Liberty University
College of Osteopathic Medicine
Research Day

Meeting Program

January 9, 2026

Greetings and welcome to the 7th annual Liberty University College of Osteopathic (LUCOM) Research Day. LUCOM Research Day is designed to be a trainee-centric event providing students and early career professionals the opportunity to practice disseminating research and scholarly activity pertinent to the biomedical sciences.

I would like to thank you for your participation in this event. As an attendee, you will gain further insight into the scientific environment at LUCOM as you hear presentations from your colleagues and peers. Your participation and engagement will be an encouragement to our presenters as they continue to develop as professionals.

I would also like to acknowledge and thank Dr. Laurieanne Hemric, Dr. Mark Hemric, Mrs. Barbara Lutz, and Ms. Madison Gray for their tremendous effort in organizing the LUCOM Research Day event. Your efforts do not go unnoticed, and we are thankful for your dedication to the mission and vision of LUCOM.

I wish you all a wonderful afternoon as we come together to support one another and build an exceptional academic environment at LUCOM.

"Therefore encourage one another and build another up, just as you are doing."
1 Thessalonians 5:11

Joseph C. Gigliotti, Ph.D.
Director of Research and Special Projects
Associate Professor and Chair
Department of Physiology and Pharmacology

Program Overview

12:00 PM	**Boxed lunch**	
12:30 PM	**Opening Prayer**	
	Welcome & Opening Remarks	
	Oral Presentations*	
12:40 PM	**P01:** Designing and Implementing a Randomized Controlled Trial in a Community-Academic Setting: Development of an Osteopathic Manipulative Treatment Protocol to Reduce Tympanostomy Tube Surgery in Children with Chronic or Recurrent Otitis Media	Speaker: Sarah Vidal (Research Fellow) Mentor: Olubukola Ojuola
1:00 PM	**P02:** A Novel Application of OMM to the Accessory Nerve in Treatment Resistant Cervicogenic Headaches	Speaker: L. Spencer Fitch DO (PGY-2) Mentor: Mark D. Unger
1:15 PM	**P03:** Osteopathic Manipulation Effects in Post-Cesarean Section Delivery Patients	Speaker: Olivia Rutowski (OMS-II) Mentor: Jacob Cukierski
1:30 PM	**P04:** ASPIRE: Athlete Strength Performance Intervention for Reducing Asymmetry: The ASPIRE Evaluation	Speakers: Patryck Penar (OMS-II), Nicolas Kress (OMS-II), Elijah Akinade (OMS-II), Jordan Welch (OMS-II) Mentor: P. Gunnar Brolinson
1:45 PM	**P05:** SOS: Stigmata, Opioids, and Standardization - Ranking High Abuse Liability Opioids based on Historical Scales	Speaker: Joseph Ponce (OMS-III) Mentor: Brian Williams
2:00 PM	**P06:** Evaluating the Impact of a DIY Laparoscopic Training Device on Surgical Rotation Preparedness Among Medical Students: A Survey-Based Study	Speakers: Rozlan Basha (OMS-II), Tori Womble (OMS-II) Mentor: James Mahaney
2:15 PM	BREAK	
2:30 PM	**P07:** REDACTED	Speakers: Richard “Jack” Anderson (OMS-II), Mary Leopold (OMS-II) Mentor: Anthony J.M. Bauer
2:45 PM	**P08:** Atypical Presentation of Snapping Biceps Femoris Mimicking Lateral Meniscus Pathology: A Case Report	Speaker: Ethan Gazan Mentor: Keith Lustig
3:00 PM	**P09:** Cadaveric Education for HALO Procedures: A Proposed Model for Emergency Medical Education	Speaker: Jerald Grissom (OMS-III) Mentor: R. James Swanson
3:15 PM	**P10:** Utilizing Community Shadowing Experiences to Support Wellbeing and Pre-clerkship Academic Performance in Medical Students	Speaker: Olivia Rice (OMS-II) Mentor: Joseph Gigliotti
3:30 – 5:00PM	**Poster Presentations**	

Oral Abstracts

P01: Designing and Implementing a Randomized Controlled Trial in a Community-Academic Setting: Development of an Osteopathic Manipulative Treatment Protocol to Reduce Tympanostomy Tube Surgery in Children with Chronic or Recurrent Otitis Media

Category: *Clinical Research*

Authors: Sarah Vidal (Graduate Research Fellow)[1], Olubukola Ojuola, MD[1], Mark Unger, DO[1], Jay Cline, MD[2], Kirsten Madea, DO[1], Joseph Gigliotti, PhD[1], Joy Palmer, DO[1]

Affiliation: [1]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia; [2]Blue Ridge Ear, Nose, Throat & Plastic Surgery, Lynchburg, Virginia

Otitis media with effusion (OME) places a significant burden on children under five years of age and their caregivers. The failure of OME to self-resolve often leads to repeated antibiotic exposure, multiple clinic visits, and, in many cases, tympanostomy tube surgery. Over 667,000 tympanostomy tube surgeries are performed annually in the United States, making it one of the most common pediatric surgical procedures. Surgical intervention offers short-term improvements in hearing and effusion resolution, without sustained reduction in infection recurrence. Given the prevalence and cost burden of OME, identifying non-surgical management strategies could meaningfully reduce antibiotic use and healthcare expenditures. Preliminary evidence suggests osteopathic manipulative treatment (OMT) may improve middle-ear outcomes in pediatric otitis media, but existing studies remain limited in scope, consistency, and design quality. Most focus on acute otitis media (AOM) and evaluate OMT as an adjunctive therapy in the short term, showing favorable but preliminary results. To date, no studies have examined standardized OMT delivered during the pre-operative window to determine whether it can avert tympanostomy tube insertion. Our objective is to design LUCOM's first randomized, triple-blinded clinical trial evaluating OMT's potential to reduce surgical intervention in this population.

The study population includes children aged 6 months to 6 years referred to otolaryngology for chronic or recurrent otitis media, representing typical candidates for tympanostomy tube placement. The interventional OMT protocol consists of six standardized techniques targeting the head, neck, thorax, and lymphatic system, while the control protocol, considered inert, includes six techniques applied to the sacrum, pelvis and lower extremities. Participants will be randomized into one of four groups (A-D) corresponding to binary combinations of the intervention and control OMT protocols, administered sequentially in two treatment rooms by separate blinded proceduralists. This 2x2 factorial design enables assessor-, participant-, and OMT provider-level blinding. The primary outcome is surgical cancellation, while secondary outcomes include effusion resolution (using tympanometry), hearing improvement (using audiometry), and symptom reduction (using parental surveys). Dose-response trends across groups will be tracked, and adverse events will be monitored weekly. Each participant will complete four weekly OMT sessions delivered using uniform instructions and structured procedural checklists to ensure consistency across providers. The study is currently in the final stages of IRB preparation and site partnership agreement.

We hypothesize a clinically meaningful reduction in surgery rates among children receiving the interventional OMT protocol compared with control. We also anticipate improvements in symptoms, middle ear function, and parental satisfaction, with favorable safety and tolerability. Execution of this project will establish LUCOM's RCT infrastructure and standardize OMT research methodology. This framework positions LUCOM to lead future interventional research, advancing evidence-based osteopathic care.

P02: A Novel Application of OMM to the Accessory Nerve in Treatment Resistant Cervicogenic Headaches

Category: *Case Report*

Authors: L. Spencer Fitch DO, (PGY-2)[1,2], Chris C. Decker DO[2], Mark D. Unger DO[1]

Affiliation: [1]Liberty University College of Osteopathic Medicine ONMM Residency, Lynchburg, Virginia; [2]Central Maine Medical Center Family Medicine Residency, Lewiston, Maine

Introduction
Despite nearly half the world's population suffering from headache, currently available treatments are insufficient. Up to 56% of patients report inadequate treatment of headache, including cervicogenic headache (CEH). In CEH, pain signaling is thought to originate from the cervical spine itself. Vigorous manual interventions are not recommended in that area due to risks of morbidity and mortality associated with high-velocity, high-amplitude techniques. On the other hand, osteopathic manipulative treatment (OMT), comprises low-velocity, low amplitude techniques that could be used to treat CEH in the appropriate context. For example, the presence of the spinal accessory nerve (CNXI) within the neck makes it a potential therapeutic target in CEH due to its overlapping innervation with both head and neck structures. We present a case of chronically debilitating CEH in an 84-year-old male successfully treated with a novel form of OMT for CNXI, termed Neural Integration Technique (NIT).

Case
An 84-year-old male was hospitalized with acute-on-chronic exacerbation of CEH and failure to thrive. Palliative care consultation was sought due to high pain burden and declining activities of daily living (ADLs). Headache was 10/10 despite morphine, ketorolac, and acetaminophen. He had 40 years of daily headaches, diagnosed as CEH by neurology four years prior. The patient was discharged on hospital day 3 with pain at baseline (7/10). He was ineligible for hospice. Four days later, the patient presented for OMT in the lead author’s outpatient clinic. Additional failed treatments for CEH included physical therapy, gabapentin, butalbital-acetaminophen-caffeine, greater occipital nerve block, tizanidine, and nonsteroidal anti-inflammatory drugs. OMT, specifically NIT, was applied to CNXI, cranial bones it passes through, and innervated muscles. Treatment began by addressing temporal and occipital bone motion, emphasizing flexion-extension motions until smooth without operator input. Gentle anterior force was applied along the C1-C6 lateral masses to affect the corresponding spinal levels. The treating hand augmented inherent nerve motion and the monitoring hand assessed upper trapezius response. Muscle softening marked the end of treatment, appreciated as restoration of longitudinal nerve motion.

Results
Prior to treatment, the patient suffered daily headaches 40 years. Mean pain severity was 7/10. The patient relied on his sister for instrumental ADLs, who noted that his mood was depressed. Baseline headache impact test 6 (HIT-6) score 72. At 6-week follow-up after the initial treatment, the patient was headache-free for 2-3 days/week. Mean pain severity was 3/10 during episodes. The patient’s sister endorsed improved mood. He began to perform instrumental ADLs independently. HIT-6 score decreased to 50. At the final 11-week follow-up, the patient demonstrated sustained improvement.

Discussion
We report a novel form of OMT for CNXI, neural integration technique, for treatment of debilitating, chronic CEH. Given the global prevalence of headaches, NIT warrants further development as a novel form of OMT for CEH. The author plans to develop and standardize NIT, expanding to other cranial nerves.

P03: Osteopathic Manipulation Effects in Post-Cesarean Section Delivery Patients

Category: *Clinical Research*

Authors: Olivia Rutowski (OMS-II)[1], Margaret Hartman, DO[2], Jacob Cukierski, DO[3]

Affiliation: [1]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia; [2]Sisters of Charity Hospital, Buffalo, New York; [3]Lake Erie College of Osteopathic Medicine, Erie, Pennsylvania

Multiple studies have already established the efficacy of osteopathic manipulative treatment (OMT) in postoperative recovery. OMT has been shown to decrease time to flatus in postoperative ileus and decreased need for opiate analgesia after abdominal surgery; however, the efficacy of OMT in the postpartum period has not been well researched. While one of the most common complaints during pregnancy is low back pain and there are several studies that have shown that OMT is effective in treating low back pain during pregnancy, the current research for OMT on pain in the postpartum period is minimal. One meta-analysis encompassing three studies previously reported significant effects in favor of pain and functional status improvement after OMT. Given these previous findings, we proposed in our study that OMT performed postoperatively from a cesarean section can similarly increase patient satisfaction during inpatient hospital admissions, decrease postoperative pain, and decrease time to flatus and first bowel movement.

The project took place over a period of one month, where multiple providers were utilized to perform simple osteopathic manipulative medicine techniques that have previously been found to have good efficacy in treating the post-operative patient. A prior meta-analysis revealed that some of the techniques with strongest evidence included: balanced ligamentous strain, counterstrain, soft tissue, myofascial release (MFR), facilitated positional release (FPR), and cranial techniques. One study that did look at use of OMT for postpartum patients (and found it efficacious) administered a single OMT session during each patient's hospital stay after surgeries and found that patients had less pain, needed less pain medication, and had improved recovery and comfort. However, this research allowed different combinations of techniques to be used on different individuals, and did not include a control group, making their research less compelling and less generalizable. For the purpose of our study, our team proposed that OMT performed once daily, starting at 24 hours after delivery via cesarean section and continuing daily until discharge, would significantly improve the aforementioned outcomes while prescribing a specific treatment regimen to be followed, and utilizing sham techniques for our control population.

P04: ASPIRE: Athlete Strength Performance Intervention for Reducing Asymmetry: The ASPIRE Evaluation

Category: *Clinical Research*

Authors: P. Gunnar Brolinson, DO[1], David Redden, PhD[2], Elijah Akinade (OMS-II)[1], Nicolas Kress (OMS-II)[1], Patryck Penar (OMS-II)[1], Jordan Welch (OMS-II)[1], Abigail Trivisonno[3], Ryan Siberg[3]

Affiliation: [1]Edward Via College of Osteopathic Medicine (VCOM-VA) Blacksburg, Virginia; [2]Edward Via College of Osteopathic Medicine (VCOM-Auburn) Auburn, Alabama; [3]United States Performance Center, Charlotte, North Carolina

Objective

The primary objective of this study is to determine whether a structured, unilateral strength training intervention effectively reduces bilateral limb strength asymmetry in high-performing athletes. Specifically, the study aims to evaluate changes in asymmetry across multiple movement patterns, including upper and lower body push and pull exercises, using kinetic data collected via pneumatic resistance equipment.

Methods

A retrospective cohort analysis was conducted using pre- and post-training data from 59 athletes between the ages 16 to 40 who completed a five-week unilateral training program at the United States Performance Center. Participants demonstrated ≥10% baseline asymmetry and were medically cleared for unrestricted activity. All participants completed the same supervised unilateral training protocol, targeting both upper and lower extremity movement patterns. Primary outcome measurements of the following movement categories: upper push (e.g., chest press), upper pull (e.g., upper row), lower push (e.g., leg press), and lower pull (e.g., leg curl). Key biomechanical variables, including resistance (lbs), power (watts), velocity (m/s), and range of motion (degrees).

