultimately, further studies and a closer understanding of the roles of molecular clocks and insulin signaling may help to develop novel therapeutics for treating some of the harmful effects of diabetes.

## Qualitative Analysis of Children with Mobility Disabilities and their Caregivers in Gulu District of Post-Conflict Northern Uganda

◆ Etling MA, Amony J, Muyinda H, Ogwang M.

In Uganda, approximately 12% of children, or 2.5 million individuals under the age of 18, have a disability. While disability prevalence varies across Uganda, it is highest in the northern region which has experienced decades of civil strife. In 2014, the United Nations Children's Fund (UNICEF) identified children with disabilities living in Uganda as a vulnerable population in situational analysis, however limited qualitative data was gathered from the northern region.

This study aims to gain a deeper understanding of the barriers experienced by children with mobility disabilities and their caregivers in Gulu district. In total, 50 semi-structured interviews were conducted with caregivers living in 16 villages within Paicho division and Bardege division. Using a community-based approach, families were identified by the village chairman (LC1). Caregivers included 31 mothers (accompanied by 4 fathers), 2 step-mothers, 11 fathers, 3 grandmothers, 1 grandfather, 1 aunt, and 1 sister. Caregivers were primarily Acholi, Christian, and working as peasant farmers, casual laborers, or operating small businesses. Additionally, 24 semi-structured interviews were conducted with key informants, including teachers, government officials, medical professionals, and traditional healers.

Using thematic analysis, the following were determined to be the primary barriers: limited understanding of disability, financial constraints, negative attitudes, lack of paternal support, limited supportive and rehabilitative services, and lack of accessibility. Due to abandonment, death, or remarriage, some children were living with relatives or in institutions, rather than with their birth parents. Overall, caregivers were most concerned about the child's health, education, and future independence.

At the conclusion of the study, caregivers and key informants were invited to a workshop where the results were disseminated. The workshop included activities on education, empowerment, and community. This gave caregivers the opportunity to get build relationships and to learn about how to access resources in the community from key informants.

## Effects of the Coronavirus Disease 2019 Pandemic on the Functioning of a Student-Run Free Clinic

◆ Aksu E, Read M, Gensel A, Smock C, Barber M, Khan M, Pandita P, Aref M

**Background:** The COVID-19 pandemic has affected primary care across the country. The pandemic poses a unique challenge for the Indiana University Student Outreach Clinic (IUSOC), a student-led free clinic on Indianapolis' near-east side, where students from health professions, law, and social work partner to serve patients. Student-run clinics depend on students to function, and with nation-wide cessation of student participation in healthcare, this multidisciplinary clinic has been limited to faculty-run urgent medical consults and medication refills. The objective of this study is to measure the impact of clinic closure due to COVID-19 on patient care at the IUSOC.

**Methods:** Patient care data from January 2019 to March 2020 was compared to data since the closure of most clinic services on March 15, 2020.

**Results:** The IUSOC cared for 727 patients in 2019 (average of 24 encounters per clinic day) and 246 patients in 2020 (average of 31 encounters per clinic day) before closure due to COVID. In March 2020, the clinic cared for 62 patients in the first 2 weeks before clinic closure and only 3 after clinic closure. The IUSOC cares for 249 patients with hypertension and 131 patients with diabetes. In this time period, 21.2% of HbA1c measurements were above 9.0%, requiring close follow up. Since clinic closure, an average of 11 appointments were cancelled per clinic day. With ongoing data analysis, our presentation will include further analysis of effects on chronic disease management.

**Conclusions:** The closure of the IUSOC due to the COVID-19 pandemic has halted patient care, leaving an already vulnerable population alone with their chronic and acute concerns. The IUSOC team is working on creative ways to maintain patient care through clinic closure and without student volunteers. Understanding the impact of closure on patient care will prove essential to the continuity of care at IUSOC.

## The Effect of Ocular and Leg Dominance on Single-Leg Balance

◆ Dimmett MM, Needle AR, Liu K

**Background:** Maintaining balance requires multiple systems to work together to assess somatosensory input and make corrective motor outputs. Comparisons in stability measures can be influenced by unintentional effects of ocular and leg dominance. There are mixed results in the effect of leg dominance on stability. No differences have been reported between eye dominance conditions. The purpose of this study was to examine the interaction of ocular and leg dominance on stability.

