Twentieth Annual
Medical Student
Research Symposium

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University of Virginia School of Medicine

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Presentation #1

Determining the Diagnostic Approach to the Evaluation of Patients with Chronic Kidney Disease

Julian Ahsan, Taylor Horgan

Chronic Kidney Disease (CKD) affects more than 30 million adults and raises the risk of comorbidities such as cardiovascular disease[1]. Knowing the cause of CKD is important for determining treatment options and the time course of the disease, though current guidelines for testing are lacking. This study was composed of two parts both with the aim of understanding how physicians order testing to determine the cause of CKD. For the qualitative part of the project, three nephrologists and one primary care provider were interviewed about what methods and testing they use to determine the cause of CKD in their patients. When a total of five nephrologists and five PCPs have been interviewed, the data will be used to design a national survey that will determine variability in practices related to CKD diagnosis. The second part of the study is a quantitative analysis of the diagnostic workup of incident kidney disease using the National Veteran Health Database. Data was pulled for patients aged 18 to 100 years with an incident eGFR < 60 ml/min/1.73 m^2 between 2003 and 2016. The time between the first and second test for EGF was measured for the 1,062,950 patients that met these criteria. Preliminary data shows that the highest percentage of patients received their second test within 4 to 6 months, with younger patients and those that identify as Black or Hispanic having higher rates of follow-up within this time frame. While these results suggest a general adherence to a diagnostic algorithm, variations in evaluation of patients based on age and race will need to be further studied to identify any disparities using other diagnostic markers of kidney disease.

Presentation #2

Definitive High Dose Proton Based Radiotherapy for Unresected Chordomas

Walter Banfield

Introduction: Chordomas are rare primary bone cancers with an incidence 0.1 every 100 000 individuals and prevalence of less than one for every 100,000.[1] Chordomas account for 1 to 4% of primary malignant bone tumors and 17% of all primary bone tumors of the spine.[2,3,4] The mainstay of treatment is surgical resection. En bloc resection with negative margins is the gold standard treatment.[5] Maximal resection of a chordoma can result in significant functional morbidity for the patient.

Methods: In an IRB approved retrospective single center analysis of 67 patients were identified with newly diagnosed spinal or sacral chordoma treated with definitive high dose proton-based radiotherapy between 1975 to 2019. The median age at diagnosis was 67.1 years (range, 32-90 years at diagnosis); 54% were male and 36% were female. Reasons for radiotherapy alone included medical inoperability and/or concern for neurological dysfunction based on spine level or patient choice. Tumor locations were sacrococcygeal (n=52), lumbar (n=4) and thoracic (n=1), and cervical spine (n=10). Median tumor diameter was 7.4 cm (range 3-25 cm; mean 8.6 cm). Median volume was 176.7 cc (range 3.4-1,878.7 cc; mean 318.9 cc). Radiation doses were measured gray radiation biological effectiveness (GyRBE). GyRBE was prescribed as Gy multiplied by the relative biological effectiveness of 1.1; and doses were tailored for gross target volume (GTV). GTV cumulative radiotherapy (RT) dose was 78.61 GyRBE. Protons made up a

significant proportion of each patients' total RT dose with a median of 67.4% (range 15.9-100%). The median follow-up was 56.2 months form completion of radiation treatment (maximum 14.3 years).

Results: The overall survival was 83.5% at 5 years (95% CI 60-85%) and 65.6% at 8 years (95% CI 45-76%). The disease-free survival was 56.4% at 5 years (95% CI 40-63%) and 43.7% at 8 years (95% CI 30-70%). Four patients died of other causes (lung cancer, oral cancer, leukemia, and unknown causes). In Cox model for local control, a Likelihood Ratio Statistic, total dose: Hazard ratio (HR) 0.85 (95%CI: 0.63-1.06) p=0.174. Local control at 8 years with dose= 73.8-77.42 GyRBE was 56.2% (95%CI: 30.1-75.9) compared to 70.2% (95%CI: 42.0-86.5) with 78.0-85.9 GyRBE, p=0.956. In Cox model for distant control, size: HR 1.07 (95%CI: 0.98-1.15), p=0.104 and Sacral site, HR:3.75 (95% CI:0.75-66.7) p=0.121. Distant control for tumors < or = 7.4 cm at 8 years was 79.3% (95%CI: 56.6-91.0%) compared to only 60.3% (95%CI: 33.5-79.2%) for tumors > 7.4 cm, p=0.277. Distant control at 8 years for sacral tumors was 65.9% (95%CI: 46.7-79.6%) vs. 88.9% (95%CI: 43.3- 98.4%) for other sites, p=0.169. The late side effects were insufficiency fracture (n=15, 22.4%), Proctitis Rectal bleeding (n=4, 6.0%), Spinal Sacral Nerve Injury (n=5, 5.5%), 1 Fibrosis, 1 Infection. Complication rate at 5 years was 37.0%(95%CI: 25.7-51.3%), at 8 years was 44.9%(31.3-61.2%).

Conclusion: In conclusion higher doses provided better local control in this study. Larger tumors exhibited worse local control. These results support the use of high dose radiotherapy with proton performance for patients with unresected chordoma

Citations:

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Presentation #3

Common Indications for Allogeneic Hematopoietic Cell Transplant (HCT) Recipients to be Admitted to the Intensive Care Unit (ICU)

Walter Banfield

Introduction: Allogeneic Hematopoietic Cell Transplant (HCT) is a treatment with curative potential for many hematologic conditions. However patients undergoing this treatment may

have underlying comorbidities, conditioning chemotherapy, immunosuppression, physiologic barrier disruptions and graft versus host disease (GVHD) that predispose them to complications such as sepsis and septic shock. Allogenic HCT patients the develop sepsis may require intensive care unit (ICU) level care. The objective of this study is to identify the common indications of allogenic HCT patient admission to an ICU.

Methods: A single-center, retrospective, study of 237 patients who had received an allogeneic HCT between January 1, 2012 and May 31, 2020 was conducted. Data collection and analyses were performed in accordance with Institutional Review Board guidelines. Variables collected included patient demographics, medical history, HCT characteristics, and patient outcomes. Patients were excluded from the analyses if they were not admitted to the ICU after their allogeneic HCT.

Results: Thirty-eight patients (16.0%) were transferred to the ICU after allogeneic HCT. Reasons for ICU admission in this study included acute hypoxic respiratory failure n=13 (5.4%), acute respiratory distress syndrome in n=3 (1.2%), cardiac etiology in n=7 (2.9%), and n=18 (47.4%) had sepsis. Of the septic patients five (27.8%) septic patients were hemodynamically stable while 13 (72.2%) patients developed septic shock. Of the 18 patients with sepsis shock the median age at allogenic HCT was 59 (range 30-71), 10 (55.6%) were male and 8 (44.4%) were female. The most common indications for allogenic HCT in patients that developed sepsis were acute myeloid leukemia (55.6%), myelodysplastic syndrome (22.2%), acute lymphoblastic leukemia (16.7%) and Hodgkin's lymphoma (11.1%). Majority of the graft sources were peripheral blood n=18 (55.6%). Other graft sources included haploidentical n=2 (11%), umbilical cord blood n=5 (27.7%), matched related n=4 (22.2%), and matched unrelated donors n=7 (38.8%). Myeloablative conditioning was given to 5 (27.8%) patients and 13 (72.2%) had reduced intensity conditioning. Median time to neutrophil engraftment in patients with sepsis was 13 days (range 6-31 days). Of the patients that developed sepsis n=3 (16.7%) survived beyond the ICU stay (median follow up 342 days; range 286-842). Acute GVHD also occurred in n=3 (16.7%) patients and chronic GVHD occurred in n=4 (22.2%) of patients. The median number of days from allogenic HCT to ICU admission overall was 177 days (range 24-1172 days). Median overall survival censored at last follow up was 210 days (range 42-1206).

Conclusion: This study demonstrates that allogeneic HCT patients that develop sepsis requiring ICU level care have a high mortality of 83.3%. By identifying the indications for ICU admission among allogenic HCT patients early interventions may be taken to reduce the need for ICU level care of these patients. Further research is required to better identify factors that predispose allogenic HCT patients to sepsis and septic shock.

Presentation #4

Retrospective Analysis of VTE Prophylaxis Following Orthopedic Trauma vs Torso Trauma Using Cox-Regression and Propensity Adjustment

Jeffrey Bellinger

Purpose: A vulnerable patient population regarding venous thromboembolism (VTE) are trauma patients. Trauma patients are of particular interest in that depending on the region of the trauma: head, neck, extremity, abdomen, chest, etc., they may be managed by different specialists with variable training and expertise. There is a paucity in the literature of the incidence of VTE and processes of care that may influence VTE across different trauma

populations, particularly when patients with torso trauma are compared to those with isolated extremity or pelvic fractures. Published manuscripts in peer reviewed literature to date vary widely in their approach to screening, diagnosis, mode of prophylaxis, time to prophylaxis, and estimates of the population risk for thromboembolism including deep vein thrombosis (DVT) and pulmonary embolism (PE), which makes it difficult to standardize prophylaxis decisions with various combinations of soft tissue/solid organ injury and orthopedic trauma. The purpose of our study is to compare the rates of VTE in various subsets of orthopedic trauma populations to torso trauma populations and to discern differences in prophylaxis modality and time to prophylaxis between the groups.

Methods: We analyzed data from the American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP) database over a two-year span (2017-2018). We included all adults that were between 18-89 years old at the time of injury that sustained at least a moderate, if not more severe, extremity fracture or torso injury according to the Abbreviated Injury Scale (AIS) diagnosis and severity. We extracted data from each patient on the following variables: demographics, injury parameters, vitals, comorbidities, time to and type of prophylaxis, hemorrhage markers, hospital complications, and more. The primary outcome variable in our analysis was the incidence of symptomatic DVT and PE that occurred in each trauma group of interest during the patient's initial hospital stay.

Results: Unfortunately, the coding and analysis for this project has not been completed yet. However, we have preliminary frequency results that may offer insight into what the results will look like after regression analysis and propensity adjustment. After exclusion criteria was applied, the two groups that we have data for at this time are the lower extremity fracture and chest trauma group. The two groups possessed similar demographics, vitals, and comorbidities. Lower extremity fractures and chest trauma both had an incidence of VTE of 0.6% (n=108,844 vs n=67,562 respectively). The median (with IQR) time until first prophylaxis was 1358 (710, 2234) minutes for lower extremity fracture group and 1027 (551, 1946) minutes for chest trauma group.

Conclusions: The greatest conclusion these preliminary results suggest is the fact that there would appear to exist a difference in time until first prophylaxis in patients with isolated orthopedic trauma compared to those with blunt chest trauma. While we don't yet possess the information to inform us on the possible reasons for this difference, or its consequences, the matter deserves further scrutiny. As such, we anticipate having the full results of the preliminary analysis available within the next 60 days.

Presentation #5

Medicine's Gordian Knot: A New Approach to Economic Disparities and Racial Inequity in United States Healthcare

Dawson Brown

In a vacuum, racial disparities in United States health outcomes could be addressed at their perceived origin – medical institutions; however, healthcare in America exists in a whirlwind, not a vacuum. Healthcare operates downstream of inequality-producing forces with tremendous strength – education, income, employment, housing, transportation, criminal justice, etc. To ignore these forces, in the pursuit of a less complicated path to fewer disparities in medicine – would be to ignore the origin of many of those disparities. To include and address these forces,

in the pursuit of a comprehensive, systematic restructuring of American society – lies well beyond the purview of many American public health institutions. This intersection, between small institutions - which lack the resources to fundamentally change the backwards game they are playing – and a game that desperately needs fundamental changing, is a tremendous resource dilemma. In light of this dilemma, this research seeks to review the literature surrounding national inequity (education, income, housing, transportation, etc.) and health inequity (chronic disease, heart disease, cancer, etc.) in order to examine and synthesize novel solutions to health inequity in the United States. Existing research reveals that health disparities are not negative externalities of a large, complex system of health delivery and payment in the United States. Rather, they are the result of direct design features of American Society. The existing literature also underscores the need for broad, decisive action in the face of that link. In light of the existing literature, we propose both a novel solution to the problem – a new Secretary/Department of Equity - and a novel way of communicating the problem - the Gordian Knot of racial health inequity.

Presentation #6

NLRP3 Inflammasome Activation in and Inflammasome Constituents' Contribution to the Pathological Processes of Diabetic Retinopathy

Xiaoyu Cai

Diabetic retinopathy is one of the leading complications of diabetes mellitus and affects millions of people each year. These patients represent a significant population who may benefit from further investigation of the pathophysiology of this illness. Literature has identified hallmark features of diabetic retinopathy to include neural and glial cell dysfunction, inflammatory cell recruitment, endothelial cell dysfunction, and loss of the blood retinal barrier. The role of inflammatory cells and inflammasome activation is of particular interest as these processes have been linked to multiple other neurovascular conditions including Alzheimer's disease and age related macular degeneration. The NLRP3 inflammasome, the best studied inflammasome, is a multiprotein complex comprised of NLRP3, the adaptor ASC, and the protease Caspase-1. This inflammasome is activated by a diverse array of "danger signals" including diabetes-related stressors such as elevated glucose and free fatty acids. NLRP3 inflammasome activation leads to cleavage of pro-IL-1β and pro-IL 18 in their active forms, ultimately inducing cells to undergo apoptosis and pyroptosis. This project aims to quantify NLRP3 inflammasome activation, elucidate the timing of activation, and explore the involvement of inflammasome constituents in diabetic retinopathy through a mouse model.

Streptozotocin (STZ) treatment is used to induce type I diabetes in wild-type and knockout mice missing different components of the NLRP3 inflammasome. After one, three, and eight months of hyperglycemia, inflammasome activation in the neuroretina is evaluated through protein and RNA analysis with immunoblotting and qRT-PCR respectively. These studies aim to measure the abundance of multiple pro- and anti-inflammatory and angiogenic cytokines as well as markers of activated endothelium. Additionally, gliosis and neuroinflammation are visualized through immunofluorescence staining of cryo-sectioned eyes with NLRP3 inflammasome antibodies. For the three and eight month groups, retinal neurodegeneration is evaluated in addition to inflammasome activation using spectral domain-optical coherence and scotopic electroretinography (ERG). The thickness and composition of the retina are also assessed using staining and immunolabeling of cryosectioned slides.

By immunoblotting whole retinal lysates, we did not observe evidence of NLRP3 inflammasome activation one month after diabetes induction in wild-type mice. Three months after diabetes induction, we measured significant depression of ERG a- and b- waves, indicative of early retinal atrophy. Further investigation will elucidate the differences between wild-type diabetes and control mice as well as between wild-type and inflammasome knockout mice. Such information will enhance our understanding of the timing and role of NLRP3 inflammasome activation in the pathogenesis of diabetic retinopathy.