Results

Across all movement categories, unilateral training reduced limb asymmetry by an average of approximately 50% (mean change: -50.10%; 95% CI: -45.42% to -56.49%; $p < 0.0001$). Significant improvements were observed across all exercises, including leg press (-54.96%), upper row (-60.25%), chest press (-51.62%), and slow pull (-39.87%), each reaching $p < 0.0001$. There were no statistically significant differences in the magnitude of improvement between exercises ($p = 0.5568$), indicating that the intervention was consistently effective across upper and lower body movements.

Conclusion

Interlimb asymmetry is a recognized risk factor for injury in athletes. This study demonstrated a statistically significant reduction in asymmetry across all movement categories following a structured unilateral strength training program. These findings suggest that targeted unilateral interventions may effectively improve strength asymmetry in high-performing athletes.

P05: SOS: Stigmata, Opioids, and Standardization - Ranking High Abuse Liability Opioids based on Historical Scales

Category: *Systematic Review/Meta-analysis*

Authors: Joseph Ponce (OMS-III)[1], Michelle Adema (OMS-III)[1], Brian Williams[2]

Affiliation: [1]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia; [2]University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania

Introduction: The ongoing opioid epidemic may be the culmination of worrisome underestimation and miscalculations, many of which have grown in societal impact over 70 years or more. Studies completed as far back as the 1960s have shown that the addiction liability of many opioids had been well-recognized. While alternatives to high-abuse liability opioids (HALO) have carried negative stigmata (methadone, buprenorphine), many studies have suggested that non-HALO alternatives have had subjectively similar analgesic effects with less abuse potential.

Objectives: Our aim is to review measures of abuse liability for both typical HALO and stigmata-laden non-HALO drugs. The secondary objective is to formulate a HALO scale by exploring historical abuse potential profiles of such medications that remain part of routine perioperative pain management.

Methods: Ten addiction medicine studies exploring abuse potential of HALO and/or non-HALO alternatives were selected, dating from 1992 to 2018, utilizing measurement scales developed from the Addiction Research Center Inventory (ARCI) and its published derivatives. ARCI is a standardized questionnaire that was used to assess subjective effects of psychoactive drugs. Using current DSM-5 criteria for opioid use disorder, subjective measurements of HALO against each other and/or against methadone/buprenorphine were extracted. Based on weighted averaging, measurements per drug were standardized into a novel HALO scale, rated from 0 to 100, using values yielded from the scales used in the selected studies, including but not limited to the ACI's Morphine-Benzedrine Group (MBG), and a Positive Reinforcement Visual Analog Scale (VAS), to generate "abuse liability" scores incorporating euphoria, tolerance, and other subjective outcomes. Hyperalgesia is also incorporated into these determinations as a driving factor in the consideration of abuse reinforcement.

Results: When comparing morphine, and six "HALO" drugs (heroin, hydromorphone, fentanyl, remifentanil, oxycodone, hydrocodone), to two non-HALO alternatives (methadone, buprenorphine), historical findings applied to the novel HALO scale suggest that non-HALO alternatives could be "first choices" in routine care, while specifically reducing abuse potential from HALO exposure, with respect to maximizing analgesic effects while minimizing abuse liability.

Conclusions: When re-prioritizing the opioid crisis in the United States, historical studies of abuse liability may offer meaningful perspectives regarding HALO formulations which remain ubiquitous in clinical care, while stigmata-laden alternatives remain available for meaningful analgesia coupled with the hope of reduced euphoria, tolerance, and rebound hyperalgesia inherent in the listed HALO choices. Alternatives such as methadone and buprenorphine, and other non-euphoric choices such as intrathecal morphine, are "ready and waiting," as meaningful, first-choice "re-engineering" options for further research and policy, aimed towards prioritizing patient safety during perioperative pain management. Overcoming stigmata associated with methadone and buprenorphine may be a crucial factor in such implementation, while intrathecal morphine implementation with necessary antiemetic support seems likely to require necessary workflow adjustments.

P06: Evaluating the Impact of a DIY Laparoscopic Training Device on Surgical Rotation Preparedness Among Medical Students: A Survey-Based Study

Category: *Educational Project*

Authors: Rozlan Basha (OMS-II)[1], Tori Womble (OMS-II)[1], Ryan Martin, BAE[2], James Mahaney, PhD[1]

Affiliation: [1]Edward Via College of Osteopathic Medicine (VCOM-VA), Blacksburg, Virginia; [2]Edward Via College of Osteopathic Medicine Virginia Campus Simulation Center, Blacksburg, Virginia

Laparoscopic surgery has become a cornerstone of modern surgical practice, requiring refined motor skills, hand–eye coordination, and depth perception that are difficult to acquire through observation alone. Simulation-based surgical training has been shown to enhance technical proficiency and reduce error rates; however, most studies have focused on postgraduate trainees rather than medical students. Commercially available laparoscopic trainers remain cost-prohibitive for many institutions, limiting access to early skills development. There is a critical gap in the literature regarding the educational impact of low-cost, in-house laparoscopic trainers on medical students' perceived preparedness and confidence as they transition to surgical rotations. Addressing this gap is essential to inform evidence-based integration of affordable simulation into the pre-clinical curriculum.

An anonymous pre- and post- survey study was conducted among first and second year osteopathic medical students (OMS-I and OMS-II) participating in a laparoscopic skills training session. Standardized demonstrations were provided by general surgery faculty and trained student facilitators prior to use. Participants practiced peg transfer tasks for up to 30 minutes under supervision, with individualized feedback provided at least once during each session. Following the activity, participants completed a post-survey. Descriptive statistics were used to calculate means and standard deviations. Two-tailed paired t-tests compared pre- and post-survey responses, and two-tailed unpaired t-tests assessed differences between participants with and without prior laparoscopic experience.

A total of 22 paired surveys were analyzed. Respondents included 17 OMS-I students and 5 OMS-II students. Among these, 17 participants reported no prior experience with laparoscopic procedures, 4 had observed such procedures, and 1 had previously assisted. Eleven participants had prior experience using laparoscopic box trainers, while 11 were novices. Across primary outcomes of familiarity with hand-eye-coordination needed for laparoscopic procedures, self-rated motor skills, confidence in performing laparoscopic tasks, and preparedness for laparoscopic cases in the OR, statistically significant improvements were observed between pre- and post-survey responses. Each question consisted of a Likert scale from 1-5, 1 being the lowest achievement and 5 being the highest achievement for each. Mean familiarity with hand–eye coordination increased from 2.0 ± 0.87 to 3.0 ± 0.73 ($p = 9.61 \times 10^{-6}$). Self-rated laparoscopic motor skill improved from 1.68 ± 0.84 to 3.18 ± 0.59 ($p = 5.65 \times 10^{-8}$). Confidence in performing laparoscopic tasks rose from 1.9 ± 0.92 to 2.9 ± 0.92 ($p = 3.88 \times 10^{-4}$), and perceived preparedness for laparoscopic cases increased from 1.54 ± 0.80 to 2.63 ± 0.85 ($p = 3.8 \times 10^{-8}$). Comparisons between participants with prior box-trainer experience and novices revealed significantly higher pre-survey familiarity with hand–eye coordination in the prior-use group (mean = 3.0 vs 2.0 in novice group; $p = 9.61 \times 10^{-6}$). No additional differences were observed between groups.
The results of this preliminary data show us that budget laparoscopic box trainers can have a significant benefit on the pre-clinical medical student's education for laparoscopic procedures. Continuation of this study will evaluate participants' performance in surgical rotations during their OMS-III year.

P07: REDACTED

Category: *Basic Science Research*

Authors: Richard “Jack” Anderson (OMS-II), Mary Leopold (OMS-II), and Anthony J.M. Bauer, Ph.D.

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Abstract: REDACTED

P08: Atypical Presentation of Snapping Biceps Femoris Mimicking Lateral Meniscus Pathology: A Case Report

Category: *Case Report*

Authors: Alexander J. Baur, DO[1], Ethan C. Gazan (OMS-II)[2], Keith Lustig, MD[2]

Affiliation: [1]Center for Research, Liberty University, Lynchburg, Virginia; [2]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

INTRODUCTION: Snapping biceps femoris (SBF) is a rare and poorly understood pathology. Diagnosis is clinical with visible or palpable tendon snapping over the fibular head during active and passive flexion past 90 degrees. Etiology is either prominent fibular head morphology or anatomical variation in distal insertion to the lateral tibia condyle. SBF can be a rare, extra-articular source of lateral knee pain that is poorly recognized. Treatment is variable and is dependent on patient goals.

CASE REPORT: We present the case of a 25-year-old recreationally active male with a decade long history of recurrent, atraumatic episodes of painful knee locking associated with lateral joint-line tenderness and a positive McMurray's. Multiple MRIs across the symptomatic period have each revealed no intra-articular pathology with intact ligaments and menisci. He has a remote history of right knee arthroscopy for medial shelf plica excision without complication. Dynamic physical examination in office demonstrated visible and palpable subluxation of the distal biceps femoris tendon over the fibular head, confirming the diagnosis of SBF.

CONCLUSION: This case documents a novel presentation of SBF mimicking lateral meniscus pathology, with mechanical knee locking, lateral joint line tenderness, and positive provocative maneuvers. We highlight the importance of considering extra-articular sources of pain when imaging is unrevealing.

P09: Cadaveric Education for HALO Procedures: A Proposed Model for Emergency Medical Education

Category: ***Educational Project***

Authors: Jerald Grissom (OMS-III), R. James Swanson, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Background:

Patients present to emergency medical personnel in a myriad of states, ranging from stable with no basis for an emergent complaint to a full working cardiac arrest. There are many procedures and medications which an emergency medical provider can perform/administer which can be considered “life-saving” under the correct circumstances. Authors Hack, Levy et. al. (2022) described a subset of procedures which are less frequently encountered during routine emergency medical care, but have significant impact on patients’ outcomes. They dubbed these interventions High Acuity-Low Occurrence skills, or “HALO skills”. This presentation seeks to provide a framework for the use of cadavers for continued education/skill upkeep with HALO skills among emergency medical providers. This hands-on, cadaveric-based training model would be in addition to the most prevalent current model which uses didactic education alone. The example of comparing provider attitudes and practices towards intraosseous vascular access, which is currently being used in an IRB approved study, will be presented. Intraosseous vascular access is an emergency vascular access used when other routes of vascular access are unavailable or unsuccessful and time is of the essence.

Method:

In preparation for the previously mentioned IRB approved research project comparing humeral head intraosseous (IO) insertion to tibial head IO insertion educational material was compiled consisting of relevant clinical research, pictures, and videos of relevant anatomy to both insertion sites. These were made into a PowerPoint which was given to the providers for viewing at their own discretion. The providers were then brought into the cadaver lab for an in-person training day. Surveys were administered before and after each learning activity to gather data on the providers attitudes on confidence with each procedure.

Results:

Data gathered from the surveys was collected with the number of responses ranging from n=12 to n=8 depending on the surveys. Pre-surveys from both the PowerPoint only collection period and the in-person collection period showed favor to the tibial head in all described scenarios. The exit surveys showed a slight change to preference of the humeral head site for both learning activities.

Conclusion

The use of cadavers for continued education/skill upkeep in HALO procedures yields consistent positive results, suggesting the potential need for implementation of cadaver labs into emergency medical education/continuing education programs. The current data gained from this research project supports cadaver use and also provides a method of integrating cadavers into emergency medical education which can be applied to any level of provider. The basic framework consists of an initial survey, a slideshow presentation, a secondary survey, an in-person cadaveric training day (not part of this study), and an exit survey. Data gathered along the way with the surveys allows for real-time feedback and modification of the next step of the educational process.

References:

Hack, K. E., Levy, M. J., Garfinkel, E., & Margolis, A. M. (2022). Establishing consensus-based high-acuity low-occurrence skills for EMS physicians: A pilot survey of EMS fellowship faculty. *AEM education and training*, *6*(6), e10828. https://doi.org/10.1002/aet2.10828

P10: Utilizing Community Shadowing Experiences to Support Wellbeing and Pre-clerkship Academic Performance in Medical Students

Category: *Educational Project*

Authors: Olivia Rice (OMS-II), Joseph Gigliotti, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Burnout is a serious and threatening issue within the medical field, and studies have shown an increase in burnout amongst medical professionals, including medical students. Research has been conducted, but is currently undecided on, determining the best way to combat burnout and decline in academic performance through various methods and approaches to incorporate more humanistic experiences into pre-clerkship years. One hypothesis assumes that a dichotomy exists in medical education where students learn all the basic biomedical sciences prior to learning how to become practicing physicians during clinical years. This disconnected approach is thought to contribute to declines in student wellbeing and academic performance.

Over the summer of 2025, a group of students enrolled in a Case Study Report Project with the goal of increasing student awareness of the processes involved in publishing a Case Report. The students met weekly to discuss author expectations and publication guidelines for publishing in a reputable journal, while also undertaking shadowing experiences in the community with physicians. Shadowing consisted of collecting deidentified patient information from clinical encounters, with which the students then developed a “case summary” describing the patient encounter with a focus on applying previously learned biomedical principles in the OMS-1 curriculum. These case summaries were constructed following the guidelines and similar examples of published literature.

Here I present a case summary based on a pediatric patient with the chief complaint of chronic stomach pain and no definitive diagnosis. The aim of this project will be to utilize the case summary to develop a Team-Based Learning Session to support the OMS-1 lecture titled “Neural Regulation of Gastrointestinal Motility.” The goal will be to follow formatting guidelines of the MedEdPortal Educational Summary Report to create the TBL that can be published on the site to be available to the public. From there, this project is meant to bridge the gap between pre-clerkship and clerkship medical education years by offering clinical insight to the classroom information being learned. This serves to address the potential burnout and poor wellbeing of medical students as they begin their medical career.