**Methods:** This cross-sectional study included 49 subjects (M:8, F:41, age: 20.1±1.6yrs, height: 169.8±8.2cm, mass: 66.9±10.3kg). The experiment consisted of three 20-second static stance trials of eight conditions for a total of 24 randomized trials on a force plate. Conditions included standing on a single leg (dominant/non-dominant) with both eyes-open (BO), both eyes-closed (BC), dominant eye-open (DO), and non-dominant eye-open (NO). Average time-to-boundary (TTB) minima in the anteroposterior (AP) and mediolateral (ML) directions were calculated and a 2x4 ANOVA was used to analyze the interaction of ocular and leg dominance on TTB.

**Results:** The ML component of TTB-minima showed no significant interaction ( $F=0.892$ ,  $p=0.447$ ), but had significant effect of eye ( $F=188.829$ ,  $p<0.001$ ) and leg ( $F=10.745$ ,  $p=0.002$ ) conditions. The BO condition had significantly better TTB-minima and the BC condition had significantly worse TTB-minima than any other eye conditions. The non-dominant leg had significantly better TTB-minima than the dominant leg. The AP component showed no significant interaction ( $F=0.603$ ,  $p=0.614$ ) or significant effect of leg condition ( $F=0.101$ ,  $p=0.752$ ), but had a significant effect of eye condition ( $F=82.602$ ,  $p<0.001$ ) with the BO condition significantly better TTB-minima than any other eye condition.

**Conclusion:** Single-leg balance on the non-dominant leg with both eyes-open was the most stable condition. The TTB-minima showed more instability in the ML direction compared to the AP direction. Since the foot is longer than it is wide, more ML adjustments must be made to maintain stability.

## The Importance of the Newborn Screen in Detection of Congenital Hypothyroidism in Females

◆ Nunge R, Rose M, Husain M, Bittar J, Zimmerman M

**Clinical Significance:** Congenital hypothyroidism has an incidence of 1:2000 in the United States, and females are twice as likely to be diagnosed. Thyroid hormones are necessary for physical and neurological development, especially brain development. The prognosis for congenital hypothyroidism is excellent as long as medication is started early (as in this patient's case). The severity of neurodevelopmental defects is related to the severity of the case, as well as how long the hypothyroidism is left untreated. The longer an infant goes without treatment, the more severe the deficit is, as demonstrated by lower IQ values. This case illustrates the need for comprehensive newborn screening for thyroid deficits. Newborn screening is a public health program whose recommendations vary by state, region, and country.

**Case:** A nine-day-old female infant presented to the pediatric endocrinology clinic to establish care for congenital hypothyroidism. She was born vaginally at 36 weeks and 6 days, without complications to a 15-year-old mother with no past medical history or family history of chronic illnesses, including thyroid disease. At birth, she weighed 5 lb 10 oz, and was 19" long. Newborn screen showed TSH >1000 mIU/mL (reference 0.72-4.77) and free T4 of 0.3 ng/dL (reference 0.9-1.7). Exam revealed slightly indented anterior fontanelle, overriding sutures and a palpable posterior fontanelle. She had no palpable thyroid. Thyroid ultrasound showed no thyroid tissue in the neck. She was started on 37.5 mcg (16 mcg/kg) daily of levothyroxine. At two-month follow-up, TSH had decreased to 17 mIU/mL and free T4 1.1 ng/dL. Accordingly, her levothyroxine dose was increased to 44 mcg. Two months later, her TSH was 25 mIU/mL and free T4 1.2 ng/dL. She will require lifelong thyroid supplementation and close follow-up.

**Conclusions:** Newborn screening for thyroid defects is crucial to detect congenital hypothyroidism and prevent lifelong neurocognitive deficits and developmental delay.

## Predictors of Use of Spreader Grafts in Patients Undergoing Nasal Valve Repair

◆ **Marsce MK**, Newman S, Novinger LJ, Nese-meier R, Shipchandler TZ

**Introduction:** Spreader grafts are commonly used in nasal valve repair. Preoperative history/physical exam findings associated with use of spreader grafts have not been fully characterized. The purpose of this study was to describe the most common preoperative symptoms and exam findings of nasal airway obstruction.

**Methods:** Single academic center retrospective study of patients who have undergone surgery by facial plastics trained otolaryngologists for nasal airway obstruction. Adult patients with nasal airway obstruction undergoing septoplasty and/or nasal valve repair performed by facial plastics fellowship trained faculty from 2015 to 2019 were included. Clinic and operative note review was performed, data was stored in a RedCap Database, and statistics were completed with GraphPad Prism.