Presentation #7

Effects of nIgM on osteogenesis and immune modulation through an nIgM knock-out murine model

Andrew Cuthbert, B.S.[1,$]; Jerrod Hammes, B.S.[1,$]; Xizhao Chen, B.S.[1]; Logan McColl, M.D.[2]; Kailo Schlegel, M.S.[3]; Peter Lobo, M.D.[3]; Abhijit Dighe, Ph.D.[4]; Quanjun Cui, M.D.[4]

Natural IgM (nIgM) autoantibodies were historically shown to decrease rejections in renal and cardiac allografts in recipients based on clinical observations. They are known to inhibit and regulate excess inflammation in animal models. On the other hand, immune response, particularly the adaptive process comprised of B and T lymphocytes, plays a crucial role in repair of bone fractures. Thus, it is hypothesized that any process that interferes with immune response may have consequences on bone formation and fracture repair. Immunologic and physiologic effects of natural IgM on osteogenesis and its potential clinical implications have never been investigated before. To address these questions, we created a natural IgM knock-out (KO) B6 murine model. Micro-computed tomography (μCT) imaging demonstrated drastic differences of the effect of endogenous natural IgM on long bone femur formation in female B6 mice versus male mice: without endogenous nIgM, male B6 KO mice showed significant increase in bone volume fraction, bone mineral density, trabecular bone thickness, cortical bone area, cortical bone thickness, cortical tissue mineral density, and minimal inertia, whereas specific bone surface and structural model index were significantly decreased. Interestingly, cytokine profile analyses of mice serum only showed significant increase in CCL-11 in male nIgM KO B6 mice. On the contrary, more significant cytokine shifts were observed in female nIgM KO B6 mice. Based on our prior study, nIgM was also delivered to well-established rat mandibular defect models. The number of $CD3^-$ $CD11b/c^+CD38^+$ M1 macrophages was significantly higher in the nIgM group, compared with the control. However, the proportion of inflammatory $CD45^+CD3^+CD4^-CD38^-$ T cells was significantly reduced with nIgM treatment. In our subcutaneous implant model, more average bone growth, although statistically insignificant, was seen in Bal b/c mice that were treated with nIgM injections. For the first time, this study demonstrates the direct effect of nIgM on osteogenesis through modulation of host immune response in multiple animal models. More future studies are required to fully understand molecular and cellular mechanisms of nIgM on bone growth and its potential clinical applications in fracture repair and even transplantation of bone, cartilages or other soft tissues.

Presentation #8

Prevalence of *Helicobacter Pylori* Infection Among Resettled Refugees Presenting to a Family Medicine Clinic in the United States

Elizabeth Farrar[1]; Nicole Jensen, MD[1]; Nadia Saif, MD, MPH[1]; Sarah Blackstone, PhD, MPH[1]; Fern Hauck, MD, MS[1]

Background: *Helicobacter pylori* is endemic to much of the global population, but few studies have examined the prevalence of *H. pylori* in refugee populations in the United States. This study investigates the prevalence of *H. pylori* infection and common barriers to treatment in a primary care refugee clinic.

Methods: We conducted a chart review of 188 refugee patients who were referred for an *H. pylori test* between January 1st, 2019 and December 31st, 2020. Recorded measures included patient demographics, *H. Pylori* test result, treatment of initial infection, completion of test of cure (TOC), TOC results, salvage therapy, and barriers to treatment. Binary logistic regression was performed to examine the association between demographic factors and *H. pylori* test results.

Results: Of the 171 patients who completed an *H. pylori* test, 94 tested positive (54.9%). Of these, 75 were treated with triple therapy (81%). Forty-nine patients completed a TOC (52%), and 18 patients (90%) who remained positive for H. pylori were subsequently treated with quadruple therapy. Patients under 18 (OR = 0.25, $p<0.01$), and patients with a previous history of *H. pylori* (OR = 0.44, $p<0.05$) were less likely to have positive results. Common barriers to treatment included pregnancy, religious observance (e.g., fasting), and health system complications (e.g., prior authorization, cost of treatment).

Conclusion: The prevalence of *H. pylori* among refugees at the IFMC was higher than the overall prevalence estimate for the United States, which is consistent with previous studies. This work represents an updated picture of *H. pylori* prevalence among refugees in the US and contributes to the identification of treatment barriers.

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Presentation #9

Interventional Outcomes for A Randomized trial of Unruptured Brain Arteriovenous malformations (ARUBA)-Eligible Patients

Faraz Farzad

Background: A Randomized trial of Unruptured Brain Arteriovenous malformations (ARUBA) suggested that medical management afforded superior outcomes to intervention for unruptured arteriovenous malformations (AVM), but its findings have been controversial. Subsequent studies of AVMs that would have met the eligibility requirements of ARUBA have supported intervention for the management of some cases.

Objective: To summarize interventional outcomes for ARUBA-eligible patients reported in the literature.

Methods: A systematic literature search for AVM intervention studies that used inclusion criteria identical to those of ARUBA (age ≥18 years, no history of AVM hemorrhage, no prior intervention) was performed. The primary outcome was death or symptomatic stroke. Secondary outcomes included AVM obliteration, hemorrhage, mortality, and poor outcome (modified Rankin Scale ≥2 at final follow-up).

Results: Thirteen studies met the inclusion criteria, yielding an overall study cohort of 1,909 patients. The primary outcome occurred in 11.2% (pooled=11% [8%-13%]). The rates of AVM obliteration, hemorrhage, poor outcome, and mortality were 72.7% (pooled=78% [70%-85%]), 8.4% (pooled: 8% [6%-11%]), 9.9% (pooled=10% [7%-13%]), and 3.5% (pooled=2% [1%-4%], respectively. Annualized primary outcome and hemorrhage risks were 1.85 (pooled=2.05 [1.31-2.94]) and 1.34 (pooled=1.41 [0.83-2.13]) per 100 patient-years, respectively.

Conclusion: Intervention for unruptured AVMs affords acceptable outcomes for appropriately selected patients. The risk of hemorrhage following intervention compared favorably to the natural history of unruptured AVMs. Future studies from prospective registries may clarify patient, nidus, and intervention selection criteria that will refine the challenging management of unruptured AVM patients.

Presentation #10

The Effect of the COVID-19 Pandemic on Gunshot Wound-Related Upper Extremity Trauma

Grace L. Forster, BS; Brent R. DeGeorge Jr., MD, PhD and Brittany J. Behar, MD

Purpose: In the wake of the COVID-19 pandemic, firearm sales and rates of gun violence have spiked. Firearm policy has additionally been in a state of flux. To date, how these changes have affected the incidence and management of gunshot wounds (GSWs) to the hand and upper extremity is unclear. This report of a national insurance database compares the incidence of GSW-related upper extremity injuries pre- and post-pandemic, as well as trends in management and outcomes.

Methods: Using ICD-9, ICD-10, and CPT codes, patients having been diagnosed with both a GSW and an upper extremity injury within seven days of one another were identified through the Mariner91 database, comprising all insurance claims made through Medicare, Medicaid, self-pay and government plans from January 1, 2010 to October 31, 2020. Demographics, comorbid conditions, subsequent operations and management strategies, as well as complications over the span of one year are reported and compared. Logistic regression analysis evaluated the association of patient or injury characteristics and management strategies with the post-pandemic period.

Results: 10,218 patients were identified to have been diagnosed with a GSW-related injury to the upper extremity; 9,331 of these patients were injured pre-pandemic (defined as before March 1, 2020) and 887 of these post-pandemic (after March 1, 2020), making the incidence of GSW-related injury to the upper extremity pre-pandemic to be 76.4 injuries/month and post-pandemic 110.9. Post-pandemic injuries were found to occur less likely in the setting of comorbid hypertension, dementia, diabetes and PVD, and less likely in the setting of depression (p-values<0.05). Post-pandemic injuries were found to occur more often as a result of accidental

injury and assault; there was no significant association between post-pandemic injuries and suicide/self-harm attempts nor legal intervention. Post-pandemic injuries more often required operative management, showing significant associations with open fracture repair (OR 1.96 [1.61-2.38], p-value <0.001).

Conclusions: There have been increased rates of GSW-related injuries to the upper extremity post-pandemic. Post-pandemic GSW-related injuries were less often associated with significant chronic comorbidities like diabetes, hypertension, dementia and depression. Notably, post-pandemic injuries were more likely the result of accidental injury or assault, and more likely to undergo operative management, particularly open fracture repair. This information could have implication in public health policy as it adapts to the post-pandemic era, as well as in the current debate regarding gun control.

Presentation #11

Comparison of Minimum 2-Year Clinical Outcomes with the Use of a Flexible Versus Rigid Reaming System for Independent Femoral Tunnel Reaming During ACL Reconstruction

Anthony J. Ignozzi, Eric Taleghani, Thomas E. Moran, Amelia Bruce, Joseph Hart, Brian Werner

Background: Radiographic and cadaveric studies have suggested that anatomic anterior cruciate ligament reconstruction (ACL-R) femoral tunnel drilling with the use of a flexible reaming system through a standard anteromedial portal (AM-FR) may result in a more anatomic graft position compared to a rigid reamer through an accessory anteromedial portal with hyperflexion (AM-RR). No prior studies have directly compared clinical outcomes between the use of these two techniques for anatomic femoral tunnel creation during ACL-R.

Purpose: The primary objective was to compare graft failure rates at a minimum of 2 years postoperatively for patients undergoing ACL reconstruction between the two techniques (AM-FR and AM-RR). The secondary objectives were to compare functional testing and patient reported outcomes between the cohorts.

Methods: Consecutive patients at a single academic institution from 2013 to 2018 who underwent primary ACL reconstruction without additional ligamentous reconstruction and subsequently participated in Lower-Extremity Assessment Protocol (LEAP) testing were analyzed. Patients were separated into two groups based on the type of anatomic femoral tunnel drilling: AM-FR and AM-RR. Graft failure, determined by ACL-R revision, was assessed with a minimum 2 years of postoperative follow-up. Patient reported outcome scores and functional performance testing performed at 6 months postoperatively were also compared.

Results: 284 (AM-RR: 232; AM-FR: 52) patients were included. Mean follow-up time was 3.7 ± 1.5 years, with a minimum two-year follow-up rate of 90% in the AM-RR and AM-FR groups. There was no significant difference in the rate of graft rupture between the use of AM-RR and AM-FR (AM-FR: 9.6%, AM-RR: 10.8%; p = 0.806). No significant differences existed in peak knee extension strength, peak knee flexion strength, limb symmetry indices, or hop testing at 6 months postoperatively between the cohorts. No significant differences existed with regard to mean IKDC at 6 months (AM-RR: 81.1, AM-FR: 78.9; p = 0.269) or KOOS (AM-RR: 89.0, AM-FR 86.7; p = 0.104) between groups.

Conclusions: Independent femoral tunnel drilling for ACL reconstruction using rigid or flexible reaming systems results in comparable rates of graft failure at a minimum of 2 years postoperatively and no significant differences in strength assessments or patient reported outcomes at 6 months postoperatively.

Presentation #12

Repair of a Complete Radial Tear of the Lateral Meniscus

Anthony J Ignozzi, Greg Anderson, David R. Diduch

Background: Recognizing and repairing a lateral meniscus complete radial tear is critical, as this tear pattern makes the meniscus nonfunctional for load sharing of axial forces, and the convex shape of the lateral tibial plateau increases contact pressure.

Indications: The diagnosis of a lateral meniscus complete radial tear was supported by joint effusion, lateral joint line tenderness, positive McMurray test, and magnetic resonance imaging findings. Arthroscopy confirmed the complete radial tear.

Technique Description: During the procedure, a self-capturing suture passer was used to pass a size 0 high-strength suture through the meniscus. To start the repair, the free ends of the suture were passed from top to bottom on both sides of the tear. These free ends were then crossed on the bottom of the meniscus to create an X configuration and passed from the bottom to top slightly further back from the first suture passes. A spinal needle and a chia were used from outside-in to create a side-to-side suture across the tear to reinforce the repair, and a knot was then tied on the outer capsule. The chia was used once again to shuttle the size 0 sutures to the exterior portion of the knee and the knots were tied on top of the capsule.

Results: Postoperatively, patients are 25% weight bearing with a 0-to-90-degree range of motion restriction for 6 weeks, with no deep squatting for 3 months. With an isolated radial tear repair, the patient can expect to return to sport by 5 months. Radial tear repair outcomes demonstrate reduced lateral meniscus extrusion, complete meniscus healing in 86.4% of patients, and significantly improved International Knee Documentation Committee, Lysholm, and Tegner scores.

Discussion/Conclusion: Repairing a complete radial tear of the lateral meniscus restores the function of the meniscus. This surgical technique provides a high rate of complete meniscus healing and excellent patient satisfaction.

Presentation #13

Technical Considerations for an Anteromedializing Tibial Tubercle Osteotomy

Anthony J. Ignozzi, Thomas E. Moran, Scott Dart and David R. Diduch

Background: Tibial tubercle osteotomy and distal realignment allows for adjustment to the patellofemoral articulation in order to improve patellar tracking and redistribute patellar contact pressures.

Indications: A healthy, active 39 year-old woman status post right knee tibial tubercle osteotomy presented with greater than two years of patellar instability symptoms in the left knee. Imaging revealed a tibial tubercle to trochlear groove (TT-TG) distance of 21 mm and patellar tendon lateral trochlear ridge (PT-LTR) distance of 14 mm.

Technique Description: After knee arthroscopy is performed, an open incision is made along the inferomedial patellar tendon. Two pilot holes are created before a sagittal saw is used to make the tibial tubercle osteotomy, before completing it with an osteotome. Anteromedialization and/or distalization of the osteotomy is performed relative to templated values in order to improve patellar articulation. After correction, three bicortical screws are placed to achieve stable fixation.

Results: There were no immediate complications following surgery. Surgical management led to improvement of the patient's patellofemoral pain, which allowed return to prior baseline level of function.

Discussion/Conclusion: An anteromedializing tibial tubercle osteotomy is an effective surgical option for patients with evidence of patellar maltracking or central or lateral patellar chondromalacia whom have failed conservative management. This case demonstrates the efficacy of an anteromedializing tibial tubercle osteotomy to provide pain relief by improving patellar tracking and offloading patellar contact pressures on areas of prominent chondral wear.

Presentation #14

No Difference in Clinical Outcomes of Five-strand and Quadruple Hamstring Autografts of Similar Diameter in Anterior Cruciate Ligament Reconstruction

Anthony J. Ignozzi, Thomas E. Moran and Brian Werner

Objectives: There is a paucity of studies in the literature examining the clinical outcomes of 5-strand hamstring (5HS) autografts. Therefore, the aim of this study is to compare the clinical outcomes of anterior cruciate ligament reconstruction (ACL-R) between 5HS and 4-strand hamstring (4HS) autografts of similar graft diameter.

Methods: Patients who underwent ACL-R from 2013 to 2018 at a single academic institution and received a 4HS or 5HS autograft were analyzed. Exclusion criteria included less than 2-year follow-up and any additional ligamentous reconstruction at the time of ACL-R. Revision ACL-R and arthrofibrosis were assessed at a minimum 2 years of postoperative follow-up. Objective measures of ability to return to sport were assessed as well.