Poster Abstracts

P11: Field Application of OmegaSkin Soy-Based Scaffold for Refractory Venous Ulcer: First Human Use in Austere Self-Care Environment

Category: *Case Report*

Authors: Jordan Scott (OMS-III)[1], Joseph P. Connell, CEO[2]

Affiliation: [1]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia.; [2]NeuEsse, Inc., Pittsburgh, Pennsylvania

OmegaSkin, a novel soy-based biodegradable electrospun scaffold, demonstrated superior wound healing in preclinical models but required human validation. A 55-year-old male with refractory venous ulcer that failed 8 weeks of standard wound center care (wound enlarged to 4×4×2 cm) self-applied OmegaSkin during international travel without medical supervision, simulating austere field care conditions. The patient independently performed all dressing changes while traveling through Europe, adapting technique based on wound assessment. Wound reduced 95% by Day 17 (2×3 mm) and achieved complete epithelialization by Day 31 with zero adverse events. First human use of OmegaSkin demonstrated remarkable efficacy in a refractory wound with successful self-application in austere conditions. Room temperature stability, minimal training requirements, and superior healing support tactical medicine applications including prolonged field care and special operations environments where conventional wound care is unavailable.

P12: Tetanus in an Unvaccinated Adolescent: Recognizing a Rare Diagnosis in Modern Practice

Category: *Case Report*

Authors: Jordan Scott (OMS-III), Carl Hoegerl, DO

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Background: Tetanus remains a clinical diagnosis that is easily overlooked in regions with high vaccination coverage. With fewer than 30 cases annually in the United States, clinicians must maintain heightened awareness in under-vaccinated populations.

Case Presentation: A 16-year-old unvaccinated Amish male from Lancaster County, Pennsylvania developed progressive trismus and neck rigidity twelve days following elective ear surgery. Despite initial treatment for presumed post-operative otitis media, his symptoms worsened. Physical examination revealed severe trismus (maximum incisor distance 1 cm), marked neck muscle rigidity, and multiple healing leg abrasions from farm work. The combination of neuromuscular symptoms, recent wounds, and absence of vaccination prompted clinical diagnosis of localized tetanus. Treatment with tetanus immune globulin (3,000 units), metronidazole, diazepam, and aggressive wound care resulted in symptom resolution within 72 hours and complete recovery.

Conclusion: This case illustrates the critical importance of obtaining vaccination history in patients with unexplained neuromuscular symptoms. Early recognition enabled timely treatment and prevented progression to generalized tetanus. Communities with philosophical or religious vaccine exemptions require particular clinical vigilance for vaccine-preventable diseases that remain rare in modern practice.

Keywords: tetanus, trismus, unvaccinated, Amish, clinical diagnosis, vaccine-preventable disease.

P13: Management of Infantile Colic with OMT and Probiotics

Category: *Case Report*

Authors: Mackenzie Harris (OMS-III), Arlene O'Donnell, DO IBCLC

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Introduction:
Infantile colic is a diagnosis of exclusion that is diagnosed when the caregiver of a healthy infant younger than 5 months of age reports recurrent and prolonged episodes of crying, fussiness, or irritability that are not attributable to any other cause. Caregivers are unable to soothe the infant or prevent the episodes from occurring. Symptoms peak around six weeks of age and resolve by three to six months of age. Recent research found that probiotics with *Lactobacillus reuteri* can effectively treat infantile colic. OMT has also been found to reduce the severity of symptoms in infantile colic.

Case Description:
We present the case of a 1-month-2-day-old male who initially presented to the clinic after being referred by his mother's lactation consultant for tightness in his jaw and the rest of his body at birth. He was born vaginally at 39 weeks gestation after a quick second stage of labor of 1 hour and 12 minutes. His mother stated that he had been "extremely fussy" and did not like lying on his back. During examination, he had left preference torticollis with limited range of motion to the right. OMT was performed on his cervical, thoracic, sacral, and rib somatic dysfunctions. The patient's mother was educated on how to stretch the patient's neck and back in flexion. Twelve days later, he presented for a follow-up appointment with fussiness. His mom reported that he had been crying constantly. She was giving him a probiotic containing *Lactobacillus rhamnosus*, which had not improved his symptoms. He cried throughout the physical examination and wanted to keep his neck and upper back extended. A significant amount of dural strain was found around his brain and spinal cord. OMT was performed to treat his head, cervical, thoracic, sacral, and visceral somatic dysfunctions. During this visit, he was diagnosed with colic and his mom was advised to switch to a probiotic with *Lactobacillus reuteri*. On his follow-up visit fourteen days later, his mom reported that his fussiness had improved. The probiotic with *Lactobaccillus reuteri* seemed to be helping his symptoms. During the examination, he could lie flat on the exam table without discomfort. He did not cry during the visit. He was treated with OMT for OA, falx cerebri, cervical, thoracic, sacral, and rib somatic dysfunctions. He was seen for follow-up one month later at which time he was 2-months-27-days-old. His mom reported that he had been laughing and babbling since his last visit. He was only fussy in the car. During the examination, he was comfortable and smiling. His neck had full range of motion in rotation with limited flexion at the base of his skull. He flexed his thoracic spine well. The somatic dysfunctions found in his head, thorax, and ribs were treated with OMT.

Discussion:
Since many physicians do not routinely evaluate the musculoskeletal system of infants, the relationship between somatic dysfunction and the development of colic remains largely unknown. The benefits experienced by this patient, including the early resolution of this patient's colic, support the notion that OMT and appropriate probiotics may have potential benefits in treating infantile colic and warrant further exploration.

P14: When a Tongue Tie Really is a Tongue Tie

Category: *Case Report*

Authors: Olivia Boeve (OMS-III), Arlene O'Donnell, DO, IBCLC

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Introduction: Tongue tie is the common descriptor of the condition known medically as ankyloglossia: a condition of limited tongue mobility caused by a restrictive lingual frenulum, which can affect breastfeeding. The incidence in newborns ranges between 1.72% to 10.7%.

Case Description: We present the case of a 24-day-old male infant, who presented to the clinic for a lactation concern. He was born with his hand against his face following an induced vaginal delivery at 40 weeks 3 days. In feedings since birth, the patient seemed to swallow milk during the letdown but was not able to extract milk well. The breastfeeding exam displayed functional retrognathia, with his lower jaw displaced posteriorly. He latched anteriorly on the finger with excess pressure at the gumline. He succeeded with a deep latch on the breast but displayed uncoordinated sucking. On musculoskeletal exam, his body was sidebent left and the muscles around the jaw and base of the tongue were significantly tight. OMT was performed on his head, cervical, thoracic, lumbar, sacral, and visceral dysfunctions. On follow-up six days later, a more relaxed jaw with a more anterior position was noted. The patient could lift his tongue over halfway to the roof of his mouth, and the lingual frenulum appeared loose. When breastfeeding, he did not have many swallows, though his sucking was more coordinated. The patient continued to prefer right cervical rotation and displayed a restricted jaw, base of tongue, and hyoid. The patient's head, cervical, thoracic, and lumbar dysfunctions were treated with OMT. The mismatch between the patient's still-growing mouth and his mother's large nipples was discussed. At a follow-up visit two weeks later, breastfeeding exam displayed a significant anterior lingual frenulum, resulting in a heart-shaped tongue that could not be protruded past the vermilion border. It appeared that the attachment had been further anterior, but that normal tongue motion had resulted in partial recession. Though the patient's jaw was looser and suck mechanics were good, determination was made that the frenulum would likely not regress quickly enough to stop nursing issues. Dysfunctions found upon osteopathic exam, including restriction of the base of the tongue, were corrected in the head, cervical, thoracic, lumbar, sacral, and pelvic regions. The patient was referred to otolaryngology for evaluation of ankyloglossia.

Discussion: Tongue tie may be over diagnosed and thought of as the only explanation for difficulty breastfeeding. A thorough physical exam is critical when examining a breastfeeding dyad struggling with latching issues. Checking the mechanics of the tongue and jaw, especially as the infant is rapidly changing, can support the breastfeeding relationship. A full exam, rather than one limited to looking for a short lingual frenulum, is necessary. Performing a frenotomy should be used as a treatment modality when it is necessary. This case shows that difficulties with breastfeeding can be multifactorial. Addressing all concerns over simply pursuing a frenotomy is best practice to ensure successful infant feeding at the breast.

Conclusion: A thorough physical exam and management of each concern is critical in any assessment of feeding difficulties in a breastfeeding dyad.

P15: Resolution of Infant Torticollis with OMT

Category: *Case Report*

Authors: Sarah Byrd Rice (OMS-III), Arlene O'Donnell, DO, IBCLC

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Introduction:
Torticollis is the third most common pediatric orthopedic diagnosis in childhood and is caused by a shortened sternocleidomastoid muscle leading to ipsilateral head tilt, contralateral chin rotation, and neck flexion. Torticollis may be congenital, due to intrauterine malpositioning or birth trauma, or acquired, due to infection, injuries, or prolonged restrictive positioning. If left untreated, it may progress into facial asymmetry, bite, vision, or auditory disorders, developmental delays, and plagiocephaly with the possibility of requiring corrective surgery. The standard treatment, physical therapy (PT), utilizes in-office and home therapy to focus on stretching the musculature and typically requires up to 12 months for resolution with a heavy reliance on parental adherence to home stretching. Osteopathic Manipulative Treatment (OMT) demonstrates immediate improvement with less dependence on parental adherence. This case shows full resolution of torticollis within a 3-month timeframe.

Case Description:
A 2-month-old male initially presented with restricted left neck rotation and jaw tightness. Birth history is significant for pre-eclampsia, induction, cesarean delivery due to failure to progress, and a nuchal cord. The patient's mother reported the infant preferentially turned his head to the right while sleeping and during tummy time. Physical exam was notable for right-sided rotation of the neck, plagiocephaly, and tight thoracic fascia limiting spinal flexion and chin tuck, with posterior positioning of the jaw. OMT was performed on the head, cervical, thoracic, lumbar, sacrum, upper extremity, and ribs. The mother was instructed in positioning exercises to perform at home to encourage left rotation of his neck. At the 2nd visit, there was an improvement in neck rotation with persistence of tight fascia in the thoracic spine. On the 3rd visit, there was notable improvement in the duration the patient was able to look left and in the plagiocephaly. OMT was performed to multiple body regions and discussed continuing encouragement to look left. By the 4th visit, neck rotation was symmetrical and the plagiocephaly was resolved. OMT was performed to address some residual tight fascia of the thoracic spine. Mother was advised to monitor for any return of symptoms.

Discussion:
Most patients with torticollis are referred to PT with the mainstay of treatment directed towards stretching the musculature over time. The length of PT may be long and heavily relies on parental involvement. OMT focuses on treating the underlying fascial strains to allow the connective tissue holding the infant in this position to unwind and loosen on its own. The infant can naturally have immediate improvement and through normal infant daily life and activities can stretch the fascia further, thus allowing more head turning and improvement of the rotation and sidebending preference. This case demonstrates complete resolution of a left-sided torticollis with just 4 in-office visits using OMT over a 3-month period and less reliance on parental adherence to home stretching.

Conclusion:
OMT demonstrates a more effective alternative to the traditionally accepted standard of care through PT with immediate results and less dependence on parental adherence for the resolution of torticollis.

P16: Application and Integration of Osteopathic Manipulation Across the Medical Disciplines with Evidence-Based Medicine: A Literary Review

Category: *Systematic Review/Meta-analysis*

Authors: Elizabeth Schuerman (OMS-II), Arlene O'Donnell, DO, IBCLC, Allison Bardowell, DO, C-NMM/OMM, CAQSM

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Introduction
Osteopathic Manipulative Treatment (OMT) is a core component of osteopathic medicine, emphasizing the integration of structure and function in the management of health and disease. However, research in the clinical application of OMT showing statistical significance remains narrow despite its demonstrated benefits across a wide range of medical disciplines. OMT has shown significant therapeutic and adjunctive value in numerous conditions, underscoring its importance in holistic patient care. Numerous literature analyses have highlighted the role of OMT in reducing the need for pharmacologic intervention, decreasing referrals to physical therapy, and improving overall patient outcomes. By targeting somatic dysfunction, OMT enhances mobility and reduces pain. In managing conditions such as acute low back pain, chronic neck pain, preterm labor, recurrent otitis media, or pancreatitis, OMT relies on the body's ability to heal itself, serving as a valuable complement to conventional treatment modalities.

Objective:
To highlight Osteopathic research that shows statistical significance of OMT utilization on different medical conditions across multiple medical disciplines; but also to show other successfully treated conditions to expand the depth osteopathic research in the future.

Measures:
Databases such as PubMed and ClinicalKey.
Journals such as *The Journal of Osteopathic Medicine* and *The Journal of Clinical Medicine*.
Inclusion criteria included publication between 2020 and 2025 and a significant p value of $p>0.05$.

Results:
Literature review showcases statistical significance in the use of OMT of medical conditions involving the brain, ear, heart, lung, stomach, large intestine, small intestine, ovary, uterus, bladder, kidney, spleen, axial spine and extremities.
Additional medical conditions involving the cerebellum, eye, gallbladder, thyroid, esophagus, liver, duodenum, pancreas, appendix, ureter, testes, prostate, and anus have been successfully treated with OMT, but is lacking in osteopathic research.

Conclusion:
By highlighting emerging evidence and therapeutic applications, this review seeks to encourage broader integration of OMT within interdisciplinary medical practice and serve as an adjunct to medical care across the medical disciplines. Medical conditions are highlighted in a one-page diagram with a QR code to statistics and references. This guide could be of incredible use to any provider or professional within or outside the osteopathic field, as it is a quick reference for referral to any Osteopathic Manipulative Treatment trained physician.