**Results:** Of 176 patients included, 51.7% were male, mean age was 46 years (SD 15.48), and 27 patients received spreader grafts. Spreader graft patients were significantly more likely to complain of purulent nasal discharge preoperatively ( $P < .0131$ ), and trended toward xerostomia ( $P < .1410$ ). Preoperative signs/symptoms recorded but statistically insignificant were: cranial nerve dysfunction, external bony/cartilaginous deformity, xerostomia, obligate mouth breathing, difficulty sleeping, objective or subjective improvement with modified Cottle maneuver, foreign body sensation, chronic sinus pressure/pain, anterior rhinorrhea, nasal tumor, sneezing, throat itching, headache, and age at the time of surgery.

**Conclusion:** In this patient population, patients receiving spreader grafts were significantly more likely to have purulent nasal discharge. Few preoperative characteristics were significant predictors spreader graft use in nasal valve repair surgery.

## Novel Repair of a Traumatic Flank Hernia

◆ **Bhagat ND**, Tadevich JT, Drucker NA, Stanton-Maxey K, Laughlin M, Mossler LP

**Background:** Traumatic flank hernias often precipitate as a result of high-speed blunt force traumas, such as high-speed motor vehicle accidents. Open repairs may prove challenging due to abdominal oblique muscle avulsion from the iliac crest as a result of the trauma, resulting in unstable anchoring for the hernia mesh. In these instances, anchoring of the hernia mesh to the iliac crest may be a more suitable treatment solution with regards to patient safety and outcome.

**Case:** A 47-year-old male was admitted to a Level 1 trauma center after involvement in a motor vehicle collision. Among other injuries, patient presented with left sided traumatic abdominal hernia. Upon readmission 1 month later, laparotomy was performed for treatment of the hernia with concern for strangulation. Postoperatively, the traumatic flank hernia was stable over the next approximately 17 months, however the patient then experienced recurrent flank bulging consistent with progressively enlarging recurrent hernia over the course of 4 months prior to presenting to clinic. Final repair of the traumatic flank hernia was successfully completed approximately 22 months post-trauma. Open repair with mesh anchored to the iliac bone was utilized in order to lower risk of recurrence and because the oblique musculature was unable to be brought down to the iliac bone to re-establish normal anatomy given the size of the defect. There has been no hernia recurrence 5-months post operatively.

**Discussion:** Traumatic flank hernia injury can be complicated by abdominal wall musculature avulsion from the iliac crest, and traditional traumatic flank hernia repair relies on anchoring of hernia mesh to these abdominal muscles, so avulsion can reduce effective treatment options. As seen in this patient, anchoring to bony structures such as the iliac crest are a suitable option in these cases, resulting in more effective traumatic flank hernia repair.

## A Case of Vancomycin-Induced Thrombocytopenia

◆ **Hadley A**, Bell M, Gates K, Prakash A, Gandhi D

**Case:** 80-year-old female was admitted for bullous pemphigoid exacerbation. Her course was complicated by acute thrombocytopenia with a decrease from 341k to 55k over a 24-hour period five days after initial presentation. She was started on vancomycin on admission due to concern for infection. Drug-induced thrombocytopenia was suspected. Her serum was found to be positive for anti-vancomycin antibodies. Platelet counts reached a nadir of critically low levels down to 6k but improved with removal of vancomycin, platelet transfusions, intravenous immune globulin (IVIG), and steroids. Platelet count improved to 91k prior to discharge.

**Conclusions:** Drug induced thrombocytopenia (DITP) is an immune-mediated reaction to drug exposure that generates drug-dependent antibodies, resulting in platelet destruction. It often presents as sudden, severe thrombocytopenia. Certain drugs such as quinine and NSAIDs are more commonly implicated; in the case of our patient vancomycin was thought to be the culprit. While the exact mechanism is unknown, it is thought to be mediated by anti-vancomycin antibodies that promote platelet clearance.

**Clinical Significance:** DITP is a serious condition that requires prompt diagnosis and treatment to avoid complications such as fatal hemorrhage. It is often overlooked due to confounding factors such as sepsis, splenic sequestration, and heparin administration. DITP should be considered in patients with severe thrombocytopenia five to ten days after exposure to a new drug, making a thorough medical review essential. Immediately remove the suspected offending agent and if the patient is at high risk of hemorrhage, platelet transfusions, IVIG, and corticosteroids can be considered. Counsel the patient to avoid the drug going forward. DITP is a clinical diagnosis made through exclusion and correlation, for confirmation drug-dependent antibodies can be considered. It is important that clinicians recognize drug induced thrombocytopenia.