Results: The mean graft diameters for 4HS and 5HS autografts were 8.26 ± 0.73 and 8.39 ± 0.67, respectively (P=. 449). The mean follow-up for the 4HS and 5HS cohorts was 3.0 ± 1.5 years and 3.3 ± 1.3 years (P=.379). The 4HS (n=59) and 5HS (n=23) cohorts had revision ACL-R rates of 15.7% and 8.7%, respectively (P=.416). Arthrofibrosis occurred in 5.9% of 4HS patients and 13.0% of 5HS patients (P=.296). There were no significant differences found between groups with regards to objective measures of ability to return to sport.

Conclusion: No significant difference was found in revision ACL-R rates, frequency of arthrofibrosis, or objective measures of ability to return to sport between patients who received 4HS and 5HS autografts of similar diameter for ACL-R.

Presentation #15

Differences in Contralateral Limb Extension Strength Can Overestimate Limb Symmetry Index after Anterior Cruciate Ligament Reconstruction

Anthony J. Ignozzi, Thomas E. Moran, Stephan Bodkin, Joseph Hart, Brian Werner

Introduction: Some literature suggests that strength deficits and functional impairment of the contralateral, uninjured leg exist following ACL injury. Given the emergence of these findings and the contralateral, uninjured limb frequently being used as a control for comparison to the operative extremity in return-to-play, limb symmetry assessments, the primary objective of this study was to evaluate whether the contralateral, un-injured limb represents a dynamic, rather than static, data point.

Methods: 144 patients undergoing ACL reconstruction at a single academic institution between March 2013 and August 2018 were evaluated. Patients completed our institution's Lower-Extremity Assessment Protocol (LEAP) testing at six and nine months postoperatively for objective evaluation of ipsilateral and contralateral limb flexion and extension strength and functional performance. Retrospective chart review was performed to determine demographic and operative factors. Extension strength, flexion strength, limb symmetry index (LSI), and hop tests of ipsilateral and contralateral limbs were compared between the six- and nine-month LEAP testing outcomes. Further sub-analysis of cohorts demonstrating less than and greater than 10% difference in contralateral limb flexion and extension strength was performed. Binary logistic regression was utilized to evaluate demographic and operative risk factors for developing differences in contralateral limb strength.

Results: On average, contralateral limb flexion and extension strength increased between 2-4% between six and nine months postoperatively. However, the contralateral limb demonstrated a difference of > 10% percent in extension and flexion strength in 35/144 (24.31%) and 55/144 (38.19%) of patients, respectively. The cohort with >10% difference had significantly weaker contralateral extension and flexion strength at six months compared to the cohort that demonstrated < 10% difference (Extension: 2.00 vs. 2.39, $p < 0.001$; Flexion: 0.84 vs. 1.08, $p < 0.001$), but similar ipsilateral limb performance. Therefore, the >10% difference cohort had a significantly greater LSI at six months compared to the < 10% difference cohort (67.3% vs. 59.4%, $p = 0.006$). At nine months postoperatively there was no difference in contralateral extension strength and LSI between cohorts. No demographic or operative risk factors were identified that correlated with which patients demonstrated deficits in contralateral limb strength.

Conclusion: Although the contralateral, non-operative limb provides a relatively stable control value with which performance metrics of the ipsilateral, operative limb may be compared after ACL reconstruction, a significant percentage of patients will also demonstrate deficits in flexion and extension strength of the contralateral limb compared to their peers. This can result in an over-estimation of normality of limb symmetry comparisons. It is not reliably predictable which patients may demonstrate greater deficits with flexion and extension in the contralateral limb. Comparison of the operative extremity to a patient's own pre-injury measures or that of a large, population-based, matched, un-injured, control group should be considered more ideal.

Presentation #16

A comprehensive approach to robotic spine surgery using the Mazor X Stealth Edition

Kosyakovsky, Jacob[*1], Kurker, Kristina P[1], Berlin, Connor[2] and Buchholz, Avery L[2]

Robotic systems are transforming spine surgery. Our institution has extensive experience with robotic spine surgery using the Mazor X Stealth Edition (MXSE). Herein, we leverage that experience to describe key concepts in workflow and pedicle screw placement using MXSE. Through a combination of written procedures, illustrative figures, and intraoperative videos, we describe optimal procedure, pearls, and pitfalls for several major indications for MXSE—T10-pelvis posterior spinal fusion (PSF), sacroiliac (SI) implants, minimally invasive (MIS) transforaminal lumbar interbody fusion (TLIF), and oblique lumbar interbody fusion (OLIF). We discuss promising results from our institution including decreased operative and fluoroscopy times comparing MXSE to freehand methods. Through this work, we aim to provide a comprehensive framework to guide the increasing integration of MXSE technology worldwide.

Presentation #17

Ectopic intestinal variceal bleeding following pancreatic transplant: A case series

Kosyakovsky, Jacob[1]; Robinson, Todd[2]; Brayman, Kenneth[2] and Agarwal, Avinash[2]

Ectopic gastrointestinal varices, defined as non-gastric non-esophageal intestinal varices, remain a challenge to diagnose and treat yet can present as a severe albeit rare source of gastrointestinal hemorrhage. To our knowledge, there are only three case reports in the literature of ectopic varices identified following pancreatic transplant, and each of these presentations involved a lengthy course of diagnostic and therapeutic attempts to localize the source of persistent gastrointestinal (GI) bleeding before the varices were identified and coiled. We present a case series of two patients at our institution that we found to have ectopic varices causing otherwise unexplained GI bleeding and anemia following pancreatic transplant. We describe the diagnostic and therapeutic approaches that culminated in successful management. Through this work, we hope to facilitate recognition of this rare presentation.

Presentation #18

Intranasal Insulin improves memory and reduces neuroinflammation in a rodent model of Alzheimer Disease

Kosyakovsky, Jacob[1*], Fine, Jared M[2], Frey, William H II[2] and Hanson, Leah R[2]

Intranasal (IN) insulin is a promising treatment for neurodegenerative disease. We and other research groups have shown that IN insulin rescues cognitive impairment in several rodent models of Alzheimer Disease (AD). Herein, we show that IN Apidra (a short-acting forming of insulin) rescues cognitive impairment caused by intracerebroventricular (ICV) streptozotocin (STZ) administration as measured by the Morris Water Maze (MWM) test. Furthermore, IN Apidra modulated several aspects of the neuroinflammatory milieu of the ICV STZ model as assessed by immunohistochemistry. This work contributes to the understanding of the STZ model of AD as well as to understanding of the efficacy and mechanisms of IN insulin.

Presentation #19

Outcomes of Ultrasound-Guided Needle Lavage for Rotator Cuff Calcific Tendinosis

Koyada PK[1], Winkler RT[1], Anderson, MW[1], Diduch D[2] and Pierce JL[1]

PURPOSE: To investigate the long-term outcomes of ultrasound-guided needle lavage (US-NL) for rotator cuff calcific tendinosis (RCCT).

MATERIALS & METHODS: After IRB approval, imaging databases were queried for all patients treated with US-NL for RCCT between January 2013 and August 2021. 218 US-NL procedures were identified. Patient demographics, imaging findings, and pre- and post-procedural clinical data were collected through chart review. 54 US-NL procedures participated in a follow-up Oxford Shoulder Score (OSS) survey and questions regarding their current pain/function and satisfaction with US-NL.

RESULTS: Of 218 US-NL procedures identified: 145 female (67%):73 male (33%); mean age 57 years; 23 patients (11%) HgbA1c of >6.5%; 81 patients (37%) tobacco use; right 120:left 98 cases; tendon involvement supraspinatus (156;72%), infraspinatus (53;24%), subscapularis (26,12%), and teres minor (1,0.5%). The calcific deposits had a mean cross-sectional area of 190 ± 24 mm^2, Gartner class 1 (85,39%) well-circumscribed dense-and-formative, and French Society of Arthroscopy (FAS) class A (88;40%). There was a significant difference ($p<0.001$) between pre-(4.9±0.5) and immediate post-procedural (1.3±0.3) pain scores; pre-(145±8 °) and post-procedural (162±5°) shoulder forward flexion, pre-(127±9°) and post-procedural (145±7°) abduction. 34 cases (16%) underwent surgery after US-NL for rotator cuff repair or subacromial/subdeltoid decompression. 54 (25%) cases participated in the follow-up survey 1.57-6.81 years after their initial US-NL (median 3.82 years). There was sustained reduction in pain scores (mean 2 ± 1), with $p < 0.001$. The mean OSS results was 43±2 (range 23–48 points). 47 cases (87%) expressed satisfaction to complete satisfaction. 53 cases (98%) stated willingness to “do-it-all-over-again” or repeat the procedure.

CONCLUSION: US-NL produced long-term significant pain and function improvement in patients with RCCT. At our institution, this data supports the use of US-NL as an effective first-line treatment for RCCT.

Presentation #20

The Impact of Mental Illness on Postoperative Adverse Outcomes After Outpatient Joint Surgery

Kristina Kurker, Pramod Kamalapathy, Alyssa D Althoff, James A Browne, Brian C Werner

Background: The effect of pre-existing mental illness on outpatient surgical outcomes is not well characterized. The objective of this study was to evaluate the association between pre-existing mental illness diagnosis and postoperative complications after outpatient total knee (TKA) and total hip arthroplasty (THA) and to compare with inpatient total joint arthroplasty (TJA).

Methods: The Mariner Claims Database was used to capture patients undergoing outpatient TJA from 2010 to 2017. Patients were grouped into three categories: those with an existing

history of anxiety and/or depression, those with severe mental illness, and those without history of mental illness. Additional subgroup analysis compared those with severe mental illness undergoing outpatient versus inpatient TJA. Outcomes were analyzed using multivariable logistic regression ($P < .05$).

Results: Patients undergoing outpatient TJA with prior history of anxiety and/or depression or severe mental illness had an increased risk of emergency department (ED) visits (TKA, $P < .001$; THA, $P = .014$) within 90 days compared with those without history of mental illness. Severe mental illness was also associated with increased risk of medical complications at 90 days (TKA, $P < .001$; THA, $P = .006$). When compared with those undergoing inpatient surgery, patients undergoing outpatient TKA with severe mental illness were at increased risk of periprosthetic infection ($P = .005$) and ED visit ($P = .003$) within 90 days of surgery.

Conclusion: Anxiety/depression and severe mental illness are associated with higher rates of ED visits after outpatient TJA. Patients with severe mental illness also experienced more adverse events, whereas those with anxiety and/or depression had similar rates compared with the control group. A higher rate of adverse outcomes was seen after TKA in patients with severe mental illness when surgery was performed in the outpatient setting versus those that had surgery as an inpatient.

Presentation #21

Cutaneous Manifestations of COVID-19: A Case Series

Grant O Lardieri*, Jackson A Narrett*, Jasmine K Malhi, Merry Ellen Barnett, Randy K Ramcharitar and Aditya M Sharma

Background: Novel coronavirus SARS-CoV-2 infection has been reported to be associated with the cutaneous manifestations of pernio, livedo reticularis and racemosa, Raynaud's phenomenon, and necrotic skin lesions.

Methods: A cohort of 1015 participants with laboratory confirmed Sars-CoV-2 infection who were seen at the University of Virginia Health System was compiled. Inclusion criteria were age 18 or older at time of positive COVID-19 PCR test, received inpatient or outpatient management of infection (including self-quarantine), and have 90 days of follow-up data in the UVA electronic health record (EHR). Data on demographics, clinical characteristics, and outcomes were abstracted from the EHR by three authors (GOL, JAN, JKM). Review of physical exam documentation and search of EHR was used to identify cases of pernio (AKA chilblains; AKA "COVID Toes"), livedo reticularis/racemosa, eruptive cherry angioma, new or worsening Raynaud's phenomenon, and necrotic skin lesions.

Results: Sixteen participants were identified to have skin manifestations of COVID-19. Twelve participants had necrotic skin lesions (75%), three (18.8%) had pernio/chilblains/COVID toes, one (6.3%**)** participant had new or worsening Raynaud's phenomenon, one had reported livedo reticularis (6.3%), and none had eruptive cherry angioma. Thirteen (81%) participants with skin findings were hospitalized and eleven (69%) received critical care. Two participants (12.5%) died within 90 days.

Conclusion: In a single center cohort of 1015 participants with confirmed Sars-CoV-2 infection, cutaneous manifestations were rare. This result may reflect a low incidence, low recognition, or

low reporting of skin findings in COVID-19. Further study with prospective design and systematic identification of cases is required to better describe the incidence of cutaneous manifestations of COVID-19.

Presentation # 22

Malignant Transformation in Laryngeal Dysplasia Treated with Photoangiolytic LASER–A Meta-analysis

Taylor Lear

Objective: Laryngeal leukoplakia is a common problem encountered by the otolaryngologist and voice specialist, and carries a risk of progression to malignancy. Historically, treatment of these lesions included vocal fold stripping procedures, cold microdissection, and CO2 laser excision. In 2003, photoangiolytic laser treatment for laryngeal dysplasia was introduced, and has become popular for treatment of laryngeal dysplasia in the operating room and office settings. Photoangiolytic laser treatment results in lesion regression with improved preservation of voice compared to conventional surgical treatment, and at a potentially lower cost. This systematic review and pooled analysis seeks to characterize the rate of malignant progression among patients with laryngeal dysplasia treated with photoangiolytic laser and compare to prior systematic reviews of conventional surgical approaches.

Data Sources: OVIDMedline, Pubmed, CINAHL, and Google Scholar.

Review Methods: Databases were searched from 2005-2020 for studies of patients with laryngeal dysplasia who underwent photoangiolytic laser therapy. Included were studies of adult patients with biopsy confirmed laryngeal dysplasia who were treated with photoangiolytic laser. Excluded were studies where patients were treated up front by other means (CO2 laser, microsurgery, radiation, etc.) or who had invasive disease or prior head and neck cancer history.

Results: Five articles with 127 cases were included. For purposes of calculating pooled rate of malignant transformation, one study was excluded for poor follow up duration. Of the remaining 4 studies, 98 cases were included. The distribution of dysplasia grade (reported in 63 cases) was 20/63 (31.7%) mild, 6/63 (9.5%) moderate, and 37/66 (58.7%) severe/carcinoma in situ (CIS). One study each used KTP or PDL exclusively, and two studies utilized both laser types during the study period. Pooled rate of malignant progression for patients with laryngeal dysplasia treated with photoangiolytic laser was 6/98 (6.1%). The weighted average follow-up time was 23.1 months. In comparison, pooled rate of malignant progression among studies using conventional surgical techniques included in Mehanna et al. was 13.6% with a mean follow up time ranging from 59 to 146 months.

Conclusion: Laryngeal dysplasia is a premalignant lesion which confers a risk of progression to malignancy. After biopsy to establish the diagnosis there are multiple surgical techniques available for treatment with the goal of lesion eradication and voice preservation. Systematic review and meta-analysis of studies of patients with laryngeal dysplasia treated with photoangiolytic laser demonstrated a pooled rate of malignant progression of 6.1% with a weighted mean follow up time of 23 months. Prior meta-analysis done before photoangiolytic laser was popularized This is lower than a prior systematic review published in 2010 reviewing

studies using conventional surgical techniques under general anesthesia, which had a pooled rate of malignant transformation of 13.6%, albeit with longer follow up time.