P17: Resolution of Subacute Thyroiditis and Thyroid Nodules Following Osteopathic Manipulative Treatment: A Case Report

Category: *Case Report*

Authors: Hanling Chang (OMS-IV), Allison Bardowell, DO, C-NMM/OMM, CAQSM

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Introduction

Subacute thyroiditis (SAT), also known as de Quervain's/granulomatous thyroiditis, is an inflammatory thyroid disease characterized by anterior neck pain, swelling, and abnormal thyroid hormone testing. The origin of SAT is most often related to viral infection or the immediate post-viral period and generally progresses through a triphasic pattern - hyperthyroidism (thyrotoxicosis), hypothyroidism, usually returning to euthyroid status.[1,3] SAT is a clinical diagnosis but can show abnormal thyroid function tests and thyroid ultrasound results.[3] It is usually self-limited and treatment focuses on managing pain and hyperthyroid symptoms.[3]

Case Report

A 36-year-old Caucasian woman who presented to her primary care clinic complaining of 1 week of gradual onset anterior neck pain and swelling following a recent self-limited GI illness. She had associated tachycardia, palpitations, and mild oropharyngeal dysphagia. Initial physical exam was notable for a diffusely enlarged, tender thyroid gland that elevated with swallow and anterior cervical lymphadenopathy. The remainder of her exam was unremarkable. Laboratory work-up demonstrated hyperthyroidism without autoimmune thyroid disease. Thyroid ultrasound revealed a heterogeneous thyroid gland with diffuse enlargement of the right thyroid lobe and isthmus and multiple thyroid nodules. Given her laboratory and ultrasound results, her presentation was consistent with subacute thyroiditis. She was advised to manage pain with oral analgesics and undergo fine needle aspiration (FNA) of the larger nodule. Before undergoing FNA, she underwent osteopathic manipulative treatment (OMT) for symptom management. OMT exam showed restricted head movement and pulling of the cervical vertebrae to the right, soft tissue congestion from the hyoid bone to the thoracic inlet, a dense thyroid gland with bilateral palpable nodules, fascial twisting toward the left chest, and intermittent irregular tachycardia while supine. The abnormal exam findings and patient's symptoms resolved with OMT treatment including balanced ligamentous tension and ligamentous articular strain (BMT/LAS) procedures, corelink, osteopathic cranial manipulation, and fluid flux. Follow-up OMT exam after 6 weeks showed resolution of the previous exam findings. The patient reports she has not had hyperthyroidism symptoms since the OMT at the previous visit. A repeat ultrasound later that day showed resolution of the thyroid nodules with normal thyroid size and vascularity without microcalcifications. FNA was deferred given the resolution of her thyroiditis following OMT.

Discussion

Postpartum thyroiditis has a similar clinical course to SAT but is typically painless.[2] At symptom onset, the patient was 10 months postpartum and while postpartum thyroiditis is a plausible cause of her symptoms, her recent GI illness and anterior neck pain makes SAT more likely. The patient did not benefit from first-line NSAIDs. Traditionally, the next step in management would have been corticosteroid therapy. However, there is a risk of recurrence depending on corticosteroids administration.[4] A 2024 meta-analysis of peer-reviewed publications showed that OMT is an effective treatment for inflammatory processes. By addressing and reducing somatic dysfunctions in the body, OMT facilitates self-regulation and self-healing,[5] which was shown in this case of subacute thyroiditis, with resolution of the patient's symptoms and abnormal objective findings 10 weeks after symptom onset.

P18: The use of osteopathic manipulative medicine in non-cardiac and non-pulmonary chest pain cases: a systematic review

Category: *Systematic Review/Meta-analysis*

Authors: Rebecca Scott (OMS-II), Simon Alvin Casas (OMS-II), Joseph Gigliotti, PhD

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Context: In 2020 at least 7 million people presented to the ER with a complaint of chest pain, representing about 5% of all ER visits (Cairns, 2022). These symptoms do not always come from a cardiac or pulmonary condition. Osteopathic manipulative methods could play a role in treating cases without a cardiac or pulmonary cause.
Objective: To investigate the role of osteopathic manipulative medicine in minimizing hospital stays, emergency room visits, and costs for emergency room patients presenting with chest pain or shortness of breath with a non-cardiac and non-pulmonary conditions.
Methods: 1309 articles were pulled from Medline via Ebsco, Ovid, and PubMed. The search phrase used was ((((("Myocardial Infarction") OR ("chest pain")) OR ("dyspnea")) OR ("shortness of breath")) AND (osteopath*). The inclusion criteria include patients presenting to the emergency room with chest pain or shortness of breath who ruled out a myocardial infarction or pulmonary embolism with assessment of circulating troponin concentrations and electrocardiogram abnormalities, such as ST segment elevation, non-ST segment elevation, or new bundle branch block formation. Exclusion criteria include editorials, opinion pieces studies outside of the emergency room, studies that do not mention a specific osteopathic intervention, and studies that do not report at least one of the following: length of stay, number of emergency room visits, or costs. Full-text articles will then be assessed between reviewers and resolved through consensus with a third reviewer. The quality of methodology and internal validity of the studies will then be assessed using an established risk of bias assessment tool appropriate for the specific study design. Lastly, relevant data will be systematically extracted from all included studies such as study design, demographics, intervention details, and reported outcomes. The findings will then be qualitatively synthesized to determine the use of osteopathic manipulative medicine in non-cardiac and non-pulmonary chest pain cases.
Results: Our initial assessment of the literature suggests there will be insufficient empirical evidence to complete a formal literature review, and a scoping review or original study is needed.

References:
Cairns, Christopher and Kang, Kai (2022). National Hospital Ambulatory Medical Care Survey: 2020 Emergency Department Summary Tables. https://dx.doi.org/10.15620/cdc:121911

P19: Effect of Osteopathic Manipulative Treatment on the Cardiovascular System of Healthy Participants and those with Hypertension or Atrial Fibrillation

Category: *Clinical Research*

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Osteopathic manipulative treatments (OMT) include hands-on manipulations of different body structures to increase systemic homeostasis and total participant well-being. Several studies have demonstrated a relationship between OMT and parasympathetic activity, including the effects on vagal tone. For this study, the effect of OMT on several cardiac measures (heart rate, cardiac output, SDNN, and RMSSD) was determined in participants using a Finapres® NOVA. Measurements were taken when participants were sitting, lying, and standing before and after OMT. For analysis, repeated-measures two-way ANOVAs were performed, followed by Holm-Sidak post-hoc tests. In healthy controls, OMT produced a statistically significant reduction in heart rate overall. This reduction was present within each position, and the magnitude of the reduction was greatest when standing. There was also a main effect of OMT for RMSSD, such that RMSSD was increased following OMT. There was no effect of OMT for SDNN, although SDNN did change with position. Finally, the position and OMT did not affect cardiac output. Those with hypertension and atrial fibrillation were combined due to a low level of recruitment. For this combined group, heart rate did change with position; however, OMT did not modulate these changes as it did in the healthy control group. For RMSSD and cardiac output, there was no change with either position or OMT. Finally, similar to the healthy control group, SDNN did change with position, but OMT did not modulate this effect. Overall, OMT can affect the cardiovascular system in healthy controls. While the same effect was not seen in those with hypertension and atrial fibrillation, it is likely due to the lack of power in this study. Future studies will include a larger sample of participants with the plan to include participants with hypertension, paroxysmal atrial fibrillation, and persistent atrial fibrillation.

P20: Utilization of the Holistic Osteopathic Approach in Management of Complicated Hypertension: A Case Study

Category: *Case Report*

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Introduction:
This 58-year-old male presented to the clinic 2 years ago with a painful RUE frozen shoulder and associated pain due to trauma. He also reported an acute myocardial infarction (MI) which required out of hospital resuscitation. Upon presentation, comorbid conditions included uncontrolled hypertension (HTN), chronic pain, and depression. Utilizing an osteopathic approach, pain, mobility, mood, and blood pressure (BP) all improved.

Case Description:
This patient was evaluated over a 2 ½ year period following a prior injury where a tree recoiled, striking him on the ribcage. This chest-wall injury led to right-sided rib and shoulder restrictions, and a questionable relationship to a subsequent MI 4 months later. His ability to work, and meaning in life suffered, while at the same time he underwent a divorce with his wife, leading to depression. Comorbidities at presentation included HTN, hyperlipidemia, C5–6 facet syndrome with upper-extremity neuropathy, chronic kidney disease, moderate depressive symptoms (PHQ-9 = 11) and anxiety (GAD-7 = 10), extensive cigarette use (11–20/day), and very high sugared-caffeine intake (≈12 sodas/day). Treatment took place in a community clinic with weekly osteopathic medicine visits and student-doctor involvement. Treatment included:
Osteopathic Manipulative Treatment (OMT): Bundled mobility techniques rooted within the Spencer Maneuvers; MFR Techniques applied to thoracic inlet, ribs, diaphragm, renal fascia, abdomen, and pelvis; sympathetic inhibition techniques which included suboccipital inhibition, rib raising, abdominal ganglion inhibition, and cranial-sacral BMT and inhibition.
Medication management: Transitioned off clonidine to losartan and amlodipine; continued beta-blocker, statin, and aspirin.
Supportive elements: Provided home exercises; intentional communication with primary care; life coaching; depression and anxiety screenings; and implemented cigarette and soda modification awareness. He evolved to find purpose by participating in student-doctor training during visits.

Discussion:
Pharmacologic therapy remains the cornerstone of chronic HTN management, with RAAS inhibitors and calcium channel blockers playing key roles. Research supports adjunctive OMT use in chronic HTN. In this case, autonomic techniques were applied successfully, reducing BP from 190/110 mmHg (2024) to 160/98 mmHg at the most recent evaluation. An acute drop from 160/98 mmHg pre-treatment to 138/98 mmHg post-treatment was also observed. OMT improved pain and mobility, with techniques such as Spencer's and MFR enhancing shoulder range of motion. The environment also strengthened the patient's sense of purpose through participation in medical student education, aligning with improved mood and reduced depression (PHQ-9 = 9) and anxiety (GAD-7 = 7). Behavioral counseling on cigarette use and soda intake further supported health gains.

Conclusion:
Utilizing osteopathic principles in addition to traditional medicine produced measurable, sustained reductions in BP, improved mobility, and improved quality of life in a trauma-affected hypertensive patient. This case underscores the value of addressing each component of the human person; mind, body, and spirit, with the combination of targeted OMT approaches, guided pharmacological treatment, and psychosocial intervention.

P21: Comparison of Cadaveric Anterior Tibial Displacement at 10°, 20°, and 30° in intact and cut ACLs

Category: *Clinical Research*

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Anterior tibial displacement is a commonly used measure to determine if there is an Anterior Cruciate Ligament (ACL) injury prior to imaging. The Lachman test (LT) and Anterior Drawer test (ADT) are two physical exam techniques used to measure this, with the LT generally being regarded as the better of the two with a sensitivity of 87% and specificity of 93% (compared to sensitivity of 48% and specificity of 93% with the ADT)[1,2]. The LT is typically performed at a knee flexion angle of 20°-30°, however, previous research suggests there is a greater degree of anterior tibial displacement at 10°. Sokal et al., (2022), hypothesized that prior findings of the sensitivity and specificity of the LT are significantly overestimated and found a sensitivity of 81% and specificity of 85% of the LT suggesting that the reliability of the Lachman test to predict ACL injury is less reliable than previously believed[3]. Furthermore, Noh et al., (2019), using a Telos device and Stress radiograph, found that there is a greater amount of anterior tibial displacement at 10º compared to 30° of knee flexion in injured ACLs[4]. Using two cadaveric specimens, this research measured anterior tibial displacement with intact and severed ACLs at 10°, 20°, and 30° of knee flexion. Anterior tibial displacement was not significantly different between knee angles in intact and cut ACLs ($p > 0.05$) The largest amount of anterior tibial displacement was found at 10° of knee flexion (intact – 2.23mm, cut – 3.12mm) with the greatest change in displacement between intact and cut ACLs at 20° of knee flexion (1.01mm).

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P22: Geniculate Nerve Block Using Perineural Injection Therapy

Category: *Case Report*

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Introduction

Total knee arthroplasty (TKA) is one of the most frequently performed orthopedic procedures in the United States. It is indicated for patients suffering from end-stage osteoarthritis (OA) and other inflammatory conditions. Prior to this procedure, conservative treatments are attempted, possibly followed by injections typically containing corticosteroids or hyaluronic acid. However, some patients are not good candidates for injections or surgery or may have restrictions to other treatments. Patients with refractory pain are often referred for nerve ablations. These procedures are often limited by cost, insurance, and number of specialists performing them. Additionally, they are more invasive, performed in surgical settings, and pose an increased risk to the patient. We present a case involving a novel procedure to address chronic knee pain in patients who have failed conservative treatment, are not good candidates for surgery or injections, or who may have restrictions to medications.

Case

A 75-year-old female with a history of multiple deep venous thromboses (DVT) on warfarin and OA of the left knee was being managed for chronic knee pain. She failed conservative management including physical therapy, oral medications, corticosteroid injections, and hyaluronic acid gel injections. She reported severe pain and inability to perform most activities of daily living, relying on a wheelchair for long-distance activities such as walking from her car into church or grocery shopping. The patient consulted multiple surgeons who initially recommended TKA. However, the patient was deemed to be a high-risk surgical candidate due to her history of multiple DVTs. After discussing with the patient, a geniculate nerve block was performed on the superomedial, superolateral, and inferomedial genicular nerves using a solution of 4 cc 5% dextrose and 2 cc 0.5% bupivacaine per site. In a typical nerve block, local anesthetic alone like bupivacaine or lidocaine, sometimes mixed with corticosteroid, is injected to tissue surrounding nerves. This typically provides an average of 5-8 hours of pain relief to the patient and is used for diagnostic purposes in patients who are considering nerve ablations. In this case, 5% dextrose was used in conjunction with the anesthetic, similar to perineural injection therapy, which treats neuropathic pain via non-specific inhibition of pain receptors.

Results

The patient was seen in follow-up two weeks after the procedure and reported no knee pain over the visit interval. She stated she was able to return to her normal activities and had been less reliant on a wheelchair. She stated that she experienced some soreness during the immediate post-procedure period but had not experienced pain since. At follow-up four weeks after the procedure, the patient reported she remained without pain up to the day prior.