## Fundamentals of COVID-19: Virtual Student-led Curriculum Design for Third and Fourth-Year Medical Students

◆ **Bailey K**, Baker J, Brenner A, Brown C, Chiu M, Francis B, Galante E, Gerena R, Gomez M, Luna Hinojosa M, Huang C, Khan I, Roll R, Ko P, Allen B, Bauer M, Mensz J, Corson-Knowles D

**Introduction:** In early March 2020, the Association of American Medical Colleges (AAMC) recommended pulling medical students from clinical rotations. This turned medical education on its head but it also provided a unique opportunity for Indiana University senior medical students to participate in medical education curriculum design.

**Methods:** A 13-student student cohort was enrolled in the "Leadership in Medical Education During COVID-19" elective during the month of April. During this month, they used curriculum design approaches to create a core curriculum COVID-19 course under faculty guidance. Student engagement was measured in large synchronous sessions. Students' change in knowledge, skills, and abilities was measured via a pre-course and post-course survey.

**Results:** The 2-week course consisted of 16-modules that covered all six IUSM competencies and were mapped to 20 course learning objectives. Its first delivery was in May 2020 to 726 medical students in either their third or fourth-year of undergraduate medical training. Student engagement was measured via comments made during large synchronous sessions on zoom webinars. Pre-course survey rate was 98.5%. Post-survey results have not yet been finalized.

**Discussion:** Student-led curriculum design led to a course that was more student-friendly in the balance of synchronous to asynchronous content. Having students create content while faculty resources were overwhelmed also allowed for collation of a lot of material from many sources. This material can be adapted to graduate medical education in the future.



## Unsuspecting Household Sounds With Risk for Hearing Loss

◆ Kokoska, RE, Kokoska, SE, Rohr-Kirchgraber, TM

**Background:** Environmental noise exposure literature provides little or no information on household appliances. Exposure to loud noises is known to result in hearing loss. Many household tasks such as vacuuming, cooking, care of pets, are frequently performed by women, either as employment (baristas, housekeepers, etc.) or home care. Hearing loss increases the risk for environmental harm, dementia, and poor quality of life. OSHA has standards regarding occupational noise exposure, but domestic exposure is unregulated and scarcely investigated.

**Methods:** Noise Levels A-weighted decibels (dBA) were measured with NIOSH sound level meter app and calibrated Apple Watch Model: watchOS 6.1.3. Both devices were held at the tester's ear level, at standard distance to appliance when in use, and at constant distance to the appliance or pet. Measurements were taken 3 times for 5 seconds duration, and the maximum dBA during each period was taken because of the lag to maximum motor speed and associated content grinding if applicable.

The tester wore ear plugs and / or ear protective covers when performing the measurements. dBA measurements were recorded indoors in quiet ambient environment (baseline was 30-33 dBA).

**Results:** None of the appliances tested offered manufacturer's noise warnings or measured levels. All emitted noise  $\geq$  80 dBA. Normal use and exposure periods are normally  $>$ 5 seconds.

**Conclusions:** Typical household appliances and pets can emit noise at levels  $\geq$  80 dBA. Chronic exposure at and above these levels can cause temporary to permanent hearing loss.

Recommendations:

- 1) Advocate for Manufacturers' labels with dBA levels for appliances
- 2) Promote awareness of risk from household environmental noise exposure
- 3) Enhance strategies for managing appliances and pets that emit harmful noise levels.

## Early Radiographic Osseointegration of a Modern 3D-Printed Highly Porous Patella Component Used in Cementless Total Knee Arthroplasty

◆ Prado R, Deckard ER, RM Meneghini

**Introduction:** Cementless fixation in total knee arthroplasty (TKA) is experiencing a resurgence. However, cementless patella components historically have been fraught with unacceptable failure and considered by many to be the "Achilles heel" of cementless TKA. Advances in technology have provided optimism that past failure mechanisms can be mitigated. This study purpose was to radiographically evaluate a modern 3D-printed cementless patellar component.

**Methods:** A retrospective review of 127 consecutive cementless TKAs from 2015 to 2018 utilizing one cementless 3D-printed highly-porous titanium patellar component was performed. Radiographs were evaluated with two blinded ratings for radiolucent lines and patellar tilt according to the Knee Society Radiographic Evaluation System at baseline 1-month and latest radiographic follow-up.