Presentation #23

Nicotine Dependence and Meaning in Life

Caroline Lebegue

Smoking is a leading cause of preventable death. Understanding the connection between one's sense of meaning in life (MIL) and nicotine dependence may help tobacco cessation programs better support people trying to quit smoking. We used an online survey to evaluate the relationship between MIL and nicotine dependence among adults who smoke cigarettes and e-cigarettes. We found that MIL was positively correlated with nicotine dependence among rural and suburban populations and among people 18 - 24 years old, but that the correlation was not present among urban populations or among people between 25 - 40 years old. Further research is needed to better understand what mediates the observed relationship between MIL and nicotine dependence.

Presentation #24

Delay in Diagnosis of Sarcoidosis Associates with Worsening Parenchymal Disease in Long Term Chest Imaging Findings

Jasmine K. Malhi*, Jimi O. Akingbade MD, James Alsobrooks MD, Sean Kearns MD, Tessy Paul MD, Numaan Malik MD, Theresa Altherr, Kathleen Brown-Steinke, Imre Noth MD and Catherine A. Bonham MD

Rationale: Sarcoidosis is a multisystem granulomatous disease of unknown etiology. Long-term clinical course for pulmonary disease vary widely and includes a variety of imaging findings from lymphadenopathy to fibrosis. The impact of delay in diagnosis on pulmonary sarcoidosis imaging is not well understood.

Methods: This was a retrospective cohort study of patients with sarcoidosis enrolled between 2019-2020 in the University of Virginia Sarcoidosis Registry (IRB #20937) at the University of Virginia seen in Pulmonary Clinic. Clinical data including demographics, symptoms, biopsy, treatment, and chest imaging were obtained via chart review. Asymptomatic patients, those without biopsy, and those without available symptom history were excluded. Those without initial and follow up imaging data were also excluded. The primary endpoint was presence of chest imaging abnormalities after treatment initiation including Scadding staging for sarcoidosis (0-IV), presence of fibrosis, mediastinal adenopathy, and parenchymal involvement on either chest x-ray or CT. Patients were grouped according to those who were diagnosed via biopsy less than 1 year or greater than 1 year from symptom onset. Statistical analysis was conducted for all variables and data were compared between groups.

Results: Of 114 patients enrolled from 2019-2020, 90 were symptomatic prior to diagnosis. Of these, 76 had both initial and follow up imaging and biopsy to determine diagnosis. All patients received imaging within 6 months of diagnosis. In the group with time <365 days from symptom onset to diagnosis, there were a total of 52 patients, 56% White, 44% Black-African American,

42% Female, 56% Male. 100% of these patients were treated. It took an average of 83.23 ± 12 days to reach diagnosis. In the group with time >365 days from symptom onset to diagnosis, there were a total of 24 eligible patients. This group was 79% White, 21% Black/African American, and 45% female, 55% male. It took these patients an average of 4.02 ± 0.74 years to reach diagnosis. In patients with less than one year to diagnosis, at initial imaging, 1.9% had fibrosis, 54.7% had parenchymal findings, 88% had LAD. With a mean follow up time of 4.96 years, 16.9% had fibrosis, 54.7% had parenchymal involvement, 68% had LAD. In patients who had over a year to diagnosis, at initial imaging, 4.2% had fibrosis, 75% had parenchymal involvement, 91.7% had LAD. With a mean follow up time of 5.03 years, 8.3% had fibrosis, 79.2% had parenchymal involvement, while 83.3% had LAD. The increase in parenchymal involvement over time for late diagnosis patients was statistically significant.

Conclusion: Patients who had longer time to biopsy proven diagnosis of sarcoidosis had persistence of lung involvement and lymph node enlargement despite treatment initiation at 5 years. Patients who received an earlier diagnosis by biopsy had more fibrosis at 5 years, with persistence of lung involvement, but diminished LAD despite treatment. We are currently extending these findings to a multicenter study and examining the imaging findings including quantifying lung involvement and discriminating features such as nodularity and fibrosis with greater precision.

Presentation #25

Vascular and Thrombotic Events in Adults Age 55 and Under with COVID-19: A Retrospective Single-Center Cohort Study

Jasmine K Malhi, Grant O Lardieri, Jackson A Narrett, Merry Ellen Barnett, Randy K Ramcharitar, Aditya M Sharma

Rationale: While pulmonary involvement is the most common cause of morbidity and mortality associated with COVID-19, there have been reports of a significant burden of vascular and thrombotic events in patients with Sars-CoV-2 infection. In this analysis, we aim to characterize the incidence of thromboembolic and bleeding events in younger adults (less than 55) with COVID-19.

Methods: A cohort of 1015 participants with laboratory confirmed Sars-CoV-2 infection above the age of 18 who were seen at the University of Virginia Health System was compiled. 648 of these patients were less than 55 years of age. Data on demographics, clinical characteristics, and outcomes at 30 and 90 days from COVID-19 diagnosis were abstracted from the UVA EHR by three authors (GOL, JAN, JKM). Outcomes recorded included venous thromboembolism (deep vein thrombosis and pulmonary embolism), arterial thrombotic events (myocardial infarction and stroke) and bleeding. Mortality and readmission were also recorded. These data were adjudicated by three physician authors (MEB, RKR, AMS).

Results: In this subgroup of participants, 60.5% women, 106 (16.4%) were admitted to the hospital and 44 (6.8%) received critical care. At 30 days, six participants (0.9%) had DVT or suspected DVT, four (0.6%) had catheter related thrombosis, five (0.8%) had PE, two (0.3%) had MI, three (0.5%) had stroke, and eleven (1.7%) had a major or clinically relevant non-major bleed. Eight participants (1.2%) died within 30 days and 2.2% were readmitted within 30 days. At 90 days, an additional six participants (0.9%) had DVT, two (0.3%) had catheter related thrombosis, two (0.3%) had PE, none had MI or stroke, and twelve (1.9%) had a major or

clinically relevant non-major bleed. At 90 days, an additional four participants (0.6%) had died and an additional seventeen (2.6%) participants were readmitted.

Conclusion: Vascular and thrombotic events were rare in this subgroup analysis of a retrospective cohort study of participants age 55 and under with COVID-19 conducted at a single academic medical center. Additional research is needed to better characterize the risk of vascular and thrombotic events in relatively younger adults with COVID-19.

Acknowledgement: The authors would like to acknowledge the collaboration of the CORONA-VTE investigators.

Presentation #26

Characterizing the Global Discussion of Rhinoplasty on Twitter: A Big Data Analysis

Shreya Mandava BS, Dr. Samuel Oyer MD and Dr. Stephen Park MD

Objectives: Twitter is a popular social media platform that allows the world to interact on all topics, including rhinoplasty. The goal of this study was to characterize the content, sentiment, and trends over time in the discussion of rhinoplasty on Twitter.

Study Design: Retrospective data-mining project.

Methods: By querying the Academic Twitter API, 1,427,015 tweets published from 2015-2020 containing the terms "rhinoplasty" or "nose job" were analyzed. The tweets were de-duplicated and filtered for spam. Natural language processing (NLP) and data visualization techniques were utilized to assess temporal trends, key terms, and sentiment scores of tweets.

Results: Significantly more "nose job" tweets (80.8%) were published compared to "rhinoplasty" (19.2%). Most "rhinoplasty" tweets were from repeat users linked to a physician or business source, while most "nose job" tweets were from isolated users. Annual tweet frequency increased from 2015 to 2020, with "rhinoplasty" tweets rising sharply each January. There was a statistically significant difference between the average compound sentiment scores ($P < 0.00001$) and sentiment composition ($P < 0.00001$) of "rhinoplasty" and "nose job" tweets. "Nose job" tweets had over twice the proportion of negative sentiment compared to "rhinoplasty" tweets (27.3% vs 12.9%, respectively). Content analysis showed the terms "aesthetic," "cosmetic," and "surgeon" were associated with positive sentiment.

Conclusions: According to Twitter data, there has been a steady increase in discussion of rhinoplasty on social media and prevalent use of the term "nose job" among the general public, especially when emotional context is elicited. Many “rhinoplasty” tweets are used by physicians for marketing purposes. Tweets mentioning cosmetic enhancement are overwhelmingly positive while other terms are more mixed in sentiment.

Presentation #27

Should Place of Death be Added to the Index of Disparities between Black and White Breast Cancer Patients?

Sarah Marion

Background: Compared to their white counterparts, Black women with breast cancer suffer from earlier onset of diagnosis, more aggressive histology, higher mortality rates, and are at risk of racial bias from healthcare providers and treatment plans that do not align with the standard of care. Place of death can be considered a metric for high quality end-of-life care as hospital death is associated with both physical and emotional distress. Given Black patients' particular vulnerability, the purpose of this study was to investigate place of death as a surrogate for end-of-life healthcare disparities.

Methods: The National Center for Health Statistics database was used to determine the place of death for all US women with primary-breast cancer death from 1999-2019. Place of death (home, hospital, and hospice) and race (white and Black) were considered; the subset of women who died <40 were also analyzed. Trends in place of death in the 20-year period were evaluated via linear regression with comparisons by Chi-square test.

Results: From 1999 to 2019, there were 867, 213 women who died due to breast cancer; 718,437 (82.8%) were white and 125,040 (14.4%) were Black women. Home death increased an absolute 5.7% (38.4 to 44.1%) in white women and 6.2% (29.3 to 35.5%) in Black women, $p<0.0001$ trend for both. Hospital deaths decreased -11.4% (31.9 to 20.5%) in white women and -14.4 (48.2 to 33.8%) in Black women, $p<0.0001$ trend for both. Hospice death was introduced as a database category in 2003; from 2003-2019, hospice death increased similarly in both white (0.6 to 14.5%) and Black patient populations (0.5 to 14.2%), $p<0.0001$ trend for both.

In 2019, white women with breast cancer are 1.24x more likely to die at home than Black women (44.1 vs 35.5%, $p<0.0001$) and Black women with breast cancer are 1.65x more likely to die in the hospital (33.8 vs 20.5%, $p<0.0001$). Hospice deaths are more closely proportional between racial groups with white women with breast cancer only 1.02x more likely to die in hospice than Black women (p=NS).

For women <40 from 1999 to 2019, home deaths decreased 4.6% (40.0 to 35.4%, $p=0.016$) for white women without significant changes in home deaths (26.9 to 25.2%, p=NS) in Black women. In 2019, white women <40 were 1.40x more likely to die at home than Black women with breast cancer (35.4 vs 25.2%, $p = 0.0009$).

Conclusions: Despite improvements in home deaths over time, racial place of death disparities persist with Black women facing disproportionately higher hospital deaths and lower home deaths than white women with breast cancer. These differences may be due to cultural preference, poor physician communication about end of life options, or even inaccurate prognosis resulting in limited integration of palliative care (particularly for young patients). As

home death has been associated with more favorable outcomes for patients including symptom control and autonomy, further research is needed to develop targeted interventions to improve communication and culturally competent end-of-life care.

Presentation #28

Differences in GoFundMe Crowdfunding based on Category of Dermatologic Disease

Erica Mark B.S., Brian Florenzo B.S,, B.A., Mira Sridharan B.S., Jules Lipoff M.D., Olivia Schenck M.D. and Mary Margaret Noland M.D.

Introduction: GoFundMe campaigns are growing in popularity, even in the field of dermatology. Analysis of platform trends can provide valuable data regarding differences in disease burden and healthcare coverage.

Methods: Data was collected from GoFundMe by two independent coders using dermatology specific search terms. Campaigns were excluded if they were not based in the United States, active for less than a day or if the primary reason for fundraising was not related to dermatology. The cleaned data were exported to R. Categorical data were summarized as frequencies and proportions. The frequencies of themes noted were calculated based on the percentage of times the theme was mentioned. Mann-Whitney-U and $\boldsymbol{X}^2$ tests were performed to investigate differences in insurance coverage and endorsement of specific themes based on race, gender, and category of fundraising condition and to investigate differences in the amount raised and campaign goal based on category of diagnosis.

Results: There was a significant difference in the amount raised based on category of diagnosis, with traumatic diseases ($12,011) having the highest average raised compared to cosmetic ($2,205) having the lowest. Fundraiser recipients for traumatic causes less often had insurance coverage than expected and those fundraising for autoimmune diseases more often had insurance coverage than would be expected by chance alone ($\boldsymbol{X}^2_7$=48.31, p<0.0001). Categories of disease associated with a greater number of individuals fundraising to afford basic necessities (food, utilities) than expected by chance alone were infectious, malignant, and traumatic. The opposite was true for those fundraising for autoimmune, cosmetic, or congenital conditions ($\boldsymbol{X}^2_7$=98.91, p<0.0001).

Relevance: The chi-square analysis showed that campaigners fundraising for traumatic skin disease such as lacerations or road rash less often had insurance coverage than would be expected. Traumatic skin diseases were also the category with the highest mean amount raised. This could be due to several factors such as risk-friendly personality type or occupational/lifestyle hazards of people more likely to experience traumatic skin disease. Conversely, those with an autoimmune condition were more likely to have insurance coverage than expected by chance. This may reflect conditions that require long-term care and thus require a prioritization of adequate insurance coverage. Regardless, the economic impact and consequences of traumatic skin disease may be an area of future education and improvement.

Presentation #29

Misinformation regarding COVID-19 etiology and social distancing

Erica Mark BS, Galina Udod BS, Jayne Skinner MS

Background: Novel and surprising misinformation typically spreads via social media and variably influences Americans individuals. In the context of the COVID-19 pandemic, we explored differing beliefs about viral etiology and safety practices in curtailing viral spread among social media users in predominantly California and New York.

Goals: The purpose of this research was to identify demographic variables associated with the spread of COVID-19 misinformation.

Methods: A self-compiled, validated knowledge, attitude, and practices (KAP) questionnaire (Cronbach's alpha 0.730, 0.687, and 0.629, respectively) was distributed via social media. Data from 675 participants were collected. We performed χ^2 analysis comparing responses to specific questions with demographic information. The significance threshold was set at $p < 0.05$.

Results: Although most respondents (83.4%) agreed that the cessation of social distancing before widespread vaccination would increase infection rates, younger people (*p=0.017*) were significantly less likely to agree with this statement than older people. While individuals who received COVID-19 information from neighbors or friends were more likely (*p=0.026)* to believe that the cessation of social distancing would increase COVID-19 cases, those who mainly received COVID-19 information from television were less likely to agree with this statement than those who did not (p=0.005).

Discussion: Recognizing that demographic differences influence the spread of misinformation may be useful for future public health interventions. Although severe COVID-19 complications are less common in younger populations, engaging young people in virus prevention strategies is crucial to reduce viral transmission. As previous research suggests that altruistic behavior is more likely to occur when individuals are motivated by friends or neighbors, community discussions about COVID-19 safety practices may increase public health intervention efficacy.