Discussion

We report a case involving resolution of knee pain due to end-stage OA after a novel genicular nerve block. The procedure may offer an additional treatment option with fewer side effects, improved cost and accessibility, and promising durability relative to existing interventional nerve block procedures. Further research is needed to study the long-term safety and efficacy of this novel procedure.

P23: Case Series of Tortuous Internal Carotid Arteries in Elderly Cadavers: Anatomical and Clinical Significance

Category: *Case Report*

Authors: Noah Benjamin Campbell (OMS-II), Sofie Rose Tennant (OMS-I), Gabriel Wilson (OMS-I), Zechariah Janzen (OMS I), Eunice Cho (OMS-I), Emily Passamonte (OMS-I), Stany Lobo, PhD

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Tortuous internal carotid artery (ICA) represents a vascular variation with important clinical and surgical implications. While frequently asymptomatic in life, its presence may complicate diagnostic imaging and increase the risk of intraoperative hemorrhage during pharyngeal or skull base surgery. We report the finding of a tortuous ICA in an 84-year-old male cadaver during routine head and neck dissection. The vessel demonstrated abnormal looping within the infratemporal and parapharyngeal region, specifically exhibiting atypical proximity to the pharynx. This anatomical variation highlights the importance of precise dissection, knowledge of ICA variants, and reliance on preoperative imaging to prevent catastrophic iatrogenic injury.

P24: Aberrant Right Subclavian Artery: A Cadaveric Case Report

Category: *Case Report*

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Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Aberrant right subclavian artery (ARSA) is a congenital variation in which the right subclavian artery arises from the aortic arch distal to the left subclavian artery instead of branching from the brachiocephalic trunk. This anomaly has the potential to deviate the normal course of the right recurrent laryngeal nerve (RRLN) during embryological development to cause a non-recurrent laryngeal nerve (NRLN). This case report presents the finding of an ARSA in a 94-year-old female cadaver during routine dissection for medical education. A proximal stenosis of the right subclavian artery was discovered, indicating the possibility of subclavian steal syndrome (SSS), and a NRLN was present. Although often asymptomatic, SSS reduces blood flow to the brain and can cause many neurological symptoms. If left unidentified, a NRLN can have significant surgical complications, and is particularly pertinent to thyroidectomy and cervical spine procedures. This case report emphasizes the importance of awareness of this rare neurovascular anatomical variation, knowledge of the associated embryology, and screening for neurovascular anomalies in preoperative patients.

P25: A Novel Anatomical Compensatory Structure of the Superior Thyroid Artery and Its Branches

Category: *Case Report*

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Typically, the thyroid gland is supplied by the superior and inferior thyroid arteries, which arise from the external carotid artery and subclavian artery, respectively. During a cadaveric dissection at LUCOM, a variant origin of the superior thyroid artery (STA) as well as a lack of an inferior laryngeal artery (ILA) was observed in a 98-year-old female donor. In this donor, the left STA originated from the common carotid artery (CCA) instead of the external carotid artery (ECA). While typically the superior laryngeal artery (SLA) branches off of the STA, the SLA branches directly off of the ECA. However, the deviated STA does give rise to a branch leading to the inferior portion of the thyroid cartilage and larynx which appears to be a novel compensatory mechanism for a lack of the left ILA. The neck vasculature pattern on the right side shows no notable variations. A thorough understanding of thyroid and laryngeal vascular anatomy is essential during thyroid and laryngeal surgeries, as well as for the accurate interpretation of angiographic studies. With increasing advancements and interest in laryngeal reconstructive procedures, including total voice box replacements, awareness of such vascular variations becomes particularly important. This case highlights a rare anatomical variation of the thyroid vasculature and emphasizes its clinical and surgical relevance.

P26: Case Series of Tortuous Internal Carotid Arteries in Elderly Cadavers: Anatomical and Clinical Significance

Category: *Case Report*

Authors: Noah Benjamin Campbell (OMS II), Sofie Rose Tennant (OMS I), Gabriel Wilson (OMS I), Zechariah Janzen (OMS I), Eunice Cho (OMS I), Emily Passamonte (OMS I), Stany Lobo, PhD

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In the infratemporal fossa, the mandibular nerve (V3) typically divides into anterior and posterior divisions. The posterior division gives rise to two major branches: the inferior alveolar nerve (IAN) and the lingual nerve (LN). The chorda tympani branch of the facial nerve (CN VII) joins the lingual nerve in this region. During routine cadaveric dissection in the Department of Anatomy, a 101-year-old female cadaver was studied. Examination of the infratemporal fossa revealed a distinct additional communicating branch between the IAN and the LN after the chorda tympani had joined the lingual nerve. This connecting branch coursed obliquely, forming a neuronal bridge between the two nerves. The remainder of the mandibular nerve branching pattern was normal, including the course of the IAN and LN. There were no surgical alterations, pathological findings, or other anomalies in the surrounding tissues.
Variant communications between the IAN and LN have been reported in 8–20% of dissections, with most connections occurring proximal to the entry of the chorda tympani. The presence of an additional connection distal to the chorda tympani junction is rare and may have functional implications.

Such a variation could influence the transmission of sensory and/or gustatory fibers, potentially affecting the efficacy of mandibular nerve blocks. Knowledge of this anomaly could inform altered surgical approaches to the infratemporal fossa, mandibular osteotomies, and the third molar region. Additionally, this configuration may provide insight into atypical sensory recovery following neural or maxillofacial surgeries.

P27: Osteopathic Manipulative Treatment for Bilateral Tibial Stress Fracture of a College Lacrosse Athlete: A Case Report

Category: *Case Report*

Authors: Yeonji Kim (OMS-II), Stephen M. Patag (OMS-IV), Allison Bardowell, DO, C-NMM/OMM, CAQSM

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Objective:

To demonstrate the utility of OMT as a successful adjunctive treatment to standard management with early return to sport in an athlete with bilateral tibial stress fractures.

Case:

A 21-year-old collegiate men's lacrosse player presented to the clinic with persistent bilateral lower leg pain with a history of bilateral tibial stress fractures, ankle sprains, and right tibial cleat impacts. MRI right lower extremity demonstrated marrow edema consistent with tibial and fibular stress fractures. Attempts at protected weightbearing using a unilateral walking boot worsened contralateral symptoms due to compensation. Pain was exacerbated by walking, stairs, sprinting, and repetitive loading, limiting in-season performance.

Outcomes:

OMT including balanced ligamentous/membranous tension, ligamentous articular strain, muscle energy and osteopathy in the cranial field techniques was directed to the pelvis, hip, knee, ankle, interosseous membrane, and posterior chain. Successful pain resolution even with instigative motions with immediate ankle freedom was achieved. Subsequent visit, addressed and further reduced compensatory strain patterns and posture support with a 98% improvement to asymmetry. The athlete completed a full return to high-level collegiate competition without recurrence of symptoms over one-year post-treatment.

Discussion:

OMT resolved persistent pain and function deficits, regained motion and quality of life with a dramatic change to the trajectory of his season. Recurrent tibial stress injury in athletes may reflect persistent biomechanical dysfunction despite typical rest and rehabilitation. OMT can effectively remove trauma, restore motion, optimize load distribution, and reduce pain thus supporting successful return to sport when symptoms persist. OMT may serve as a valuable adjunct to standard management for athletes particularly when symptoms persist despite traditional care.

P28: Simulating Stress Fractures in Cadaveric Bone Using Mechanical Loading: A Pilot Study

Category: *Basic Science Research*

Authors: Yeonji Kim (OMS-II), Keith Lustig, MD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Stress fractures are common overuse injuries, and the tibia is among the most frequently affected bones, particularly in the mid-to-distal third region. Although previous studies have described the epidemiologic patterns of tibial stress fractures, the underlying mechanical reasons for this regional vulnerability remain unclear. This project aims to investigate the mechanical behavior of (cadaveric) bone under repetitive submaximal (cyclic) loading to determine whether fractures occur preferentially in the mid-to-distal third region. Data collected from the cyclic loading tests will be analyzed to identify the location and characteristics of fracture initiation. The results will help clarify whether regional stress concentrations observed in the tibia can be replicated experimentally and may provide insight into the mechanical thresholds that predispose specific bone regions to stress fracture.

P29: Microtrauma fracture pattern morphology of the tibial plateau and distal femur associated with repetitive versus high impact load bearing

Category: *Basic Science Research*

Authors: Mary Leopold (OMS II), Collin Sutter (OMS II), Keith Lustig, MD.

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Background:
Musculoskeletal injuries are a leading cause of lost duty days and medical discharges among U.S. service members, particularly within physically demanding communities such as airborne, special operations, and maritime units. Load-bearing stress from activities including prolonged marches, parachute landings, and high-impact vessel operations imposes significant mechanical strain on the lower extremities. Although the connection between load carriage and musculoskeletal injury is well established, limited research has characterized microtrauma fracture patterns—specifically within the tibial plateau and distal femur—under various types of military load bearing.

Objective:
To identify microtrauma fracture pattern morphology in the tibial plateau and distal femur under repetitive versus high-impact load-bearing conditions.

Methods:
Cadaveric lower extremities will undergo simulated military load-bearing scenarios using controlled mechanical loading. Microstructural analysis will be performed to assess fracture initiation sites, trabecular microdamage, and cortical stress responses. Comparative testing will evaluate differences between repetitive low-magnitude loading and acute high-impact forces representative of real-world military activities such as ruck marches and parachute landings.

Expected Results:
Repetitive load bearing is expected to produce diffuse trabecular microfractures, while high-impact conditions are anticipated to cause focal cortical defects and more defined fracture lines.

Conclusion:
This study aims to define specific patterns of osseous microtrauma resulting from military load bearing and provide insight into the mechanical factors contributing to bone injury at the knee. By distinguishing the morphological differences between repetitive versus high impact fracture patterns this research may inform prevention strategies, training design, and biomechanical standards aimed at reducing musculoskeletal injuries in military populations.

P30: The Effect of Spinal Loading on Intervertebral Disk Compression

Category: *Clinical Research*

Authors: Nathaniel Sherman (OMS-II), David Shepherd (OMS-II), James Baldonado (OMS-II), Keith Lustig, MD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Background: Lower back pain is the leading cause of disability in the United States and occurs at a 70% higher rate among military personnel than in the general population, imposing an estimated $2 billion annual burden on the VA healthcare system (Lehman et al., 2012). Chronic spinal loading from body armor and rucksacks is a major contributing factor. Soldiers in Iraq and Afghanistan carried average marching loads of ~100 lbs, with combat loads ranging from 63–81 lbs depending on role (Fish & Scharre, 2018). Prior work (Kimura et al., 2001) demonstrated that loads exceeding half of body weight cause significant intervertebral disc compression and postural alterations. Disc height below 4 mm has been linked to lumbar nerve pain, compared to the normal 7–10 mm range (Mayoux-Benhamou et al., 1989).

Objective: To determine whether carrying a 60-lb load for 12 hours, simulating a rifleman's typical workday, induces acute intervertebral disc compression in healthy, military-aged individuals.

Methods: Twenty participants (ages 18–35) with no history of chronic low back pain, spinal surgery, or abnormalities will undergo lumbar ultrasound imaging (L1–L5) under four conditions: (1) pre-load, (2) immediately post-load, (3) 45 minutes post-unload, and (4) 24 hours post-unload. Additional data will include subjective discomfort logs, lower leg edema, and changes in height and posture.

Hypothesis: Carrying a 60-lb load will significantly reduce lumbar intervertebral disc thickness due to increased compressive forces and transient fluid loss from the nucleus pulposus.

Expected Impact: Demonstrating acute spinal compression from standard body armor loads could justify revising military equipment design, implementing decompression protocols, and integrating osteopathic manipulative techniques (e.g., traction, counterstrain) to mitigate load-induced spine stress and associated pain.

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P31: A Narrative Review Highlighting the Shortcomings of DXA in Measuring Bone Demineralization and Estimating Fracture Risk in Comorbid Patient Populations

Category: *Educational Project*

Authors: Spencer T. Powers (OMS-II), Ethan C. Gazan (OMS-II), Keith Lustig, MD

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Dual energy X-ray absorptiometry (DXA) has been the gold standard to diagnose bone demineralization for over three decades. It is an accessible and low-cost diagnostic tool with minimal radiation dose. Recent research indicates that DXA scans may be insufficient in detecting contributors to bone deterioration and mechanical weakness in specific patient populations. DXA scans provide a two-dimensional view of bone density that can be confounded by patients with glucocorticoid use, certain structural considerations, and comorbid metabolic factors unrelated to mineral content. Emerging imaging modalities, including quantitative computed tomography (QCT), high-resolution QCT, and finite element analysis (FEA) have been shown to more accurately assess bone structure, mineralization heterogenicity, and predicted failure load. These new methods show promising results in more accurately predicting the fracture risk and osseous structural integrity in these patient populations. The goal of this review is to summarize the current evidence that mismatches DXA scores with bone quality and fracture risk among these patients, and outline hurdles that need to be overcome before QCT and FEA can be integrated into clinical practice. By consolidating recent advances in imaging and clinical research, we underscore the need for continued investigation into this expanding patient population to improve risk stratification and clinical care.

P32: Determining the Hardness of the Incus in an Aging Population

Category: *Basic Science Research*

Authors: Matthew McIntyre (OMS-II), Paul Hesch (OMS-II), Keith Lustig, MD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Age has long been known to be a factor in decreasing bone density. The bones of the ossicular chain, however, are unique in their structure and lack remodeling after birth. Previous research has been done on the hardness – the ability of the ossicles to resist plastic deformation – of the Incus but has primarily focused on younger populations. Our research decided to focus on an older population with the goal of determining if a statistical significance exists between age and the hardness of the Incus. Incus specimens were obtained from cadavers and tested using a microhardness tester. To determine the hardness, a digital confocal microscope was used to capture images of the Incus bones both before and after the hardness tester created indentations. The images and the microscope's software were then used to measure the diagonals of the indentations. The hardness of the specimens was then obtained using the hardness formula. Finally, the data obtained from the tests was then analyzed to determine if there was a statistically significant change in hardness due to age. No statistically significant change due to age was found from our testing. We believe that more testing is warranted and would provide further insight into the unique nature of the ossicular chain.