**Results:** Ninety-two cases obtained minimum one-year radiographic follow-up (mean 22.9 months). Mean age and BMI were 57.0 years and 36.8 SD kg/m<sup>2</sup>; respectively and 60% male. Mean preoperative and postoperative patellar tilt were 4.3 and 2.5 degrees, respectively. From 1-month to latest follow-up, radiolucent lines decreased in all zones (range, -0.2% to -21%). All radiolucent lines were  $<$ 1mm in depth and 88% were isolated to the non-porous ends of pegs, indicating full ingrowth around the porous peg periphery and the porous ingrowth patella baseplate surface. With available numbers, age, BMI, gender, current tobacco use, and patellar tilt did not predict the presence of radiolucent lines ( $p \geq 0.337$ ). No patellar components were revised and no radiographic osteolysis was observed.

**Conclusion:** Early radiographic results of this 3D-printed patella component with a highly-porous titanium ingrowth surface show promising osseointegration at minimum one-year. Radiolucent lines were generally small and located at the end of the porous pegs. Radiographic osseointegration was consistently evident around the highly-porous titanium pegs indicating some degree of differential ingrowth between the pegs' peripheral circumference and the ends. Further research is warranted for long-term follow-up of this cementless patellar component

## Hif1a-miR-21 Signaling Exacerbates Beta Cell Dysfunction During Diabetogenic Stress

◆ Ibrahim S, Hernandez-Stephens C, Moore R, Mirmira R, Sims EK

A hallmark of diabetes is the loss of physical or functional Beta ( $\beta$ ) cell mass. MicroRNAs (miRNAs), small RNAs that repress mRNA translation, serve as important regulators of  $\beta$  cell development and function. We previously showed that  $\beta$  cell microRNA 21 (miR-21) is increased by islet inflammatory stress and diabetes, that miR-21 induces  $\beta$  cell dysfunction by targeting mRNAs maintaining  $\beta$  cell identity, and that  $\beta$  cell miR-21 induction in vivo leads to hyperglycemia. However, upstream regulators of  $\beta$  cell miR-21 are poorly defined. We hypothesized that increases in the transcriptional regulator Hypoxia Inducible Factor 1 Subunit Alpha (Hif1a) during diabetogenic islet stress activate  $\beta$  cell miR-21 transcription, thereby contributing to loss of  $\beta$  cell identity occurring under these conditions. To test this, we examined Hif1a and miR-21 levels in  $\beta$  cell lines and mouse islets. Hif1a was increased in islets from mice after multiple low dose streptozotocin (STZ) or 4 wks of 60% high fat diet (HFD). Hif1a overexpression in INS1 cells increased miR-21 levels, insulin and glucagon co-expression, and aldehyde dehydrogenase 1a3 staining, all suggesting loss of  $\beta$  cell identity. By contrast, siRNA depletion of Hif1a abrogated cytokine-induced reductions in mRNAs regulating  $\beta$  cell identity. Chromatin immunoprecipitation studies verified increased HIF1a occupancy at the miR-21 promoter after IL1 $\beta$  treatment. To test if these HIF1a-mediated increases in  $\beta$  cell miR-21 exacerbate  $\beta$  cell dysfunction under diabetogenic conditions in vivo, transgenic mice harboring a  $\beta$  cell tamoxifen inducible miR-21 transgene (Tg( $\beta$ -miR-21, Ins1(CreERT2)Thor)) were treated with STZ or HFD. Compared to controls, STZ and HFD-induced hyperglycemia was exacerbated in Tg( $\beta$ -miR-21) mice following tamoxifen administration. In conclusion, these findings implicate Hif1a-miR-21 signaling as a contributor to  $\beta$  cell dysfunction under conditions of inflammation and diabetes.

## Novel Cranial Nerve VI Hypoplasia Causing Lateral Rectus Palsy with Pathogenic Variant in PPP1CB

◆ White K, Parikshak S, Christensen C, Curtin M

**Introduction:** We present a 2 year-old male with novel findings of cranial nerve (CN) VI hypoplasia with lateral rectus palsy in the presence of a pathogenic variant in protein phosphatase-1 catalytic subunit gene, or PPP1CB, (c.548 A>C, p.Glu83Ala). Changes to the PPP1CB gene have been reported via case series with Noonan syndrome-like disorder with loose anagen hair 2 (Noonan like-syndrome), a known RASopathy (appearing on some RASopathy panels). Changes to this gene have been previously described in 15 other patients with described clinical features including macrocephaly, ear findings, slow-growing hair, hypotonia, developmental delay, short stature, and feeding difficulties and imaging findings of white matter volume loss. Two patients in the series had the same variant as our patient, but the CN VI findings were not reported.