Presentation #30

Abstract: Effect of Opioids on NSCLC

Ravdeep Mathone

Background: Opioids have become first line in the management of lung cancer related pain; however, there are limited randomized studies detailing the interactions between opioids and immune checkpoint inhibitors (ICIs) in NSCLC.

Purpose: The aim of this study was to investigate whether high opioid use was associated with worse outcomes in patients receiving ICIs for advanced NSCLC.

Design and setting: A single-center, retrospective, cohort study of 209 patients with a diagnosis of lung cancer at the University of Virginia Health care system between February 4, 2015, and January 1, 2020.

Method: Selected patients were over the age of 18 with advanced NSCLC that received ICI therapy and did not have small cell lung cancer or NSLC. The primary endpoint of the study was overall survival (OS) and the secondary end point was duration of treatment (DOT). Patients with low-moderate opioid use on ICI therapy were compared to those receiving ICI therapy with ≥ 50 morphine equivalent daily dose. A multivariate regression model was designed to compare OS and DOT between high and low opioid users. Variables included in the multivariate regression model included: opioid use, PD-L1 status (if known), sites of metastatic disease, BMI, histology, Eastern Cooperative Oncology Group performance status, smoking history, gender, and age.

Result: We found that high opioid use was associated with a significant decrease in median overall survival (3.8 vs. 14.7 months) and shorter median duration on therapy (1.9 vs. 7.5 months) among advanced NSCLC patients receiving ICIs.

Conclusion: High opioid use among patients with advanced NSCLC receiving ICIs was associated with reduced OS and shorter DOT when compared with those with low opioid use and confirmed using a multivariate regression model. Our findings should encourage providers to use opioids judiciously in NSCLC patients receiving ICIs when treating cancer related pain. Development of opioid-sparing symptom management, and the role of peripheral opioid antagonists warrant further investigation.

Presentation #31

Analysis of Respiratory Kinematics

Brendan McNamara, Swet Patel and Dr. Shrirang Gadrey

Rationale: Careful observation and classification of a patient's breathing motion is paramount to assessing the status of hospitalized patients. Currently, this is predominantly performed by a visual bedside evaluation from a trained healthcare worker, who must qualitatively describe the patient's breathing condition. With this, there is significant inaccuracy in the visual monitoring of respiratory features, descriptive terminology is not well standardized across institutions, and as a result only moderate inter-rater reliability is achieved. The Analysis of Respiratory Kinematics (ARK) method is a novel respiratory monitor designed to quantitatively characterize breathing mechanics in an unobtrusive manner. Additionally, the ARK method may allow for the explanation of variance seen in respiratory kinematic features that is not currently elucidated by commonly monitored vital signs.

Objective: To test the viability of the ARK method in the clinical setting by recruiting patients with signs of respiratory distress (e.g. tachypnea, labored breathing patterns, accessory muscle usage) and correlating their ARK-generated breathing signals with clinical outcomes.

Methods: 125 patient volunteers were assessed for respiratory function via the ARK method. Patients were recruited from various departments at UVA University Hospital, ranging from acute to critical care conditions. Respiratory kinematics were assessed in these patients via a network of seven motion sensors. Algorithms are used to extract individual breath intervals,

respiratory rate time series, and magnitude-synchrony relations between sensors, using motion sensor data. Respiratory kinematics data were collected on each patient over a period of up to 6 hours and compared to their clinical course.

Results and Conclusions: Our study shows that patient respiratory kinematics can be successfully visualized via the ARK method in various populations of patients at UVA University Hospital, providing a convenient way to quantitatively assess patient respiratory kinematics without the need for a bedside clinician. This has the potential to serve as an early warning system for worsening respiratory function, allowing for improved patient outcomes through earlier interventions. Furthermore, this project builds on earlier studies demonstrating the ARK method's viability in assessing respiratory kinematics. While prior studies had limitations in terms of their sample size and inclusion of only healthy individuals, this project addresses both of these issues. Further analysis of collected data will aim to correlate ARK measurements with clinical outcomes or parameters.

Presentation #32

Harnessing the Antimicrobial Effects of Human Chemokine CXCL10

Micayla M. Menchel, Matthew A. Crawford, Debra J. Fisher and Molly A. Hughes

New therapeutics to treat antibiotic-resistant infections are a critical branch of the multi-faceted strategy to combat antimicrobial resistance. One potential reservoir of novel antimicrobial therapeutics is human chemokines, immune proteins best known for their chemoattractant properties that also possess the ability to directly kill bacteria. Our lab previously distinguished chemokine CXCL10 for its ability to kill a broad range of multidrug-resistant bacteria. We hypothesized that the pathogen-targeted activities of CXCL10 could be isolated into discrete peptides while simultaneously abolishing the host-targeted, pro-inflammatory effects traditionally associated with chemokines Here we aimed to identify the minimal active sequence of peptide P1, a 14 amino acid antimicrobial peptide derived from the N-terminus of CXCL10. We additionally investigated the possibility of generating peptide P1 variants composed of D-amino acids as a potential way to abolish host-targeted activity while also improving protease resistance. Sequential removal of amino acids from the N- and C-termini of Peptide P1 ultimately yielded a minimal active sequence of 8 amino acids ($P1^{N\text{-}4,\ C\text{-}2}$; RTVRCTCI). Conversion of this peptide to D-amino acids enhanced bacterial killing, abolished host-targeted functions, and conferred protease resistance. Collectively, our findings identify the D-isomer peptide $P1^{N\text{-}4,\ C\text{-}2}$ as a promising candidate for pre-clinical testing using animal models of bacterial infection. Harnessing the intrinsic ability of human proteins to broadly kill bacteria is a promising avenue to bring new antimicrobial peptides into the therapeutic pipeline.

Presentation #33

Metaphors in/of Medicine

Elena Parcell

Metaphors and other forms of figurative language are an important, but often hidden bedrock of communication – in *Metaphors We Live By*, George Lakoff and Mark Johnson suggest that "our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature" (3). Medicine is not immune to this figurative scaffolding underlying our conceptual system – metaphors in medicine may communicate the inner workings of the body, translate the mechanisms of medications, convey illness experiences, and can even help shape the clinician-patient relationship. The purpose of this project was to create a forum for analyzing and assessing metaphors commonly encountered within medicine, with the objective of interpreting how figurative language may influence perceptions of illness and health. This was accomplished by developing a curriculum for and facilitating a reading group, held during the summer of 2021, that was devoted to figurative language in medicine. Each session focused on a different metaphorical schema regularly encountered within medicine and had a select number of brief associated readings to help guide discussion. The three reading group sessions included an introduction to medical metaphors, a close examination of detective metaphors in medicine (e.g., the search for a diagnosis as a mystery-solving process) and an exploration of military metaphors in medicine (e.g., the notion of 'fighting' cancer). Looking forward, this curriculum may be used to host additional sessions with medical students, as well as potentially with other students throughout the university. Furthermore, it may be useful to design additional sessions focused on the practice of actually creating and applying meaningful metaphors within medicine and with patients, rather than solely analyzing metaphorical frameworks that are already in use. Metaphors in medicine can frame, and at times constrain, perceptions of illness for both patients and clinicians, and therefore are worthy of careful consideration and examination, which was the aim of this project.

Works Cited

Lakoff, George, and Mark Johnson. *Metaphors We Live By*. University of Chicago Press, 2008.

Presentation #34

Evaluation of Sentinel Lymph Node Mapping Detection Rates at Increasing BMI

Grace Prillaman, BS, Katherine Peng, MD, Leigh Cantrell, MD, Kari Ring, MD

Objective: Sential lymph node (SLN) mapping has become the preferred method for the surgical staging of endometrial cancer. However, previous studies on SLN mapping have failed to determine whether this technique produces reliable detection rates at increasing BMIs. This study was conducted to evaluate the success of SLN detection in endometrial cancer as it relates to BMI.

Methods: Clinic pathologic data was collected for patients who underwent hysterectomies with surgical staging between 2015 to 2020. Descriptive statistics were calculated, and chi-square tests were used to assess the associations between categorical variables. Continuous variables were evaluated with independent student's t test.

Results: The study population consisted of 337 patients who completed surgical staging over the study period from 2015-2020. The majority of these patients were obese, accounting for 65% of the study population. Of these patients, 226 women completed cervical dye injection with attempted sentinel lymph node mapping. This cohort had a mean BMI at the time of surgery of 34.4 (range 18.5 - 66.1). Of the 226 who underwent SLN mapping, 210 (92.9%) successfully mapped. The mean BMI at time of surgery was significantly lower for patients with sentinel lymph nodes identified (mean=34.06, class I obesity) compared to those who did not successfully map (mean 39.15, class II obesity) (p=.02). Overall, 40% of women with a BMI greater than 55 did not map successfully. In contrast, only 2 patients with a normal or overweight category BMI (2.6%) did not successfully map. Additionally, patients that did not map had significantly longer time in OR (mean 192) by 35 minutes (p=.00).

Conclusions: Patients with class II and III obesity had decreased rates of sentinel lymph node identification. In addition, the rate of sentinel lymph node detection declined with increasing BMI. The current results should aide in the selection of surgical staging methods and the preoperative counseling for patients, particularly those with super morbid obesity.

Presentation #35

Delayed Cholestatic Liver Injury Induced by PD1 and CTLA4 Inhibitors in a Patient with Metastatic Renal Cell Carcinoma

Grace Prillaman, BS; Kelly Diaz, MD; Nicolas Intagliata, MD

Introduction: Nivolumab and ipilimumab, monoclonal antibodies that inhibit PD-1 and CTLA-4 respectively, are immunotherapy agents that are used to treat a variety of malignancies, including metastatic renal cell carcinoma (mRCC). These medications, however, are associated with a host of immune-related adverse events (irAEs), including hepatitis, that typically presents 8 to 12 weeks after treatment initiation. This case discusses a woman with mRCC who presented with elevated liver enzymes and was found to have checkpoint inhibitor (CPI) induced hepatitis over a year after her first dose of ipilimumab and nivolumab, well outside of the previously described range.

Case Description: A 60-year-old female with metastatic renal cell carcinoma treated with nivolumab and ipilimumab and complicated by resolved immune-related nephritis and ongoing immune-related colitis presented with elevated liver enzymes. She presented to the hospital over a year and a half after her first infusion of ipilimumab/nivolumab and 25 weeks after her last dose of nivolumab. Her liver enzymes had been increasing for two weeks and on admission showed an alkaline phosphatase of 2635, ALT of 333, AST of 550 and total bilirubin of 3.8. Initially, checkpoint inhibitor-related injury was lower on the differential as she had not received these agents in approximately six months. However, labs were negative for viral and autoimmune hepatitis, and imaging showed no evidence of metastatic cancer. A liver biopsy was performed that demonstrated histopathology consistent with CPI-induced hepatitis. Based on the biopsy results, and her clinical history, she was treated for CPI-induced hepatitis with oral prednisone 1 mg/kg/ along with ursodiol 600 mg twice daily. After 20 days of steroids, her

alkaline phosphatase had improved to 211 and her AST and ALT were both within normal range.

Discussion: This is a case of a patient who was diagnosed with CPI-induced hepatitis over a year and a half after her first infusion of ipilimumab/nivolumab and 25 weeks after her last dose of nivolumab. While the timing of her presentation was atypical compared to previous reports, her lab and pathology findings were consistent with CPI-induced hepatitis. Her late presentation may have been due to her near-chronic use of steroids due to CPI-induced colitis that began 1 month into her treatment. The level of immunosuppression provided by her varying doses may have suppressed the hepatitis from presenting until she was completely tapered off, which occurred approximately one month before onset. In addition, our patient's multiple prior immune-related adverse events, including immune-related nephritis and immune-related colitis, may have predisposed her to developing CPI-induced hepatitis.

Presentation #36

Examining the relationship between heart rate variability and stress in Emergency Medical Services providers

Sushma Reddy, Kevin Livingstone and James Calland

The nature of Emergency medical services (EMS) lends itself to mental trauma inflicted on the providers who show up to these calls. The long hours and inherent stressors lead to psychic distress and burnout, which decreases productivity and can present a potential public health risk. However, due to lack of consistent downtime between calls or debriefing time, it is impractical to use surveys to establish how a provider is feeling acutely. Thus, the need for a physiologic measure of burnout is required.

Analysis of literature shows that there is a role for heart rate variability (HRV) as a predictor of stress. However, HRV has yet to be used in a dynamic setting on a broad basis nor has it been used to predict psychic stress or burnout in EMS providers. Other studies have shown that short-term HRV analytic measures are reliable. Now, devices such as the Apple Watch have been shown to calculate HRV with good reliability. With the relatively ubiquitous nature of wearable devices such as the Apple Watch in the population, we decided to use it to measure HRV in subjects and correlate that data to their responses to reputable psychometric surveys: MBI (Maslach Burnout Inventory), PSS (Perceived Stress Scale), GAD-7 (Generalized Anxiety Disorder), CD-RISC-25 (Connor Davidson Resilience Scale), PCL-5 (Posttraumatic Stress Disorder Checklist), AUDIT (Alcohol Use Disorders Identification Test), PHQ-9 (Patient Health Questionnaire), and MAAS (Mindfulness Attention Awareness Scale).

This study is relevant because the stresses placed on healthcare providers in general can lead to burnout, depression and anxiety, leading to decreased productivity and missed days. EMS providers are one group within that population that currently does not have precautions in place to prevent burnout or detect excessive stress in a provider. This study could identify a cost-efficient way to potentially identify providers who may be at higher risk of experiencing psychic stress and provide an opportunity to intervene before true burnout arises.

Presentation #37

Assessment of Medical Cannabis in Patients with Osteoarthritis of the Thumb Basal Joint

Zachary Scharf, B.S., Lauren M. Fader, M.D., and Brent R. DeGeorge Jr., M.D., Ph.D.

Background: The use of cannabis for medical purposes is a controversial but relevant topic of public and scientific interest. With increasingly widespread availability of over-the-counter hemp- or CBD-derived products, more patients with hand and wrist musculoskeletal pain are seeking counseling on evidence for use of these products. Our purpose was to understand the current utilization practices of medical cannabis for treatment of pain in patients with a diagnosis of thumb basal joint arthritis. Secondary aims were to compare patient and disease characteristics of cannabis users to non-users and to investigate patient perceptions of efficacy of medical cannabis for treating musculoskeletal pain.

Methods: Consecutive patients with thumb basal joint arthritis were identified using ICD-10 codes between May and June 2020. All patients received an invitation to complete a survey on patient perceptions of cannabis and cannabis-related products. Patient medical records were retrospectively reviewed to gather demographic information and thumb basal joint arthritis factors including laterality, date of initial diagnosis, and prior history of corticosteroid injection or thumb basal joint operative procedures.