P33: Cervical Pedicle Screws Versus Lateral Mass Screws: A Comparative Review of Biomechanical Strength, Surgical Outcomes, and Complications

Category: *Systematic Review/Meta-analysis*

Authors: Andrew T. Lewin (OMS-II)[1], David Vorobey (OMS-II)[1], David R. Lewin (OMS-II)[2], Alexander Baur, DO[1], Keith Lustig, MD[1]

Affiliation: [1]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia; [2]Lake Erie College of Osteopathic Medicine, Erie, Pennsylvania

Background: Posterior cervical spine instrumentation is a cornerstone of managing instability, trauma, and deformity. Among available techniques, cervical pedicle screws (CPS) and lateral mass screws (LMS) are widely used.
Objective: This review aims to compare CPS and LMS in terms of biomechanical stability, and complication rates.
Methods: A systematic review was performed using PRISMA guidelines querying PubMed, Scopus, and DOAJ. Studies were identified that directly compared CPS and LMS in adult populations. Malposition rates and vertebral artery injury were analyzed using a random-effects model. Biomechanical data were compared using qualitative synthesis and unpaired t-tests.
Results: Twenty-five studies met inclusion criteria. Across four biomechanical studies, cervical pedicle screws demonstrated higher pull-out strength (677–1,214 N) and construct stiffness (5.8– 6.5 Nm/deg) compared to lateral mass screws (332–355 N; 3.1–3.3 Nm/deg; $p<.001$). The pooled CPS malposition rate was 10% (95% CI: 6%–14%), with individual rates ranging from 3% to 15%. Studies using navigation, including 3D-printed templates, reported lower rates. The pooled VAI rate with CPS was 1% (95% CI: 1%–2%). No VAI events were reported in LMS cohorts.
Conclusion: Cervical pedicle screws (CPS) demonstrate superior biomechanical strength and improved construct stability compared to lateral mass screws (LMS), particularly in multilevel or complex reconstructions. However, CPS carries higher risks of malposition and vertebral artery injury, especially without image guidance. LMS remains a reliable option with fewer complications. As navigation and 3D-guided techniques become more accessible, the clinical utility and safety of CPS may continue to improve.

P34: Comparative Compressive Biomechanics of Post-Laminectomy Vertebral Segments: A Cervical-Through-Lumbar Analysis

Category: *Basic Science Research*

Authors: William Dedmond (OMS-III)[1], Joseph DiPetto (OMS-III)[1], Charlotte Bader (OMS-III)[1], Jacob Franzen (OMS-III)[1], Thomas Alipranti (OMS-II)[1], Efosa Osayamwen (MS-I)[2], Keith Lustig, MD[1]

Affiliation: [1]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia;[2]Trinity School of Medicine, St. Vincent

Background: Understanding the compressive properties of vertebrae can help to predict fracture risk and extent. To our knowledge a compressive comparison between vertebral subregions has not been reported. **Methods**: Whole vertebral segments post-laminectomy from 7 cadaveric donors were tested under axial compression (n=119; Cervical n=11; Upper Thoracic (T1–T4) n=28; Middle Thoracic (T5–T8) n=28; Lower Thoracic (T9–T12) n=27; Lumbar n=25). Outcome metrics were apparent modulus (E_app), structural stiffness (K), ultimate load, plateau mean stress, and energy to failure. Analyses included ANOVA, pairwise Welch tests with Benjamini–Hochberg FDR. **Results**: Subregion effects were significant for strength-related metrics of ultimate load, plateau mean stress, and energy to failure (ANOVA, $p<0.05$). Coarse region effects were significant for strength-related metrics (ANOVA, $p<0.05$). Pairwise contrasts indicated Lumbar exceeded Upper and Lower Thoracic, while Lower Thoracic was comparable to Lumbar in most strength-related metrics. Cervical exhibited higher plateau mean stress than Lumbar (BH-FDR $p<0.05$). Elastic measures (E_app, K) showed smaller or non-significant subregional differences. **Conclusions**: Subregional and regional differences in strength-related measures persist, while regional differences in elastic measures are non-significant. This challenges the assumption of Lumbar dominant elastic strength measures. Significant characterization of several significant strength-related metrics across vertebral subregions exist enabling a more accurate understanding of vertebral biomechanics.

P35: Outcomes of Arthroscopic Surgery for Sports-Related Shoulder Instability in Adolescents: A Systematic Review

Category: *Systematic Review/Meta-analysis*

Authors: Theodore J Houseman (OMS-II), Alexander J Baur, DO, Keith Lustig, MD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Context: Arthroscopic surgery has rapidly grown in popularity for the treatment of shoulder injuries because it not only requires a smaller incision site, but it also is associated with faster recovery times in comparison to its open surgery counterpart. A common need for surgical repair of the shoulder is from an athletic injury. Evaluating the clinical outcomes of arthroscopic surgery on the shoulder has become a topic of interest in the treatment of athletes who sustain shoulder instability from sports-related events; however, these outcomes have not yet been analyzed in the adolescent population, specifically.

Purpose: The purpose of this study is to conduct a systematic review and meta-analysis to examine the outcomes of arthroscopic shoulder surgery on adolescent athletes who acquired a shoulder instability during a sports-related event.

Methods: This systematic review and meta-analysis is being conducted using PubMed and Scopus databases from January 2005 to June 2025. Cohort studies are being limited to those reporting on surgical outcomes of adolescent athletes undergoing arthroscopic surgery on the glenohumeral joint. Only level I, II, and III studies are being included. The selected studies will undergo meta-analysis to potentially compare return-to-sport time, re-operation frequency, and length after surgery of the final follow-up appointment.

Results: 1,632 total studies were identified from the original search in PubMed and Scopus. 1,422 studies remained after removing duplicates. The title screen narrowed down the studies to 584. An abstract screen yielded 33 studies, which will be used to do a full-text screening and data extraction. Some of the surgeries being included are the Laterjet, Bristow-Laterjet, Bankart repair, and Hill-Sachs lesion repair, among other procedures. We expect to have data analysis on a variety of outcomes from this array of arthroscopic procedures.

Conclusion: This will be the first systematic review and meta-analysis to analyze the outcomes of arthroscopic shoulder surgery in adolescent athletes. We aim to clarify the value of arthroscopic surgery in adolescent athletes by statistically comparing an array of outcomes such as return-to-sport time, re-operation frequency, and length after surgery of the final follow-up appointment. Further research would indicate whether there is an association between specific injury-provoking athletic movements and athlete outcomes in arthroscopic surgery. This would refine physician protocols and improve patient outcomes.

Key words: arthroscopy; shoulder instability; surgery; sports injury; glenohumeral; adolescents.

P36: I'm perfect but suffering silently and alone: Examining the role of perfectionistic self-presentation and parental alienation on physical and mental health among adolescents from a high-achieving school

Category: *Clinical Research*

Authors: Alexis A. Anello (OMS-2)[1], Laura A. Wright, PhD, ABPP[2], Jenna B. Shapiro, PhD[3], Kelsey N. Jervis, BS[4], Edin T. Randall, PhD[5,6]

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Introduction: Adolescents in high-achieving schools (HAS) are considered a high-risk group due to unrelenting pressures to excel. Despite being at risk for poorer mental health outcomes, few studies have assessed how psychosocial stressors impact physical health in this population. There is evidence that youth from HAS struggle with perfectionistic demands and perceive greater parental alienation, both of which may influence psychological and physical health. This study examines associations between three domains of perfectionistic self-presentation, somatic, anxiety, and depressive symptoms, and explores the moderating role of parental alienation and gender identity on these relations. This study also presents a detailed description of somatic symptoms among adolescents from HAS.
Methods: Two waves of cross-sectional data were collected in 2017 and 2019. Students (n=181; 99 females and 82 males, M_{age}= 15.61, SD_{age}= 1.01) from a HAS in the Northeastern United States completed self-report measures. Direct and moderated effects were analyzed using SPSS and the PROCESS macro.
Results: Adolescents in the current sample endorsed high levels of somatic symptoms. Non-display of imperfections (NDisp) was associated with more depressive symptoms and anxiety, while perfectionistic self-promotion (PSP) was associated with more somatic symptoms. Moderated effects indicated that PSP was related to higher levels of somatic symptoms and NDisp related to more anxiety and depressive symptoms only for students endorsing moderate-to-high levels of parental alienation. Additionally, NDisp was associated with more depressive symptoms for females only.
Conclusions: Findings suggest that targeting parental alienation and perfectionism may improve the emotional and physical well-being of adolescents from HAS.

Keywords: adolescents, high-achieving schools (HAS), parental alienation, perfectionism, somatic symptoms, internalizing symptoms

P37: Visual Acuity and Treatment Durability Outcomes After Switching From Faricimab in Patients With Wet Age-Related Macular Degeneration: Protocol for a Multicenter Retrospective Cohort Study

Category: *Clinical Research*

Authors: Nathaniel O. Poff (OMS-I), Mark D. Unger, DO

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Introduction: Anti-vascular endothelial growth factor (anti-VEGF) agents are the standard of care for neovascular age-related macular degeneration (wet AMD). However, patients frequently switch from one drug, for instance faricimab, to another drug due to non-response, durability issues, or other reasons. A critical evidence gap exists regarding outcomes for patients who switch between agents. This multicenter, retrospective cohort study will characterize the 12-month visual acuity and anatomical outcomes in non-naïve patients who switched from faricimab to another agent. Retrospective data will be compared to results published in treatment-naïve clinical trial populations. We hypothesize that post-switch outcomes will be inferior to that of treatment-naïve populations for both mean best-corrected visual acuity (BCVA) gain < +6.0 letters) and mean post-switch injection interval < 8 weeks.

Methods and Anticipated Results: This retrospective, multicenter study will evaluate the real-world effectiveness of switching from faricimab to alternative anti-VEGF therapies in treatment-non-naïve patients with wet AMD. Electronic medical record data will be collected from two ophthalmology clinics in Central Virginia to identify patients meeting inclusion criteria: ≥3 consecutive faricimab injections immediately preceding the switch to another anti-VEGF agent and availability of BCVA measurements at 0, 6, and 12 months post-switch. Patients with confounding retinal conditions or significant macular fibrosis will be excluded. The cohort will be stratified into subgroups based on the documented reason for switching, including treatment failure due to diminished BCVA, persistent subretinal/intraretinal fluid, or durability failure. Primary outcomes will include mean and median change in BCVA from 0 to 12 months in the efficacy failure subgroup and mean and median post-switch injection interval in the durability failure subgroup. Secondary outcomes will include proportions of patients with diminished BCVA, shortened injection interval, persistent fluid, or mean change in central subfield thickness (CST). Continuous variables (BCVA, CST, injection interval) will be compared across groups by ANOVA. Categorical variables (fluid status, failure rate) will be assessed using chi-squared tests. To evaluate clinical significance of faricimab nonresponse, a t-test will be used to compare the cohort's mean BCVA change against a prespecified benchmark derived from the clinical trial literature.

Conclusion: Post-switch outcomes in this wet AMD cohort are expected to be inferior to compared to pivotal trial outcomes in treatment-naïve patients. We anticipate that these findings will provide critical real-world evidence of diminished therapeutic returns for both visual acuity and treatment burden. Characterizing the long-term clinical and economic realities of managing wet AMD will help clinicians set realistic expectations and directly inform patient assistance and access programs, such as those offered by the GoodDays Foundation.

P38: Surveying Glaucoma Literacy and Treatment Adherence in Glaucoma Patients at an Ophthalmology Missions Clinic in Roatan, Honduras

Category: *Clinical Research*

Authors: Daniel Courter (OMS-IV)[1], Darin Bowers, MD[2]

Affiliation: [1]Liberty University College of Osteopathic Medicine, Lynchburg, Virginia; [2]Health in Sight Mission, Lynchburg, Virginia

Health in Sight Mission has been providing eye care for the island population of Roatan, Honduras since 2005. Uncertainty about the glaucoma patient population's understanding of their disease and their adherence to treatment regimens leaves the effectiveness of glaucoma management in question. The objectives of this cross-sectional study were to survey glaucoma-related health literacy among patients diagnosed with glaucoma and to evaluate treatment adherence of patients for the purpose of understanding social determinants of health and improving the clinic's effectiveness. A paper survey consisting of true or false and multiple-choice questions was developed to assess patient glaucoma literacy, treatment adherence, and barriers that create challenges to accessing care for glaucoma. Health literacy findings determined from responses to the true or false portion included 57% of patients believed that vision loss from glaucoma can be restored and 48% of patients believed eye pain is often a symptom of glaucoma. Results from the treatment adherence multiple choice section included the majority of patients were unsure of the severity of their glaucoma, most patients who miss taking their eye drops either run out of drops or forget to take them, and the majority of patients reported either cost or transportation as the biggest challenge to treating their glaucoma. These results highlight areas where the Health in Sight clinic can reinforce patient understanding of glaucoma and its progression and address common barriers to treating glaucoma in Roatan.