**Case:** Our patient initially presented with ophthalmological complications of alternating esotropia and nystagmus around 2-4 months of age, concerning for bilateral CN VI (lateral rectus) palsy. Pertinent imaging revealed bilateral CN II and VI hypoplasia, mild white matter volume loss, and thin corpus callosum. Developmentally, the patient has gross motor, fine motor, problem-solving, and speech delays. Other features included: hypotonia, short stature, delayed bone age, patent foramen ovale, unilateral preauricular pit, 2 café au lait spots, right sided cryptorchidism, and a right inguinal hernia. Genetic testing included karyotype analysis, chromosomal microarray (CMA), and Whole Exome Sequencing (WES). Karyotype analysis was normal. CMA produced a paternally inherited variant of uncertain clinical significance not likely causative of his phenotype. A WES trio followed and identified a pathogenic variant in the patient's PPP1CB gene; parents did not have this variant. The variant is a missense variant causing an amino acid change from Glutamine to Alanine (c.548 A>C, p.Glu83Ala).

**Discussion:** Of the 15 individuals with pathogenic variants in the PPP1CB gene previously described, including 2 with the same missense variant as our patient. The patient has many of the clinical features previously described, including relative macrocephaly, white matter volume loss on MRI, epicanthal folds, preauricular pits, developmental delay, hypotonia, short stature, delayed bone age, and cryptorchidism. Only one other individual was described as having a CN II hypoplasia like our patient in that case report. Our patient is currently the only individual with a diagnosis of bilateral CN VI hypoplasia with lateral rectus palsy. The findings from this case expand the PPP1CB phenotype and contribute to what is known about Noonan syndrome-like disorder with loose anagen hair 2 and RASopathies.

## Enhancing Cytotoxic Chemotherapy Response Through Targeted BET Bromodomain Inhibition in Preclinical Pancreatic Cancer Models

◆ Awasthi N, Schwarz R, Schwarz M, Schwarz J, Singh S, McCauley R

Pancreatic ductal adenocarcinoma (PDAC) has a poor prognosis and the current standard of care regimen, nab-paclitaxel (NPT) plus gemcitabine (Gem), leads to a dismal 8.5 months median survival. Targeted inhibition of Bromodomain and Extra-Terminal (BET) protein is currently under investigation for several cancers. We hypothesized that BET protein pathway inhibition by iBet-762 will enhance cytotoxic chemotherapy response in PDAC. In vitro cell proliferation assays were performed using WST-1 reagent. Protein expressions were determined by Western Blot analysis. In vivo animal survival and tumor growth experiments were performed in NOD-SCID mice. Inhibition in cell proliferation in human PDAC cells at 1  $\mu$ M concentration in NPT+Gem, iBET-762, and NPT+Gem+iBET762 was 64%, 27%, 76% in AsPC-1; 43%, 13%, 69% in Panc-1; and 42%, 51%, 75% in MIA PaCa cells. iBET-762 decreased oncogenic proteins c-Myc, b-catenin, Vimentin, and P-AKT while apoptosis-related proteins such as cleaved PARP-1 and cleaved caspase-3 and cell cycle inhibitors proteins P21 & P27 were increased. In a peritoneal dissemination model, median animal survival compared to control (21 days) was increased after therapy with NPT+Gem (33 days, a 57% increase), iBet-762 (30 days, a 43% increase) and NPT+Gem+iBET-762 (44 days, a 110% increase). These findings suggest that the effects of standard chemotherapy can be enhanced through specific inhibition of BET proteins activity, and supports the clinical application of iBET-762 in combination with standard chemotherapy in PDAC patients.