Results: 103 patients with a diagnosis of thumb basal joint arthritis completed the survey. Twenty-five percent reported a history of ingesting an oral medical cannabis product, and 21% reported topical application of a medical cannabis product. A majority of patients reported using these products specifically for relief of their thumb basal joint pain. Forty-eight percent of oral users and 33% of topical users felt that the product was effective in relieving their pain and consequently worth the financial cost. Of total patients surveyed, 69% would be interested in trialing an oral formulation, and 80% would be interested in trialing a topical formulation for treatment of their thumb pain.

Conclusion: Along with the general population, patients with thumb basal joint arthritis use cannabis-related products, and nearly half of these patients find them effective. A larger number of these patients would be interested in trialing either oral or topical formulations of medical cannabis for treatment of their thumb basal joint pain. More research is needed to determine efficacy of these compounds for therapeutic use and to make evidence-based recommendations for patients.

Presentation #38

Canvassing Patient Perceptions and Perspectives on CADASIL

Andrew Schmidt

Background/Objectives: The correlation between genetic factors and cerebral ischemic or hemorrhagic events, also known as strokes, is an important subject of current research. One of the most common genetic stroke syndromes is called CADASIL (Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts and Leukoencephalopathy). Research into the quality of life of patients with CADASIL has been lacking. The objective of this mixed-method exploratory study is to assess the health status and healthcare of patients with CADASIL.

Methods/Approach: Data will be collected on patients' experience with CADASIL, their quality of life, and pre-existing gaps along their disease management pathway. Patients will be approached for the study via telephone after clinician approval. The first half of the study is a quantitive survey outlining demography, medical history, and general health and wellness. The second half is comprised of a qualitative interview canvassing the subjective experiences of CADASIL patients.. The data will be analyzed in collaboration with international colleagues at the University of Technology, Sydney.

Anticipated Results: It is expected that patient's will outline areas of dissatisfaction with their current and past level of care. They will explain the need for new and effective treatments for their condition, the importance of providers who understand CADASIL, and an urgent desire for appropriate mental health support.

Impact: This information will be used in the creation of a clinical and epidemiological data set for these patients; the results of this study may provide a foundation for further investigation into treatments, resources, and models of care for CADASIL patients.

Presentation #39

Investigation of Inceptor in the Brain

Sarah Sebastian

Although it was once believed that the brain was insulin insensitive, the discovery of insulin receptor (IR) and insulin-like growth factor 1 receptor (IGF1R) in the brain has changed this paradigm. Furthermore, as in the periphery, brain insulin resistance can occur. It is associated with neurological diseases including early-stage Alzheimer's disease (AD), although the mechanisms by which brain insulin resistance may contribute to AD pathophysiology is poorly understood. This has led to interest in intranasal insulin (INI) as a potential therapy. While INI produced some benefits in pilot studies, those results have not yet translated to Phase 2/3 trials. Recently, a protein called insulin inhibitory receptor (Inceptor; also known as EIG121, ELAPOR1, KIAA1324, or 5330417C22Rik) was found to downregulate plasma membrane insulin receptor (IR) and insulin-like growth factor 1 receptor (IGF1R) in the endocrine pancreas of adult mice. Thus, there is an interest in determining if Inceptor is also present in nervous tissue and whether it acts in a regulatory role for brain insulin signaling.

To date, we have validated methodology in order to study Inceptor in nervous tissue via Western blotting. We have also detected Inceptor in neural tissue via immunofluorescence, although refinements to these protocols are still needed. Preliminary data demonstrate that Inceptor levels are reduced in the hippocampi of 3xTg mice, an animal model of AD. Further experiments aim to determine the distribution of Inceptor in the brain and among different neural cells, as well as if Inceptor has a similar role in regulating IR and IGF1R signaling in the brain. Based on these results, subsequent research will use murine models to analyze changes in Inceptor expression between sexes, while on a high-fat diet, and in AD. This is crucial work as many questions about brain insulin resistance remain unanswered, especially since there is interest in INI as a potential therapeutic for AD.

Presentation #40

Framework for considering abnormal heart rate characteristics and other signs of sepsis in very low birth weight infants

Misky Sharif, Dr. Fairchild and Dr. Sullivan

Background: A HeRO score is a risk score that can alert clinicians to infants with changing physiology possibly caused by sepsis. Clinicians (especially those with less experience) need a framework for considering vital signs and clinical changes potentially associated with sepsis, including the HeRO score, when deciding whether to send a blood culture and start antibiotics for very low birth weight NICU patients.

Methods: Neonatology Fellows at UVA completed a NeoSept survey for 10 clinical signs and vital signs at the time of sepsis workups and identified ones associated with sepsis ruled in and ruled out. The survey responses and the hourly HeRO scores prior to workups were analyzed in relation to the final designation of Clinical Sepsis (CLINSEP), Culture-Positive Sepsis (CXSEP) and Sepsis Ruled Out (SRO).

Results: Changes in heart rate (tachycardia, bradycardia or rising HeRO score) were noted as having prompted workup orders in 40 of the 93 workups. The mean HeRO score rose slightly in the 12 hours prior to the time of the blood culture and was lower for CLINSEP workups (n=20) compared to CXSEP (n=35) and SRO (n=38).

Conclusion: A rise in the HeRO risk score can direct clinicians to perform a bedside assessment. However, it is imperative to consider the other clinical and vital signs through a structured framework (such as the HaRD SToP and CRASH acronyms) to make the final determination on when to order a sepsis workup and start antibiotics.

Presentation #41

Financially Dominated Health Insurance Plans Offered to Full-time University Employees

Rudrajit Sinha and Adam Leive

Introduction: Recent studies have shown that employees often make imperfect decisions when choosing among their employer-sponsored health insurance plans. These decisions leave them financially vulnerable and may partially be systemic, as many large employers offer financially dominated health insurance plans, meaning an individual or family on that plan would have saved money had they chosen another insurance plan irrespective of the level of health care spend they accrue over the course of the plan year. The purpose of this study is to determine the frequency at which universities offer dominated health insurance plans to full-time employees.

Methods: Data collection involved gathering the relevant health insurance plan and coverage information from the benefits websites of 13 public and private universities around the country chosen for their variety in size and health plan structures. Entering the relevant data points for each plan into the Center for Medicare and Medicaid Services Actuarial Value Calculator, we simplified each plan so that it could be represented graphically. This allowed for the comparison of the out-of-pocket costs across plans as a function of total health spending in a plan year.

Results: Thus far, our data have shown that almost every university included in the study offered at least one health insurance plan that was entirely or almost entirely financially dominated by another plan offered by the same university during the most recent plan year. Data collection is ongoing.

Discussion: Our findings suggest that universities, like other large employers, are prone to offering dominated health plans to their employees. This conclusion implies important ramifications for university employees who may face steep financial consequences for choosing more expensive health insurance plans.

Presentation #42

Analyzing how the ARRIVE trial impacted elective inductions of labor at a tertiary academic center

Caleigh Smith, Margot Gurganus, Amanda Urban and Donald Dudley

OBJECTIVE: A landmark study in obstetrics, the ARRIVE trial has potentially changed practices around scheduling elective inductions of labor. Our goal was to demonstrate how the ARRIVE trial's publication in 2018 impacted one tertiary care center's practice of scheduling elective inductions and the resulting labor outcomes.

STUDY DESIGN: We conducted a retrospective cohort study obtaining information about the births in the University of Virginia Health System during the 18-month period prior to publication of the ARRIVE Trial (Feb 1 2017 - Aug 1 2018) and the 18-month period after publication (Sep 1 2018 - Mar 1 2020) before the lockdown necessitated by the COVID-19 pandemic. We included women ≥18 years with elective inductions between 39- and 41-weeks gestation, defined as having no known medical indication for induction. Chi-squared tests and two sample t-tests were used for comparison of group characteristics and birth outcomes before and after trial publication.

RESULTS: A total of 3213 births were included, with 1542 from pre-ARRIVE and 1671 from post-ARRIVE. The rate of elective inductions increased from 9.9% of total births pre-ARRIVE to 27.4% of births post-ARRIVE for a 2.8 times increase. After trial publication, elective inductions occurred at an earlier gestational age ($p<0.001$) and among women who were slightly younger ($p=0.03$), had higher BMI ($p=0.002$), and lower parity ($p<0.001$) on average. The rate of cesarean delivery among electively induced women increased from 6.5% pre-ARRIVE to 14.8% post-ARRIVE ($p=0.01$). The post-ARRIVE cohort also had longer hospital stays ($p=0.002$), increased blood loss ($p=0.001$), and lower infant birth weights ($p=0.005$).

CONCLUSION: The publication of the ARRIVE trial significantly impacted the scheduling of elective inductions at our institution, resulting in more than a twofold increase. Inductions were performed earlier and resulted in a higher rate of unscheduled cesarean deliveries and other adverse labor outcomes than prior to publication. These findings have implications for obstetric outcomes, hospital management, and staffing.

Presentation #43

COVID-19 Vaccination Status Surveying and Education

Cameron Stadlin & Caroline Cotton

We travelled throughout Charlottesville and the surrounding counties to conduct research regarding why community members chose not to receive the COVID-19 vaccine, where vaccine information was being obtained, and demographic data. Concurrently, we also distributed informational handouts on the virus, vaccine, free rides to vaccination sites, and lists of vaccination sites nearby. Our sites included bus stops, farmer's markets, emergency food locations, grocery stores, and University Medical Associates Clinic. Anonymous paper surveys were self-completed at sites in Albemarle and surrounding counties, including Greene, Louisa, Augusta, Nelson, Madison, and Buckingham. Participation by community members was voluntary. 215 surveys were completed by community members. In addition, 264 online surveys were conducted via Google Surveys to gain additional data regarding why people declined to receive the vaccine. In summary, our data suggests the highest unvaccinated rates were found to be associated with lower educational attainment, Republican party affiliation, Buckingham, Greene, and Nelson County residence, and male sex. Of these groups, lower education completion and Republican party affiliation were found to have statistically significant differences in vaccination rates when compared to other the subcategories. Many individuals received COVID-19 information from family members, TV/News, and their doctors. Higher vaccination rates were among groups of 18-24 age, Orange, Madison, Louisa, and Charlottesville/Albemarle, Democrat party affiliation, females, higher level of education obtained. Of those who voiced vaccine hesitancy data: 44.4% did not feel the vaccine was necessary, 37.0% were concerned about side effects, 25.9% had concerns about the approval process, 18.5% had religious objections, and 11.1% declined the vaccine due to medical conditions.

Presentation #44

An Analysis of the Incidence, Risk Factors, and Timing of Development of Cyclops Lesions after Anterior Cruciate Ligament Reconstruction

Eric Taleghani, Anthony Ignozzi, Thomas Moran MD, Jeffery Ruland MD, David Diduch MD

Introduction: Localized anterior arthrofibrosis, also known as a 'cyclops lesion,' is a known complication following ACL reconstruction surgery with a described incidence between 1.9% to 10.9%. To date, however, there remains a relative paucity of studies examining predisposing factors for their development. Therefore, the primary objective of this study was to identify the incidence, timing, and pre-, intra-, and post-operative variables that correlated with the development of a cyclops lesion after ACL reconstruction. A secondary objective of this study was to examine whether objective functional testing measures would significantly differ groups.

Methods: 313 consecutive patients who underwent ACL reconstruction at a single, academic institution were analyzed. Retrospective chart review was performed to evaluate patients for study inclusion and to identify patient demographic factors, medical comorbidities, and potential pre-operative risk factors. Operative and clinical notes were evaluated to identify potential intra-operative risk factors and identify outcomes of interest. Postoperative objective functional outcome metrics and patient reported outcomes were collected per the institution's LEAP testing protocol. Binary logistic regression was utilized to identify risk factors for arthrofibrosis.

Objective functional outcomes and patient reported outcomes were compared between patients with and without cyclops lesions.

Results: 23/313 (7.35%) patients developed a cyclops lesion following ACL reconstruction, of which 17 (73.91%) were found to be symptomatic and 10 (43.48%) underwent surgical intervention. Only the performance of concomitant meniscal repair correlated with an increased likelihood of developing a cyclops lesion ($p = 0.040$); no other patient demographics, pre- or intra-operative characteristics significantly differed between cohorts. There were no clinically relevant extension deficits or differences in objective functional performance measures at six months post-operatively between our study cohorts.

Conclusions: Concomitant meniscal repair may be associated with the development of cyclops lesions postoperatively, however no other demographic, pre- or intra-operative factors demonstrated significant correlation. The development of symptoms from a cyclops lesion may also occur later in the post-operative course than previously recognized. Presence of a cyclops lesion should be considered in patients with late development of loss of terminal knee extension after ACL reconstruction.

Presentation #45

Error in Scoliosis Curve Measurement

Eric Taleghani, Rohit Rustagi, Alexander Singh, Rayaan Faruqi and Hasan Syed MD

Introduction: Each year, 600,000 children are at risk of scoliosis progression. Curves are measured for a range of features, most notably Cobb Angle (CA); however, these measurements can be subjective and prone to error due current technology. Variations in measurement of these angles can range from 2° to 7° between different measurers. This deviance may be significant, as reimbursement thresholds for bracing (10°) and spinal fusion surgery (40°) are typically set by insurance payers and may alter patents' treatment courses if measured incorrectly. The purpose of this study is to validate measurement variance as a baseline for developing new measurement tools.

Methods: A representative group of 10 scoliosis x-rays were digitally measured from the coronal plane to determine the main thoracic (MT), proximal thoracic (PT), and thoracolumbar/lumbar (TL/L) CA and the sagittal plane to determine lumbar lordosis (LL). Average measurement was considered the ground truth value of the different curves from which the average error was subsequently measured.

Results: Average error observed for MT, PT, TL/L, and LL was 4.7°, 5.9°, 4.3°, and 8.9° respectively. The average minimum and maximum error for MT, PT, TL/L, and LL was 3.3°, 3.2°, 2°, 4.3° and 5.5°, 8.6°, 11.6°, 14.1°, respectively, indicating the range of error is likely higher than reported. There was no statistical correlation found between the size of the initial angle measured and the resulting error.

Conclusion: The results of this study are ongoing among a largely surgeon cohort but have demonstrated the prevalence of high error in reading radiographs for scoliotic measurements which may alter treatment plans for borderline surgical cases. Despite no correlation between severity and error, other factors to consider for continued research include measurement time and other spinal features.

Presentation #46

Payments for Hand Surgery Services: The Value of Billing and Coding

Eric Taleghani, Thomas Moran MD, Sheriff Akinleye MD and Brent DeGeorge MD

Purpose: The primary objective of this study was to identify the trends in reimbursement for hand surgeons for new patient visits, as well as outpatient and inpatient consultations from the years 2010 to 2018. Additional analysis was planned to identify the influence of payer mix and coding level of service on physician reimbursement in these settings.

Methods: PearlDiver Patients Records Database was used to identify clinical encounters and their respective physician reimbursements for analysis within this study. This database was queried using Current Procedural Terminology codes to identify relevant clinical encounters for inclusion, filtered for presence of valid demographic information and by physician specialty for the presence of a hand surgeon, and tracked by primary diagnoses. Cost data were then calculated and analyzed using R Project with regard to payer type and level of care.