P39: Impact of Diet on Blood-Retina Barrier Integrity and Inflammatory Gene Expression in Rats

Category: *Basic Science Research*

Authors: Sean Johnson (OMS-II), Joseph Gigliotti, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Nutrition and dietary behavior significantly impact disease development and health outcomes beyond genetic predisposition; however, the biological pathways linking diet to disease pathogenesis remain poorly defined. Excess intake of high-fat and/or high-sugar diets is linked to metabolic dysregulation and disorders such as hyperlipidemia and diabetes mellitus—risk factors for retinal vascular diseases including diabetic retinopathy and age-related macular degeneration. The goal of this study was to determine how diets of differing nutritional quality influence expression of inflammatory cytokines and a blood–retina barrier tight-junction protein, claudin-5, in the rat retina. All experimental procedures were performed according to protocols approved by the Liberty University Institutional Animal Care and Use Committee (IACUC #87.230502). Weanling male and female Wistar Kyoto rats were purchased from a commercial vendor and group housed 2-3 rats per cage. Rats were given access to standard rodent chow for 1-week to acclimate animals to solid food and a new environment. After 1-week, body weights were recorded and the animals were randomly assigned to receive unlimited access to one of four commercially available diets: standard rodent chow, high-calorie high-fat diet (HFD), high-calorie high-sugar high-fat diet (WD), and a novel Americanized diet (AD) formulated to match the 50th percentile American consumption of fructose, saturated/unsaturated/trans-fat, cholesterol, fat-soluble vitamins (A, D, E), minerals (Na^+, K^+, Ca^{2+}, PO_4^{3-}, Mg^{2+}), and fiber. After 4- or 16-week intervals, the animals were housed individually in metabolic cages for 24 hours for measurement of food and water intake. Animals were anesthetized with 3% isoflurane, body weights were collected, and the animals were then euthanized by exsanguination. Retina tissue was collected and processed for quantification of gene expression by RTPCR. Gene specific primers for claudin-5 (*Cldn5*), vascular endothelial growth factor A (*Vegfa*), and tumor necrosis factor alpha (*Tnf*) were created using genetic sequences obtained from the University of California Santa Cruz Genomics Institute Genome Browser and Primer3 software. Proposed primer sequences were validated for accuracy using the Gene Blast Function in National Center for Biotechnology Information (NCBI) for rat RefSeqRNA. Interleukin-6 (*Il6*) primer was purchased from a commercial vendor and used to quantify gene expression by RTPCR. Results were analyzed using general linear model procedures (ANOVA) followed by Tukey's post-hoc multiple comparisons analysis. P-value of <0.05 was considered statistically significant. After 4-weeks of feeding, female rats had higher retinal mRNA expression of *Cldn5* (0.23±0.06) as compared to males (0.04±0.05, *P*=0.02). There was also a significant effect of diet on retinal mRNA expression within male rats. Male rats fed the WD had significantly lower expression of *Cldn5* (0.015±0.004) as compared to rats fed the AD (0.042±0.004, *P*=0.003) and rats fed the HFD (0.052±0.004, *P*<0.001). Diet, biological sex, nor their interaction significantly influenced the mRNA expression of *Vegfa* or *Il6* (*P>0.05)*.

P40: Examining the role of Diet on Nitric Oxide Expression in the Anterior Rat Eye and the potential for Alternative Options for Managing Ocular Hypertension and Glaucoma

Category: *Basic Science Research*

Authors: Howard Strubhar (OMS-II), Joseph Gigliotti, PhD

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Introduction

Varying lifestyles have long been considered for their roles in determining health and disease burden, independent of genetic predisposition for morbidity and mortality. Diet is a significant part of lifestyle under ongoing investigation to mechanistically understand its contribution and impact on health and disease. Glaucoma is a silent disease of the eye that, without intervention, gradually progresses to blindness secondary to elevated intraocular pressure (IOP) and neural degeneration. IOP is fundamentally controlled by balancing production and drainage of aqueous humor (AH) in the ciliary body (CB) and trabecular meshwork (TM) respectively, both anterior to the lens. Nitric oxide (NO) is an endogenous, constitutively active molecule that can be upregulated as needed. In the anterior eye, NO decreases production of AH in the CB and increases drainage through the TM, both mechanisms reducing IOP. The goal of this study was to investigate how diets of various nutritional quality can affect IOP secondary to their effect on NO expression in the anterior eye.

Methods

All experimental procedures were performed according to protocols approved by the Liberty University Institutional Animal Care and Use Committee (IACUC #87.230502). Weanling male and female Wistar Kyoto rats were purchased from a commercial vendor and group housed 2-3 rats per cage. Rats were given access to standard rodent chow for 1-week to acclimate animals to solid food and new environment. After 1-week, body weights were recorded and animal were randomly assigned to receive unlimited access to one of three commercially available diets: standard rodent chow, a high calorie high-fat diet (HFD), or a high-calorie high-sugar high-fat diet (WD). After four- or 16-weeks, animals were housed individually in metabolic cages for 24-hours for measurement of food and water intake. Animals were then anesthetized with 3% isoflurane, body weights were collected, and the animals were then euthanized by exsanguination. Eyes were collected and processed for quantification of gene expression by RTPCR. Gene specific primers for *Nos1*, *Nos2*, *Nos3*, *Gch1*, *Gapdh*, and *Hprt1* were created using genetic sequences obtained from the University of California Santa Cruz Genomics Institute Genome Browser and Primer3 software. Proposed primer sequences were validated for accuracy using the Gene Blast Function in National Center for Biotechnology Information (NCBI) for rat RefSeqRNA.

Results

RNA Primers were designed in-house (*Nos1*, *Nos2*, *Nos3*, *Gch1*) and used for QT-PCR along with *Gapdh* and *Hprt1* as housekeeping genes. In the 4-week study, *Gapdh* and the primers of interest showed double peaks suggesting a lack of specificity. Pre-verified *Nos2*, *Nos3*, and *Gch1* were ordered and trialed with *Hprt1*, which showed a single peak when previously tested but double peaks on subsequent runs signifying possible contamination, as it was used by multiple other researchers at various times. Results for the 12-week study are pending tissue processing and QT-PCR with a fresh batch of *Hprt1*.

P41: Procedural Sharps Safety and Post-Exposure Prophylaxis: A Cross-Sectional Study of Needle-stick Injuries Among Licensed Tattoo Artists

Category: *Clinical Research*

Authors: Eleanor Barden (OMS-III), Tabitha Hutchison (OMS-III), Lauri Ann Maitland, DO, MPH

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Background: Tattoo artists routinely handle needles and are at increased risk for needlestick injuries. Although many states require bloodborne pathogen certification for tattoo licensure, no standardized post-needlestick medical care guidelines have been identified in the literature for this population. This study addresses a gap in the literature regarding the incidence of needlestick injury in tattoo artists in the United States.

Objective: To estimate the self-reported frequency of needlestick injury among licensed tattoo artists in the United States; to assess knowledge and practices of post-needlestick care and prior training received; and to evaluate perceived injury severity and willingness to adopt a standardized workplace post-needlestick action plan.

Methods: This cross-sectional survey will be conducted among licensed tattoo artists attending a regional tattoo convention in Norfolk, Virginia. Participants will complete an anonymous questionnaire assessing prior needlestick injuries, perceived injury severity, whether medical care was sought and attitudes towards implementing a post-injury workplace action plan. Quantitative data will be summarized using descriptive statistics, and qualitative responses will undergo thematic analysis to identify patterns of perceptions and attitudes.

P42: The Psychosexual Impact of Delayed Diagnosis in Vulvar Dermatoses

Category: *Systematic Review/Meta-analysis*

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Vulvar dermatoses are common yet frequently underrecognized conditions associated with physical, emotional, and psychosexual morbidity. Delayed diagnosis is pervasive and driven by nonspecific symptoms, patient stigma, and provider unfamiliarity, often leading to preventable harm, including chronic pain, dyspareunia, loss of sexual identity, and strained relationships. This narrative review examines the multifaceted barriers to the timely diagnosis of vulvar conditions. We also examined the psychosocial consequences of delayed care and the systemic challenges associated with fragmented, multidisciplinary management. These delays are further compounded by limited clinician training, inconsistent examination practices, and the persistent stigmatization of vulvar symptoms. The impact on patients can be profound, affecting not only physical health but also mental well-being, body image, and intimate relationships. We emphasize that improving awareness, addressing systemic gaps, and fostering multidisciplinary collaboration are essential steps towards reducing diagnostic delays and mitigating the far-reaching impact of vulvar dermatoses. Greater education and coordinated care are urgently needed to improve outcomes.

Measurable Learning Objectives:

- Identify the common clinical presentations of vulvar dermatoses and describe how nonspecific symptoms contribute to diagnostic delay.
- Recognize the psychosocial and psychosexual consequences of delayed diagnosis, including effects on mental health, body image, and intimate relationships.
- Discuss systemic or structural barriers (e.g., limited training, fragmented care, stigma) that delay timely diagnosis and management.
- Apply best practices in vulvar examination techniques and patient communication strategies to reduce stigma and improve diagnostic accuracy.
- Discuss strategies for multidisciplinary collaboration (e.g., dermatology, gynecology, mental health, and sexual medicine) to enhance continuity of care for patients with vulvar dermatoses.

P43: Assessing Breastfeeding Resources at Lynchburg Family Medicine Residency

Category: *Educational Project*

Authors: Elizabeth Schmitz (OMS-II), Dr. Lauri Ann Maitland, DO, MPH

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Breastfeeding is the optimal source of nutrition for infants, but can be an overwhelming process for new mothers to navigate. Financial, educational, and resource challenges may limit new mothers from choosing breastfeeding. This quality improvement project assessed the breastfeeding information currently being given to patients at Lynchburg Family Medicine Residency (LFMR) clinic, compared this process to another local clinic, and identified areas to improve this process. The goal of this project was to take the first step in potentially increasing breastfeeding rates at LFMR by designing an organized pamphlet written for the 6th grade reading level to hand out to patients to share helpful information about how and why to breastfeed and creating a list of resources that families could utilize to increase their support of breastfeeding. The next intended step of this project is to collect data from LFMR about breastfeeding rates before and after introducing the pamphlet to see if this is a helpful resource to promote breastfeeding.

P44: Gestational Diabetes Mellitus and Pre-Eclampsia: A Retrospective Study Comparing the Rate of Pre-Eclampsia in Insulin Treated and Non-Insulin Treated GDM Patients

Category: *Clinical Research*

Authors: Ciera Miller (OMS-III), Nicole Muhlenbruck (OMS-III), Anita Register, DO

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Gestational diabetes mellitus (GDM) is a common pregnancy complication associated with increased maternal and fetal morbidity, including pre-eclampsia, preterm birth, cardiovascular disease, and a heightened risk of type 2 diabetes mellitus later in life for the mother, as well as macrosomia, hypoglycemia, and respiratory distress syndrome in the fetus. Initial management typically involves lifestyle and dietary modifications, with insulin therapy serving as the standard of care when these measures fail to achieve glycemic control. This study uses the NIH-funded *All of Us* Research Database in a retrospective cohort design to compare the incidence of pre-eclampsia among women with GDM treated with insulin versus those managed without insulin. Findings from this study aim to clarify the relationship between insulin therapy and pre-eclampsia risk. This study showed that there was no significant difference in those with gestational diabetes. There was significance, however, when looking at a combination of pre-gestational diabetes and gestational diabetes. These results suggest that pre-existing diabetes influences pre-eclampsia risk and that insulin treatment in GDM patients is unlikely to be the sole cause of this.

P45: Observed Effects of Dairy Consumption on Physical and Cognitive Performance

Category: *Basic Science Research*

Authors: Evan Gaugler (OMS-III), Mark E. Hemric, PhD

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Dairy Withdrawal is a frequently discussed topic in popular nutrition and exercise publications; however, no scientific literature supports the reported observations or its existence (1, 2). Having observed a constellation of personal history symptoms aligned with the cluster of signs reported in popular media, the author (Gaugler) proposed a project aimed at quantifying the effects and qualifying the symptoms of dairy withdrawal. The goal of this pilot study was to explore several measurements in the hope of establishing parameters for a more expansive, targeted study. The measurements within the study included temperature at bedtime, heart rate during exercise, sleep quality, hormone levels, cognitive performance, and subjective symptom reporting over 36 days with dairy consumption and withdrawal periods. The hypothesis was that dairy consumption has a significant impact on physical or cognitive performance, and the impact could correlate with hormonal changes.

Cumulatively, the study aims to provide insight into the impact of dairy consumption on daily life. In accordance with the data collected with the two subjects of the pilot study, we can conclude that dairy consumption could have an impact on physical and cognitive performance, as well as temperature, resting heart rate, and other reportable symptoms. Future plans will be to restructure the parameters and methods that produced unusable data and refine those that did, to increase the study's internal validity. Finally, we intend to recruit a greater number and more diverse population of participants to increase the external validity of the study.

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P46: Modeling Ectopic Pregnancies in Murids

Category: *Basic Science Research*

Authors: Andrew Rheam (OMS-II), Julia VanDyken (OMS-II), Thomas Hall (OMS-III), R. James Swanson, PhD

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Ectopic pregnancies, a life-threatening complication, affect 1-2% of all pregnancies and an estimated 5 million mothers around the globe. Despite its prevalence, the research towards the prevention and treatment of ectopic pregnancies remains limited, particularly because of the lack of an animal model for study.

Our goal is to develop an efficacious rat model in which the induction of ectopic pregnancies, particularly tubal, can be performed and lead to pregnancy and life-saving studies on causes, prevention, and experimentation with innovative treatment plans. Based on our previous research in this project, we found that creating such a model is a multifaceted challenge. Multiple experimental trials of this project have been performed, focusing on endometriosis as a major risk factor for ectopic pregnancies. Although rats have been used as a model for abdominal endometriosis, they have not been well defined as an appropriate model for uterine and tubal endometriosis. To induce tubal endometriosis in previous experiments, portions of endometrial tissue were surgically removed, enzymatically digested into single cells, and reimplanted into the fallopian tube of the same rat. Superovulation of another rat was performed, and the resulting embryos were then implanted into the fallopian tube with ectopic endometrial cells. Little equitable results were observed from both the implantation of endometrial cells or the embryos. We suspect there are more factors involved, particularly due to immune responses, i.e., inflammation and fibrotic tissue deposition. Due to the invasive nature of the procedure and the administration of foreign substances (media from both the endometrial cell processing and embryo collection), there is evidence to support that failure of the endometrial tissues to implant and develop into endometriosis in the fallopian tube and the failure of the embryos to implant post-surgery is due to an immune response.