## Limitations Impressed on Mobility Device Dependent Patients Due to Insurance Restrictions

◆ Moore H, Smith M, Gonzalez A, Rousseau E

**Case:** A 14-year-old male with history of localization-related epilepsy and spastic tripartite cerebral palsy, status post bilateral tibial rotation and foot reconstruction surgery has experienced a decline in his ambulatory function and endurance over the past several years. His main mode of mobility is a power wheelchair. He also requires a walker to assist ambulation at school for 20 minutes daily but cannot complete transfers independently. He is currently borrowing an ill-fitting transport chair and does not have a backup mobility device should any of his assistive devices malfunction. His private insurance and secondary Medicaid only cover one mobility device every five years. If his equipment failed, he would have no mode of independent mobility in the community which would greatly reduce his quality of life. This would limit him from attending school and medical appointments.

**Conclusions:** Pediatric patients would benefit from having access to multiple mobility devices and should not be restricted by insurance policies. Insurance coverage of only one device every five years is especially detrimental to pediatric patients because of their continued growth and development. Many of the guidelines established by insurance are geared toward the adult patient populations and are incompatible with the needs of pediatric patients. Insurance regulations, including the rules and requirements for coverage of mobility devices, should be reevaluated with greater consideration for the realistic needs of pediatric patients.

**Significance:** Understanding the impact of insurance on our future patients is crucial in providing the most appropriate and accessible care. Medical providers must educate themselves regarding medical insurance requirements and regulations to understand the limitations that their patients may face and to initiate change when possible. It is imperative for patients who rely on mobility devices to have access so that they can function at their highest potential at home and in the community.

## Laparoscopic conversion of vertical banded gastroplasty to Roux-en-Y gastric bypass: outcomes of 44 patients.

◆ Nader SM, Bolhassani A

**Background:** Up to 50% of patients with vertical banded gastroplasty (VBG) experience failure or complications in the long-term and present for revisional bariatric surgery. This study aims to compare outcomes of VBG revision to primary gastric bypass (RYGB), in addition to reviewing our experience for indications and outcomes of VBG revisions.

**Methods:** Patients who underwent VBG revision surgery between 2009 and 2014 were identified. Perioperative outcomes and long-term weight loss, complications, reoperations and length of stay were analyzed and compared to those of matched primary RYGB patients. All patients enrolled in this study had failed VBG complications, weight loss of less than 50% in 2 years, stomal stenosis, stomal ulcers, intractable bleeding, reflux esophagitis, pouch dilation, GG fistula with weight regain.

**Results:** A total of 44 patients with a previous VBG who underwent revision after 17 $\pm$ 7 years were identified. Mean age was 55  $\pm$  9 years (female (n=39, 89%). Thirty-nine patients converted to RYGB (80%), 1 to sleeve gastrectomy (2%), and 4 had VBG reversal (9%). Patients with VBG revisions were compared with 1589 patients after primary RYGB. VBG revisions were indicated because of weight gain (55%), dysphagia (20%), or both (25%). Of the 68% who were undergoing revision, 23% had strictures, 29% gastrogastic fistula, and 16% pouch dilation. Compared with primary RYGB patients, VBG revision patients stayed in the hospital longer, and experienced more complications. However, 2 years after revision to RYGB, BMI decreased significantly (36.7 $\pm$ 6.2) compared to preoperation (49.8 $\pm$ 11.9; p<0.01) except for patients who underwent VBG reversals gained weight (10 kg/m<sup>2</sup> over 2 years). Dysphagia resolved in 100% and reflux in 95% of patients who underwent VBG conversion to RYGB.

**Conclusion:** Compared to primary RYGB complications after revision of VBG are substantial however they should not minimize its good outcomes. VBG revision to RYGB is effective in treatment of both weight gain and dysphagia.

## Variable Presentations of Osteoporosis and the Importance of DEXA Screening

◆ Swiezy S, Junod C, Lewis K, Walker G

**Case:** 61-year-old Caucasian female, BMI 19.6. PMHx: total hysterectomy, smoker. FHx: osteoporosis. DEXA showed bone mineral density (BMD) L1-L4 vertebrae T-score = -1.6 and BMD femoral neck T-score = -3.6 (osteoporosis -2.5 [WHO]). Patient started on salmon calcitonin. Extensive dental caries necessitated prompt treatment and delayed bisphosphonate therapy (~1 year) due to risk of jaw osteonecrosis. Reclast (Zoledronate) then prescribed by infusion. Repeat DEXA 3 years after beginning Reclast: BMD L1-L4 vertebrae T-score = -1.6 and BMD femoral neck T-score = -2.4.