Results: In total, 156,863 patients were included in this study. The mean reimbursement for inpatient consultations, outpatient consultations, and new patient encounters increased by 92.75% ($134.85 to $259.93), 17.80% ($161.33 to $190.04), and 26.78% ($102.58 to $130.05), respectively. When normalized to 2018 dollars, the adjusted percent increases were 67.38%, 2.24%, and 10.09%, respectively. Commercial insurance reimbursed hand surgeons more money than any other payer type. Mean physician reimbursement differed depending upon the level of service billed, with level of service V reimbursing 4.41 times more than level of service I for new outpatient visits, 3.66 times more for new outpatient consultations, and 3.04 times more for new inpatient consultations.

Conclusions: This study helps to provide physicians, hospitals, and policymakers objective information regarding the trends in reimbursement to hand surgeons. Although this study indicates an increasing trend in reimbursements for hand surgeons, this trend is not reflected in the literature for hand surgery or other surgical subspecialties, and the margins shrink when adjusted for inflation.

Presentation #47

Arthroscopic Treatment of Iatrogenic Slipped Capital Femoral Epiphysis Screw Impingement and Associated Hip Pathology

Eric Taleghani, Thomas Moran MD, Winston Gwathmey MD

Background: Screw impingement is an infrequently reported sequelae following in situ pinning of a slipped capital femoral epiphysis, but it may result in significant bony and chondrolabral degeneration. Hip arthroscopy may offer the advantage of screw removal in a minimally invasive manner under direct visualization, as well as providing the opportunity for management of concomitant hip pathology.

Technique Description: A healthy, active 27-year-old woman with right hip dysfunction secondary to screw impingement and concomitant chondrolabral pathology following previous in situ pinning of a slipped capital femoral epiphysis elected to undergo arthroscopic removal of

hardware, osteochondroplasty, and management of hip labrum pathology. After the screw was localized, a 2.8-mm pin was inserted down the cannulated center of the screw to prevent intraarticular displacement during removal. The screw and washer were removed intact, and femoroplasty was performed to remove the reactive bone and resolve the cam-type impingement. Acetabuloplasty was then performed to remove pincer-type impingement and provide an appropriate rim of bone for labral reconstruction. The pathologic labrum was then debrided and reconstructed with a semitendinosus allograft.

Results: There were no immediate complications following surgery. Surgical management led to resolution of the patient's mechanical symptoms and provided pain relief, which allowed return to prior baseline level of function.

Discussion/Conclusion: Symptomatic screws that impinge the osteochondral and soft tissue anatomy of the hip require removal. Historically, these screws have been removed by open, mini-open, or percutaneous techniques. This case demonstrates the advantages of arthroscopic removal, as it affords the surgeon the ability to perform a dynamic examination, safely remove the screw, and directly visualize and manage concomitant hip pathology that may not be otherwise be recognizable. Further studies will be required to determine the ability of this technique to more clearly illustrate long-term improvement in function and prevention of the development of osteoarthritis.

Presentation #48

Exercise Modulates Corticosterone-Induced Mood Behaviors in Mice

Sable Thompson

Objective: Dysregulation of the Hypothalamic Pituitary Adrenal (HPA) axis has been implicated in the pathophysiology of several mood disorders, including depressive and anxiety disorders. Exposure to excessive glucocorticoids, such as during chronic stress, can cause HPA axis dysregulation and, in turn, predisposes individuals to mood disorders. It has been proposed that exercise reduces anxiety and depressive symptoms through modulation of the HPA axis. We hypothesized that chronic exogenous corticosterone (CORT) injections would induce depression- and anxiety-like behaviors in mice and that these behaviors would be reduced through wheel running exercise.

Methods: Male C57BL/6 wild-type mice were subjected to 21 days of either normal cage activities (n = 12), normal cage activities with CORT administration (40 mg/kg/day, n = 12), or voluntary wheel running with CORT administration (n = 11). Anxiety-like behaviors were assessed via an open field test (OFT), an elevated plus maze (EPM), and nestlet shredding. Depression-like behaviors were measured using a tail suspension test (TST) and a forced swim test (FST). Additionally, nestlet shredding and distance traveled during the open field test and elevated plus maze were used to assess psychomotor activity.

Results: CORT-exposed sedentary mice displayed significant anxiety-like behaviors in the EPM, spending more time in the closed arm ($p<0.01$), frequenting the center less often ($p<0.005$), and spending less time in the open arm ($p<0.05$) than their control counterparts. There was no difference in anxiety-like behaviors in CORT-exposed exercised vs. controls. No significant differences were seen between groups for time spent in the center vs. periphery on the OFT. There were no significant differences between groups on the TST. On the FST, there

was no significant difference between groups on duration inactive. The control mice moved significantly less than the CORT-exposed sedentary and CORT-exposed exercised group ($p<0.05$) on the FST. The CORT-exposed exercised mice were significantly more active than the CORT-exposed sedentary mice with greater percent nestlet shredded ($p<0.005$) and greater distance traveled on the OFT ($p<0.05$).

Conclusions: These data indicate that corticosterone injections induced anxiety-like behaviors but not depression-like behaviors in exposed mice. Interestingly, anxiety-like behaviors were seen on the EPM but not the OFT, suggesting that CORT may induce only certain aspects of anxiety. Additionally, exercised mice displayed greater psychomotor activity and reduction in CORT-induced anxiety-like behavior. This study has implications for the development of mouse models of mood disorders and future studies of HPA axis dysregulation.

Presentation #49

Evaluating the relation between the presence and size of extra tissue at the vaginal apex on patterns of recurrence in endometrial cancer following adjuvant vaginal cuff brachytherapy

Emily K. Venner[a], Kristin A. Ward, MD[b], Timothy N. Showalter, MD, MPH[b], and Kara D. Romano, MD[b]

Endometrial cancer is the most common gynecologic cancer in the United States. In 2021, it is estimated that there will be 66,570 new cases of endometrial cancer diagnosed and that 12,940 patients will die of endometrial cancer.[1] Standard of care for patients with early stage endometrial cancer consists of a total hysterectomy and bilateral salpingo-oophorectomy, +/- lymph node dissection for staging. The vaginal cuff is a common site of tumor recurrence following surgery, and adjuvant vaginal cuff brachytherapy (VCB) is often utilized to reduce the risk of local recurrence in many of these early-stage patients. VCB a form of radiation therapy in which a cylinder is inserted into the vaginal canal to deliver radiation directly to the vaginal cuff. Following hysterectomy, many patients have redundant tissue at the lateral apex of the vaginal cuff, colloquially termed “dog ears.” This extra tissue may extend irregularly beyond the typical cylindrical dose distribution of radiation delivered during VCB and it is hypothesized that they are a potential site of local treatment failure even after VCB. The effects of the presence and size of vaginal cuff “dog ears” on tumor recurrence is not yet fully understood. The aim of this study is to identify factors that can predict patterns of recurrence in patients treated with adjuvant VCB for endometrial cancer, with particular interest in the prevalence and size of extra tissue at the vaginal apex. We retrospectively reviewed the medical records 219 patients with early stage endometrial cancer treated with VCB at our institution from 2012 – 2021 with available brachytherapy planning CT simulation images. “Dog ears” were defined as the presence of any tissue extending at least 10 mm from the apex of the vaginal cuff beyond the brachytherapy applicator as defined on CT simulation. We found that 57.6% of patients (n = 128) met our criteria for having “dog ears”. 9 patients (7.0%) with dog ears developed a local recurrence at the vaginal cuff compared to 4 patients (4.4%) without dog ears developing a recurrence. Most of the patients (77.78%) with dog ears on imaging who had a local recurrence of their cancer had the recurrence on the same side as the extra tissue or had extra tissue bilaterally at the vaginal cuff. In this investigation, we preliminarily examine the relationship between the presence and size of extra tissue at the vaginal apex and the patterns of treatment failure among these patients. The finding of this redundant tissue on imaging may be a factor

that the treating radiation oncologist considers when planning adjuvant treatment for patients with early-stage endometrial cancers.

Sources: 1. Cancer Stat Facts: Uterine Cancer. Surveillance, Epidemiology, and End Results (SEER) Program. National Cancer Institute. Bethesda, MD.

Presentation #50

Patient Perspectives on Use of Topical Equine Ivermectin ("Horse Paste") for Rosacea: A Survey Study

Stephany L. Vittitow, B.A.; R. Hal Flowers, M.D.; Barbara B. Wilson, M.D

Topical ivermectin 1% (Soolantra®) cream is FDA-approved for the treatment of inflammatory lesions of rosacea. Ivermectin 1.87% paste can be purchased as an over-the-counter oral horse dewormer. The safety of these equine products in humans is unknown; however, topical use of oral horse dewormers for self-treatment of rosacea is increasingly seen in patients. Rosacea self-help and support groups on popular social media sites are replete with patients touting successful use of "horse paste" or "HP" for rosacea and recommending its use to others. Despite its growing popularity among the lay public, unsanctioned HP use by patients is largely under recognized by the dermatology community. To understand the perspectives and motivating factors of patients using these products, we conducted an online survey created on the Qualtrics platform of members of a large Facebook® rosacea support forum who had used HP in this context. Our study found cost to be the strongest driver in patient selection of HP over its FDA-approved counterparts, and its use was further amplified through promotion by its users on social media forums. The majority of survey respondents did not discuss the use of HP with a dermatologist or other healthcare provider, citing fear of judgment or a poor relationship with the provider as reasoning. Our study highlights a need for dermatologists to be aware of this practice in order to inquire about its usage in a nonjudgmental manner and appropriately counsel patients.

Presentation #51

Characterization of Bullous Pemphigoid Patients on Doxycycline and Niacinamide: A Retrospective Study

Stephany L. Vittitow, BA, Olivia L. Schenck, MD, and R. Hal Flowers, MD

Bullous pemphigoid (BP) is the most common blistering skin disorder, typically affecting the elderly with tense and pruritic blisters on the trunk and extremities. Although topical or systemic corticosteroids are favored as initial treatments, combined doxycycline and niacinamide has been previously reported as a steroid or immunosuppressive-sparing therapy. Little is known about how this combination treatment is currently used in clinical practice. We conducted a retrospective chart review of BP patients seen at our institution and prescribed doxycycline and niacinamide to further characterize the population receiving this treatment. Contrary to what prior studies have indicated, our findings suggest that doxycycline and niacinamide are more frequently used as adjuvant therapy rather than as an alternative to steroids or immunosuppressives, as most of our patients were concurrently taking oral prednisone or mycophenolate mofetil. Most patients had moderate/severe disease and risk factors for

corticosteroid or immunosuppressive treatment at presentation. Patients who improved did so gradually at an average of three months, and many who improved initially later experienced exacerbations. Our data provides a unique perspective of how academic dermatologists use doxycycline and niacinamide, although a larger study size is needed to make any conclusions.

Presentation #52

Impact of EBV status on clinical course of acute NK cell Leukemia

John S. Wang, Omar Elghawy, HeeJin Cheon, David J. Feith, MD, and Thomas P. Loughran, MD

Introduction: Acute NK-cell leukemia (ANKL) is an extremely rare and aggressive blood malignancy wherein patients typically survive a limited few months post-diagnosis. Within the literature, there have been less than 400 reported cases of acute ANKL since the disease was first documented in 1986. A subset of ANKL patients have neoplastic NK cells with Epstein-Barr Virus (EBV) DNA which has implicates a role of the virus in the disease. No morphologic or immunophenotypic differences have been established in EBV-positive versus negative patients to date, likely due to the limited number of cases documented. Herein, we report 12 cases of ANKL, with 5 EBV-positive patients.

Methods: Adult patients diagnosed with ANKL enrolled in research studies by Dr. Thomas Loughran between 2002-2021 were included. The primary aim of this analysis was to compare the clinical features and course of EBV-positive versus negative patients. Student's two-sample t-tests were run to analyze the quantitative differences between the two groups.

Results: 12 ANKL patients met the inclusion criteria with a median age of 61 (range 33-91) and 83.3% were male (n=10). Eight of the patients were Caucasian, two were Asian, one was Hispanic, and one was black. Amongst the cases, 41.6% (n=5) of the patients were documented to be EBV-positive. Patients commonly presented with fever, night sweats, weight loss, and rash. 3 of 12 patients underwent treatment with hyper-CVAD while the others received various different chemotherapeutic agents. 1 of 12 patients underwent splenectomy. 6 of 12 patients were CD56+ on flow cytometry. Bone marrow biopsy demonstrated an immature population of NK cells consistent with ANKL. None of the patients achieved remission, and the most common cause of death was sepsis (n=3). The median overall survival was 209 days.

EBV-positive patients were significantly younger than negative patients (median age 52 vs. 73; p-value = 00373). The five EBV-positive patients were Asian (n=3), Hispanic (n=1), and Black (n=1). All eight EBV-negative patients were Caucasian. 80% of EBV-positive patients (n=4) demonstrated CD56+ on flow cytometry whereas only 25% of EBV-negative patients (n=2) were CD56+. There were no remarkable differences on the bone marrow biopsies between EBV status. All twelve patients regardless of EBV status did not achieve remission. There was not a statistically significant difference in overall survival (median 147 vs. 282 days; p-value: 0.22).

Conclusion: EBV-positive ANKL presents earlier than EBV-negative patients. The majority of EBV-positive ANKL demonstrates CD56+ on flow cytometry. There is no difference in overall survival based on EBV status.

Presentation #53

Autoimmune Associated Vocal Fold Lesions: a Systematic Review

Allan Weidman

Objective: Autoimmune disease can present with laryngeal manifestations, including vocal fold lesions or “bamboo nodules.” The presence of autoimmune associated vocal fold lesions (AaVFLs) can be an important indicator of undiagnosed disease in patients presenting with laryngeal complaints. While AaVFLs have been described in many reports, there is no consensus on best practices in management. The purpose of this systematic review is to clarify the characteristics and treatment of dysphonia in the setting of AaVFLs.

Review Methods: Literature searches were run in Pubmed and OVIDMedline to construct a list of potential Medical Subject Headings (MeSH), keywords, and text phrases. These headings and text words were translated into the language of CINAHL and used as keywords in Google Scholar. Initial searches resulted in 135 unique citations. Two reviewers screened all 135 citations in two rounds: an initial screen of citations and abstracts, and a full-text review of citations whose abstracts met eligibility criteria. A third reviewer settled conflicts arising between the two initial reviewers. Reviewers used the following inclusion criteria: original research studies and case reports, English based or translated, patients 18 years of age or older, reported outcomes on patient characteristics, treatment plans, and/or stroboscopic characteristics. A total of 16 articles were included for review.

Results: Sixteen studies with 46 patients diagnosed with AaVFLs were included. 100% of the patients were female. Most common professions included performers/singers (19.6%, 9/35) and teachers (13%, 6/35) Autoimmune or connective tissue disease was already established in 57.7% (15/26) of patients presenting with AaVFLs , while there was no prior history of autoimmune disease in 42.3% (11/26). Associated autoimmune diseases included systemic lupus erythematous (33.3%, 13/39), rheumatoid arthritis (17.9% 7/39), mixed connective tissue disease (17.9%, 7/39), and sjogren’s syndrome (15.4%, 6/39). Bilateral lesions were present in 83.9% (26/31) of patients. Thirty five total treatment attempts were reported and included medical therapy alone (40%), voice therapy alone (14.3%), combination of medical and voice therapy (22.9%), surgery only (11.4%), and combined medical and surgical treatment approaches (11.4%). Limited outcome data was reported, but the great majority of patients treated with voice therapy had voice improvement; lower rates of voice improvement were seen with medical or surgical therapy alone.

Conclusion: Autoimmune associated vocal fold lesions or “bamboo nodules” are a poorly understood entity without unifying treatment consensus. AaVFLs occur predominantly in women, and are associated with a wide variety of autoimmune conditions. Many patients diagnosed with AaVFLs have no prior autoimmune diagnosis prior to presentation to the Otolaryngologist. While treatment outcomes were not robustly reported, a significant number of patients with AAVFLs treated with voice therapy alone or voice therapy in combination with other treatment modalities (medical or surgical) experience voice improvement.

Presentation #54

The use of contextualized metabolic network modeling to identify tissue-specific metabolite changes in Zambian children with Environmental Enteropathy.

Mara Weigner, BS, Philip Fernandes, MD, Yash Sharma, BS, Paul Kelly, MD, FRCP, Beatrice Amadi, MD, MMed and Sana Syed, MD, MSCR, MSDS

Background: Environmental enteropathy (EE) is a chronic inflammatory intestinal disorder implicated in malnutrition and growth stunting, low response to oral vaccines, and delayed neurocognitive development in underdeveloped countries. Despite its global prevalence, little is known about the metabolic changes underlying EE. Using an *in silico* approach, we used tissue-specific transcriptomic expression data to explore reaction flux value changes within a contextualized metabolic network model.

Methods: Transcriptomic data was used from duodenal biopsies of children with EE (GEO: GSE162630) and healthy controls (GEO: GSE159495). The EE vs. control transcriptomes were overlayed on Recon3D, a human genome-scale metabolic network reconstruction (GENRE) containing 3,695 human annotated functional genes to limit the network. Parsimonious flux balance analysis (RiPtIDE) was used to generate a contextualized metabolic model to identify energy-efficient pathways. A decision tree-based algorithm was used to identify the top 20 altered reactions between EE vs. control patients. These top reactions were extracted, grouped according to function, and investigated with an extensive literature review.

Results: RNAseq data was collected from a representative cohort of Zambian children with EE (n= 30; median age 11 months, 47% female) and healthy children at Cincinnati Children's Hospital Medical Center (n= 25; median age 5.4 years, 44% female). Reactions were analyzed to identify the top 20 reactions altered between control and EE data sets. Reactions were grouped based on their metabolic pathways with alterations seen in carnitine-mediated long chain fatty acid (LCFA), myo-inositol, and glucose metabolism.

Conclusion: These results corroborate and add to prior literature that proposes tissue-specific metabolic dysregulation underlies phenotypic changes seen in EE patients. Intestinal changes seen in EE are associated with dysregulation of both lipid and carbohydrate macronutrient metabolism as well as cellular signaling pathways. Carnitine-mediated LCFA metabolism is disrupted at the intestinal mucosa and could play a role in the malabsorptive symptoms classically seen in EE. Furthermore, inositol is a critical component of the signaling cascade downstream of zonulin, a regulator of tight junctions that increases intestinal permeability. This *in silico* approach provides an efficient way to identify possible investigative targets, though further work is needed to better elucidate the pathophysiologic significance of these findings.

Presentation #55

Alanyl Glutamine for Prevention of CDI in Aged Mice

Carley Whitt[1], BS, Sophia Goldbeck[1], Deiziane V.S. Costa[1], PhD, Jae H. Shin[1], MD and Cirle A. Warren[1], MD

Background and Objectives: *Clostridioides difficile* (*C. difficile*) is the most common pathogen to cause healthcare associated infection in the US, and as such, it is a significant cause of

morbidity and mortality annually. Because *C. difficile* recurrence increases with age and cumulative antibiotic use, a non-antibiotic approach to attenuate disease severity and prevent infection is urgently needed. Since alanyl-glutamine (AQ) has been shown to promote epithelial integrity and reduce inflammation associated with *C. difficile* infection (CDI), pre-treatment with AQ is one strategy that may help to achieve this goal. Using an aged mouse model developed in our lab, we evaluated the effectiveness of AQ to prevent CDI.

Methods: C57BL/6 aged mice (18 months) were given AQ in drinking water for two weeks followed by an antibiotic treatment before *C. difficile* VPI10463 challenge. The mice were monitored for 14 days to compare disease severity, immune response, and intestinal microbiome. Novel Object Recognition tests for acute memory were performed.

Results: Post-antibiotic treatment, AQ-pretreated infected mice had lower Bacteroidetes and Enterobacteriaceae burden compared to control mice. At day 14 post-infection, AQ-pretreated infected mice had increased IL-22 levels compared to controls. AQ-pretreated infected mice had 85% survival, while the non-treated infected group had 40% survival. There was no difference in pathogen shedding between groups. AQ-pretreated infected mice exhibited higher discrimination index in the NOR test, indicated by their tendency to explore the novel object more than infected controls, suggesting improved acute memory.

Conclusions: AQ demonstrated a protective effect against CDI in an aged mouse model, which does not seem to be via targeting *C. difficile*. IL-22 may be involved in the mechanisms by which the AQ pretreatment protects against CDI. Further investigation into AQ protective mechanisms in aged mice is needed.

Presentation #56

Isolated Undetectable Serum IgE as a Predictor of Impaired Polysaccharide Vaccine Response

Abigail Williams

Rationale: Undetectable serum IgE is a sensitive and specific biomarker for common variable immunodeficiency (CVID). We hypothesized that isolated undetectable serum IgE would predict impairment of polysaccharide vaccine response and thus serve as an early marker for developing humoral immunodeficiency.

Methods: A retrospective chart review was conducted on patients who had a serum total IgE drawn as part of their clinical workup. Undetectable serum IgE was defined as ≤ 2.0 IU/mL. Patients who had no history of recurrent sinopulmonary infections or known history of cellular or humoral immunodeficiency were invited to take part. Subjects underwent *Salmonella typhi* polysaccharide vaccine challenge and a normal vaccine response was defined by at least a two-fold increase in the post-vaccine titer (index ≥2.0). Fisher's exact test was used for analysis. In parallel, we interrogated when samples were available (n=10) whether absence of IgE reflected a defect in the capacity of B cells to undergo an isotype switch to IgE. Lymphocytes were stimulated with CD154 (CD40L) with or without the additional presence of IL-4 (10 and 30 ng/mL) and cultured for 5 days. Expression of epsilon germ line (εGL) and IgE heavy chain transcripts were quantified.

Results: 11 subjects were ultimately recruited into the study. All were found to have normal IgG/IgM/IgA serum concentrations. 2/11 subjects had a deficient response to *Salmonella typhi* vaccine challenge. This compares to 0/18 healthy controls with deficient response (not significant). εGL and IgE heavy chain transcripts were inducible in all subjects.

Conclusion: Low serum IgE may be associated with an abnormal humoral immune response to *Salmonella typhi* vaccine challenge in some patients. The current study will continue enrollment. The clinical significance of this finding is currently unknown. Absence of IgE production is not related to a defect in the IgE heavy chain class switch molecular pathway.

Presentation #57

B Cell Acute Lymphoblastic Leukemia (B-ALL) Cells have Super-Enhancers that Enforce a Precursor B Cell Genetic Program Leading to Developmental Arrest

Margaret Wiltsie and Dr. Brian Belyea

The Belyea Lab previously discovered that in a genetic mouse model of B cell leukemia, the leukemia cells exhibit developmental arrest at the precursor stage of B cell development. We hypothesized that genes under the control of super-enhancers (SEs) are responsible for this arrest and the subsequent development of a leukemia phenotype. To identify super-enhancers in B-ALL, we performed Chip-Sequencing analysis for the histone mark H3K27ac in 9 human B-ALL primary patient samples. We identified SEs in proximity to genes that are specific to the different genetic subtypes of leukemia. Finally, when combined with Chip-Seq data from a genetic mouse model of B-ALL, three genes stood out as strong candidates for super-enhancer driven developmental arrest in B-ALL: *VpreB1*, *VPreB3*, and *Igll1*. These genes are promising drug targets for future treatment of childhood B-ALL.

Presentation #58

Lung Transplantation in End Stage Lung Disease Caused by COVID-19

W Zachary Wright MEd[1], Erik J Scott MD[1], J. Hunter Mehaffey MD[1], Nicholas R. Teman MD[1] and Mark Roeser MD[1]

In a subset of patients with severe Coronavirus disease (COVID-19), lung injury progresses to irreversible pulmonary fibrosis. Bilateral orthotopic lung transplant (BOLT) has been used as a rescue therapy in these patients. In this case series, we describe four patients with pulmonary fibrosis secondary to SARS-CoV-2 infection who were bridged to BOLT using venovenous extracorporeal membrane oxygenation (VV-ECMO).

Median age was 42 years and three were male. Three patients had no significant comorbidities; one had a history of undifferentiated interstitial lung disease managed with chronic steroids. Pre-transplant hospital course was complicated by right ventricular failure due to pulmonary hypertension in two patients and ventilator-associated pneumonia in one. Three patients were non-ambulatory, remaining bedridden for a median of 54 days prior to surgery. Timing of transplantation ranged from hospital day 26 - 68 with a median of 48 days. At the time of transplant, three patients were being mechanically ventilated via tracheostomy, while all had been on VV-ECMO for a median of 27 (IQR 11 - 42) days. All patients underwent BOLT via

clamshell exposure utilizing cardiopulmonary bypass (CPB) with aortic and right atrial cannulation. VV-ECMO was discontinued intraoperatively in all cases after initiating CPB. The three patients with tracheostomy prior to transplant were liberated from the ventilator a median of 9 days postoperatively and decannulated from their tracheostomy a median of 11 days postoperatively. Aside from one patient developing acute renal failure requiring short courses of hemodialysis, there were no significant postoperative complications. Patients were discharged a median of 17 (14 - 20) days following surgery with only one patient requiring supplemental oxygen. After a median follow-up of 226.5 (223 - 257.75) days, all four patients were alive with no supplemental oxygen requirement.

Pulmonary fibrosis secondary to COVID-19 pneumonia can be successfully treated with VV-ECMO and subsequent lung transplantation in select patients. Special consideration should be given to this patient population as they may present with contraindications to traditional listing requirements.

Presentation #59

The relationship between health literacy and comorbidity burden in breast cancer patients

Janet Yan

Introduction: Breast cancer patients with a high comorbidity burden are known to have inferior oncologic outcomes. Health literacy (HL) has been shown to impact self-management of chronic conditions. The relationship between HL and comorbidity burden has not been established in breast cancer patients. This is important because HL specific tailored interventions may promote optimal management throughout the cancer care continuum. The purpose of this study is to examine the relationship between HL and comorbidity burden in breast cancer patients in order to establish a patient-centered approach to improving oncologic outcomes.

Methods: A validated 3-item HL questionnaire has been integrated into the standard intake forms for all new breast cancer patients seen at a single academic surgical oncology clinic. Each question is answered on a Likert-type scale ranging from 1 to 5. Patients who have a total score of $\geq$7 are classified as having low HL, whereas patients with a score of $\leq$6 are classified as having high HL. HL data, as well as patient demographics, comorbidities, cancer characteristics, treatment and adherence are collected in a prospectively maintained database. Comorbidities of interest include coronary artery disease, congestive heart failure, cerebral vascular disease, hypertension, peripheral vascular disease, diabetes mellitus, rheumatoid arthritis, and chronic obstructive pulmonary disease. A high comorbidity burden was defined as $\geq$2 of these diagnoses. Students t-tests and chi-square tests were utilized to compare patients with high and low HL utilizing SASv9.4 statistical software.

Results: The study cohort included 580 breast cancer patients, 426 (73.5%) of which had high HL and 154 (26.6%) of which had low HL. Patients with low HL were more likely to be of a non-White race (37.5% vs 13.0%, $p<0.0001$), and were more likely to have triple negative disease (16.9% vs 10.3%, $p=0.03$). Additionally, patients with low HL were more likely to have a high

comorbidity burden, with 77.6% having ≥2 comorbidities, compared to 62.7% in the high HL group (p=0.0003). These differences were accounted for by a higher rate of cardiac and vascular comorbidities (66.2% vs 50.2%, p=0.0006), and diabetes (29.9% vs 16.4%, p=0.004) in the low HL group. In regards to cardiac and vascular comorbidities, patients with low HL had higher rates of congestive heart failure, cerebral vascular disease, and hypertension.

Conclusions: The results of this study establish a relationship between HL and comorbidities, particularly cardiac/vascular disease and diabetes, in breast cancer patients. HL is an actionable social determinant of health in the delivery of patient-centered cancer care. Future research should be conducted to determine: (1) the impact of HL and comorbidity and (2) the efficacy of HL-specific tailored interventions on breast oncologic outcomes.

Presentation #60

Mesenteric angiography in the detection and treatment of lower gastrointestinal bleeding

Patricia Zhao BS and Daniel Sheeran MD

Purpose: To assess the diagnostic performance of selective and super selective mesenteric angiography in identifying sources of acute lower GI bleeding (LGIB) in patients who did not undergo CT prior to angiogram versus patients for whom CT was performed as an initial test. Additionally, we aimed to investigate the technical success rate, clinical success rate, and complication rate of transcatheter embolization for the treatment of acute LGIB.

Materials and Methods: This retrospective study comprised 225 patients who underwent mesenteric angiography for the evaluation of acute LGIB between January 2012 and December 2020. Patient demographics, etiology of bleeding, location of bleeding, angiographic findings, and details of embolization were recorded from the electronic medical record. Sensitivity of bleeding site detection was calculated to evaluate diagnostic performance.

Results: In cases without an initial CT, the sensitivity of selective angiography for the detection of LGIB was 21.6% while that for super selective angiography was 44.3%. Following a CT positive for active extravasation, however, the sensitivity of bleeding site detection was notably higher at 32.3% for selective angiography and 54.9% for super selective angiography. Transcatheter embolization was performed in 76 patients with a technical success rate of 97.4% and clinical success rate of 86.8%. A total of 131 patients (58.2%) required an additional procedure, and 3 patients (1.3%) developed bowel ischemia within 30 days of the angiogram. The overall in-hospital mortality rate in this study was 4.9%.

Conclusions: Both selective and super selective angiography showed increased bleeding site detection following a CT positive for active extravasation. Additionally, super selective angiography was notably more sensitive for detecting the active bleeding site compared to selective angiography following a positive CT. Thus, rather than terminating an angiogram following a negative selective run, we propose that super selective catheterization still be performed in the area of potential bleeding seen on prior CT in order to maximize the probability of localizing and treating the site of bleeding.