56 year old Caucasian female, BMI 34.2. PMHx: ER+ breast cancer treated with aromatase inhibitor, taking Ca and Vit. D. DEXA showed BMD L1-L4 vertebrae T-score = 0.9 and BMD femoral neck T-score = -0.15. Ca/Vit. D were continued, no further osteoporosis treatment was pursued. Clinical Significance: Osteoporosis affects 10 million Americans, with a disproportionate burden on women 65+ (24.8%, men 65+, 5.6%). It contributes to significant morbidity and mortality, with US women having a 1 in 2 lifetime risk of breaking a bone, often their hip, due to osteoporosis. And, 24% of hip fracture patients age 50+ die within the year following. Sadly, 80% of Americans 65+ who have suffered fractures were never screened or treated for osteoporosis, despite clear DEXA screening guidelines from the USPSTF, ACOG, and NOF. While, osteoporosis often presents with no clinical symptoms, and risk factors are often not predictive of disease extent in individual patients, the availability of effective medical therapies implores physicians to be vigilant in their prescription of lifesaving DEXA diagnostic screening.

**Conclusion:** Osteoporosis represents a substantial health burden, especially for women. All women 65+ should receive DEXA scanning to assess bone density, while women with relevant risk factors should be screened earlier. Full implementation of current osteoporosis screening guidelines may drastically improve women's health.

## Mollie Wheat Memorial Clinic: Missed Appointments Review and Improvements

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◆ Swiezy S, Eckrote E, Ratcliffe B, Reyes E, Danek R

**Introduction:** Missed primary care appointments represent a potential cause for negative health outcomes in patients. As student clinicians, we have a responsibility to make sure patients with missed appointments are consistently and efficiently contacted for two purposes: 1) to reschedule appointments to facilitate access to needed care and 2) to evaluate and assess reasons for missed appointments so that, as providers, we can work to implement policies and procedures to overcome the barriers that cause our patients to experience delays in preventive assessment, treatment, and diagnosis.

**Methods:** Patients who 1) presented for a scheduled appointment, 2) did not present for a scheduled appointment, and 3) presented for a walk-in appointment were surveyed for relevant demographics. Patients in group 2) did not present for a scheduled appointment, were contacted via phone to understand reasons for missed appointment. Comparisons between the three groups of patients seen by MWMC will be made. Reason(s) for missing appointments will be evaluated and ranked from most to least common barriers to care. A literature review will then be undertaken to understand potential actions that MWMC can take to reduce the most common barriers to care and, thus, to decrease the percentage of missed appointments in our clinic population.

**Future Directions:** Through this prospective study, we hope to understand the basis for missed appointments in our population. Subsequent to the study, we plan to propose solutions aimed at decreasing the rate of missed appointments. We will continue to track rates of missed appointments after the implementation of our recommendations to evaluate their efficacy.

## Temporal Bone Metastasis: A Systematic Review

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◆ Tucker BJ, Jones AJ, Novinger LJ, Galer CE, Nelson RF.

**Objectives:** To describe a case and summarize all previously reported temporal bone metastases.

**Methods:** The PubMed, MEDLINE, Embase, and Web of Science databases were systematically reviewed according to the PRISMA guidelines to identify all reported cases of distant metastatic disease to the temporal bone. All articles with available English translation published until October 1, 2019 were included in our review. Descriptive statistics were performed on the extracted data.

**Results:** Out of 576 full-length articles included for review, a total of 119 met final inclusion and exclusion criteria for data extraction. Including our reported case of metastatic p16-negative tonsillar squamous cell carcinoma, a total of 276 individual cases of distant temporal bone metastasis were identified. There was a male predominance (55.4%) with median age of 60.0 years (range 2 – 90). The most common locations of primary malignancy included the breasts (19.9%), lungs (15.9%), and prostate (9.1%). Most tumors were carcinomas of epithelial origin (75.3%) and predominantly adenocarcinoma (50.5%). The commonest metastatic sites encountered within the temporal bone were the petrous (72.2%) and mastoid (49.5%) portions. Bilateral temporal bone metastases occurred in 37.9%. Patients were asymptomatic in 29.6% of cases. Symptomatic patients predominantly reported hearing loss (45.3%), facial palsy (32.8%), and otalgia (16.4%) for a median duration of one month. Management consisted primarily of chemotherapy and/or radiation (54.4%). Median recorded survival was 3.5 months.

**Conclusions:** Temporal bone metastasis is an uncommon phenomenon but should be considered in patients with subacute otologic symptoms or facial palsy and concurrent distant malignancy.