In the continuation of this project, we will center our focus on the effects of surgical intervention and exposure to foreign substances. We will begin by comparing the effects of surgery on the physiology and anatomy of the uterus and fallopian tubes, taking special care to observe the inflammation and scarring that develops acutely and chronically. Performing surgery unilaterally on a rat's uterus and fallopian tube will allow a direct comparison to the appearance of normal function of the untouched reproductive organs compared to the surgically manipulated organs . Using the same methodology, we will observe the effects on the uterus and fallopian tubes of cell and embryo media exposure. We hypothesize that due to the small scale, delicate nature of the uterus and fallopian tubes, the damage from current surgical methods, and the administration of foreign materials, implantation of both the endometrial cells and embryos ectopically is not possible due to the levels of inflammation, scarring, and immune response. At this point, we have successfully operated unilaterally on rats uteri and fallopian tubes and are going to perform another surgery on the same rat to qualify the extent of scarring that has occurred. Our end goal will be to develop methods to decrease damage and immune response, both by limiting surgical intervention as well as limiting immune reactions to the administration of foreign materials.

P47: Virulence Factors in Cryptococcus neoformans: Roles of SCP1 and DCM1 in Pathogenesis

Category: *Basic Science Research*

Authors: Jeffrey Carruth (OMS-II), Andrew Mann (OMS-II), Michael S. Price, PhD.

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Cryptococcus neoformans is one of the most prominent fungal pathogens worldwide, particularly relevant in clinical scenarios involving immunocompromised patients. This study investigates two critical virulence factors that contribute to *C. neoformans* pathogenesis through distinct mechanisms. The *SCP1* gene, implicated in pH adaptation and stress tolerance, and the *DCM1* gene, involved in titan cell formation, both represent promising therapeutic targets for antifungal intervention.

Our dual objective is to examine whether deletion of these genes compromises different aspects of *C. neoformans* virulence. For *SCP1* analysis, we performed spot assays under alkaline conditions (pH 8) and cobalt chloride stress (7mM $CoCl_2$) to assess stress tolerance in wildtype versus *scp1*Δ mutants. For *DCM1* investigation, we focused on titan cell formation, as these enlarged cells are resistant to host phagocytosis and crucial for immune evasion. Both studies utilized *Galleria mellonella* larvae as an in vivo infection model, inoculating specimens with wildtype strains (CM2049) and respective knockout mutants (*scp1*Δ and *dcm1*Δ).

We anticipated that *scp1*Δ mutants would demonstrate impaired growth under alkaline and metal stress conditions, correlating with reduced larval mortality. Similarly, we hypothesized that *DCM1* disruption would significantly reduce titan cell formation in the host, as assessed through survival analysis and histological examination of infected larvae. By examining these virulence factors, we can provide insight into cryptococcal infections and potential targets for therapeutics.

P48: Impact of ∆rdiA Deletion on Aflatoxin-Associated Virulence in *Aspergillus fumigatus* Using a *Galleria mellonella* Infection Model and Optimization of Protoplast Production for Functional Studies

Category: *Basic Science Research*

Authors: Caleb Hovis (OMS-II), Oluwasemilore Omoniyi (OMS-II), Michael S. Price, PhD

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Aspergillus flavus is one of the most important pathogens that infects grains and is the second leading cause of invasive aspergillosis. Previous studies focusing on the regulation of aflatoxin (AF) biosynthesis identified a putative Rho-GDP dissociation inhibitor, *rdiA*, with profound impacts on AF production. Previous work on the role of the RdiA on growth and AF production resulted in a Δ*rdiA* deletion mutant strain, MPA1, that exhibited numerous growth phenotypes. In *A. fumigatus*, *rdiA* has been associated with hyphal branching and septation through its regulation of the actin cytoskeleton. Previous studies suggest that *rdiA* may modulate the activities of RhoA and Cdc42, key regulators of polarized growth and hyphal morphology, and it likely inhibits *Bbc1*, an activator of *RasA*, which inhibits aflatoxin production (Richard and Payne, 2003). Previous studies on the *Cryptococcus neoformans* ortholog, *RDI1*, also showed roles in growth and cell morphology as well as virulence in this human pathogen. Based on these models, deletion of *rdiA* is hypothesized to reduce aflatoxin biosynthesis and attenuate virulence. This was investigated in a *Galleria mellonella* model with *rdiA* deletion. The effects of the gene deletion on virulence was determined at different temperatures (30°C and 37°C) to isolate virulence defects from temperature sensitivity. The Δ*rdiA* mutant showed reduced pathogenicity in the *Galleria* infection model at both temperatures. Culture studies will focus on demonstrating the identity of this putative Rho-GDP dissociation inhibitor through orthologous complementation of the ∆*rdiA* mutation using the *C. neoformans RDI1* gene. In order to transform *A. flavus*, the fungal cell wall has to be enzymatically broken down releasing protoplasts that can take up the DNA. Therefore, we also utilized various published protocols to develop a method for optimum protoplast isolation that can be used here at LUCOM to allow for efficient transformation of *A. flavus* strains.

P49: Influence of Pathogen Carbon Metabolism on Host Immunity

Category: *Basic Science Research*

Authors: Bright Danso[1]; Elizabeth Haring[1]; Emily Hamilton (OMS-IV)[1]; Yansiree Sumption[1]; Jeremy Felten (OMS-IV)[1]; Hannah Berguson, DO[4]; Chloe Guidry[1]; Matthew Karpel[1]; Betsy Schloo, MD[1]; Lori Neal, PhD[2]; Michal Olszewski, DVM, PhD[2]; Dena Toffaletti, PhD[3]; John Perfect, MD[3]; Michael Price, PhD[1]

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Cryptococcus neoformans is an emerging fungal pathogen that remains a leading cause of fungal meningitis and is classified among the four critical fungal pathogens by the World Health Organization due to its significant mortality and global health impact. *C. neoformans* first colonizes the lungs before potentially disseminating to the central nervous system, resulting in meningoencephalitis. Successful adaptation to these distinct host environments depends on flexible carbon utilization and immune evasion.

We investigated the signaling interactions between *C. neoformans* and sentinel immune cells during initial lung colonization, focusing on how disruption of carbon utilization pathways alters immune recognition and host response.

The study employed complementary ex vivo and in vivo approaches. Phagocytosis assays using IFNγ/LPS-activated J774A.1 macrophages quantified yeast uptake microscopically. Primary bone marrow-derived macrophages from BALB/c mice were co-incubated with *C. neoformans* strains to assess cytokine and marker expression via real-time PCR. In vivo, BALB/c mice were intranasally infected to evaluate fungal burden, lung cytokine responses, and tissue pathology. Lung RNA was analyzed by qPCR, and histological staining (H&E, GMS, mucicarmine) visualized tissue and fungal cells.

Ex vivo analyses demonstrated that macrophages exposed to the pyk1Δ mutant of *C. neoformans* showed unchanged phagocytic uptake compared to wild type (WT); however, the *pyk*1Δ mutant of *C. neoformans* induced a marked reduction in iNOS and an increase in arginase expression in macrophages, indicating a shift toward an anti-inflammatory activation state compared to the wild type. In vivo, mice infected with the *pyk*1Δ strain exhibited significantly reduced cytokine responses, lower TNF-α and IFN-γ levels, absence of titan cells, and diminished pulmonary inflammation relative to WT infection, reflecting attenuated immune recognition and reduced tissue activation. Despite its attenuated virulence, *pyk*1Δ persisted in lung tissue for extended periods without causing overt disease.

Collectively, these findings suggest that impaired carbon metabolism in *C. neoformans* dampens immunological signaling and alters host-pathogen communication at the onset of lung infection, highlighting the central role of fungal metabolic adaptation in shaping the immune response.

Deeper insight into how *C. neoformans* metabolism modulates host immune recognition could reveal new angles for targeted disease intervention.

P50: A DASH complex ortholog mediates pH adaptation and virulence in *Cryptococcus neoformans*.

Category: *Basic Science Research*

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Cryptococcus neoformans is an opportunistic fungal pathogen responsible for approximately 19% of AIDS-related deaths per year. It was listed in the critical priority group on WHO Fungal Priority Pathogens List (WHO FPPL) in 2022 which shows the need for further research into *C. neoformans*. One of the factors that contributes to its virulence is its ability to rapidly adapt to ambient pH differences it encounters during its infection cycle. Previous work at Duke University identified numerous genes displaying altered growth at alkaline pH in *C. neoformans*, including the gene CNAG_02291, a potential homolog of *DAM1* in *S. cerevisiae* involved in the attachment of microtubules to the kinetochore. It was our goal to determine whether this gene is involved in pH adaptation and virulence of *C. neoformans.* First, CNAG_02291 (hereafter *DCM1* for DASH complex with microtubules) was deleted in wild-type (WT) *C. neoformans* strain CM2049 using electroporation and integration with CRISPR-Cas9. The gene was then reconstituted and both the *dcm1Δ* and reconstituted strains were evaluated for various growth/stress phenotypes. *dcm1*Δ exhibited poor growth on YPD pH 8 compared to WT, supporting the hypothesis that *DCM1* affects the ability of *C. neoformans* to adapt to alkaline pH. Virulence studies using *Galleria* and murine inhalation models showed statistically significant differences in virulence between the WT and *dcm1Δ* strains. This supports the hypothesis that this gene affects the virulence of *C. neoformans* in the host. Therefore, *DCM1* appears to be involved in pH adaptation and virulence of *C. neoformans*. Growth assays showing delayed growth, qPCR to determine which of the known alkaline-pH adaptation pathways this gene falls into, flow cytometry to determine ploidy, and histological sectioning of *Galleria* to search for presence of Titan cells were performed as well. These tests served to help better characterize how *DCM1* affects virulence and growth of *C. neoformans.*

P51: Evidence of serotonin-induced acetylcholine release from anterior hypothalamus nucleus leading to increase in MAP and demonstration of co-localization of M3 and CB1 receptors in the posterior hypothalamus nuclei in rats

Category: *Basic Science Research*

Authors: Lillia Lucas (OMS-II), Bryce Gambino (OMS-II), Long Nguyen (OMS-II), Simon Cases (OMS-II), John Martin, PhD.

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Introduction

This study investigates central mechanisms by which serotonergic and muscarinic receptor activation influence mean arterial pressure (MAP) via a connection from anterior hypothalamic nucleus (AHN) to posterior hypothalamic nucleus (PHN). The serotonin 2A/2C receptor agonist DOI activates a neural pathway originating in the AHN leading to the potential release of acetylcholine (ACh) in the PHN. This cholinergic activation is hypothesized to elevate MAP and heart rate (HR) through sympathetic activation and engagement of the renin-angiotensin-aldosterone system (RAAS).

The administration of physostigmine, a reversible acetylcholinesterase inhibitor administered into the PHN prior to DOI injection into the AHN is thought to stimulate acetylcholine release in the PHN. This response is expected to be amplified by physostigmine through increased sympathetic outflow via involving the nucleus tractus solitarius, caudal ventrolateral medulla, and rostral ventrolateral medulla. To further investigate the effect of stimulation of 5-HT 2A/2C receptors in the AHN, TCB-2, which acts like DOI, will be used to further determine the role of serotonin.

Cannabinoid agonists targeting CB1 receptors antagonize the pressor response evoked by PHN DOI. Thus, we further hypothesize that CB1 receptors are co-localized with M3 receptors in the PHN, suggesting a potential site of interaction between endocannabinoid and cholinergic systems in centra regulation of MAP.

Methods

Animals

Male Sprague-Dawley rats (280–320 g) were used in all experiments

Surgical Preparation

Rats were anesthetized with urethane. The left femoral artery was catheterized for direct MAP measurement. Animals were placed in a stereotaxic frame and a stainless-steel guide cannula (22-gauge) was implanted targeting either the AHN or PHN. Injection cannulae extended 2.0 mm beyond the guide tip.

Physiological Monitoring and Microinjection

The MAP catheter was connected to a pressure transducer and analyzer for continuous MAP and HR monitoring. Once baseline was stable, microinjections were performed using a 5 µL Hamilton syringe and 33-gauge injection cannula. Drugs were administered in volumes of 50–400 nL.The injection cannula was inserted into the guide 1–2 minutes prior to drug injection. After a 5–10 minutes the cannula was removed, and MAP monitored for 60–90 minutes.

Perfusion and Histology

Rats were euthanized by transcardial perfusion with saline followed by 4% paraformaldehyde (PFA) in 0.1 M phosphate-buffered saline (PBS). Brains were post-fixed in 4% PFA overnight, then cryoprotected in 30% sucrose with NaN3. Coronal brain sections (40 µm) through the PHN were made using a cryostat. Free-floating sections underwent immunohistochemistry staining for CB1-R and CHRM3, using Alexa Fluor 488 and 647-conjugated secondary antibodies, respectively. Nuclei were counterstained with DAPI, and images acquired using a Keyence fluorescence microscope.

Results

We anticipated a greater increase in mean arterial pressure (MAP) in rats receiving co-administration of physostigmine and DOI or TCB-2 compared to controls. We also expect to observe both M3 and CB1 receptors within the PHN, with potential co-localization on the same neuronal populations. Initial results show TCB-2 increases MAP similar to DOI. Immunohistochemical staining indicates this technique can be used to identify both CB and muscarinic receptors in the PHN.

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P52: Elucidating Mechanisms for Cholinergic Agonist Influence on Preclinical Model of Acute Kidney Injury

Category: *Basic Science Research*

Authors: Rachel Chiramel (OMS-II), Tavin Smith (OMS-III), Joseph C. Gigliotti, PhD

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Acute kidney injury (AKI) affects about 13.3 million people and results in 1.7 million deaths each year globally. AKI is a common risk factor for chronic kidney disease (CKD). The proposed mechanism is that AKI leads to unresolved inflammation which then leads to fibrosis, resulting in CKD. The cholinergic anti-inflammatory pathway (CAP) is proposed as a potential therapeutic target or AKI. The CAP activation in humans is unclear (ultrasound, vagal nerve stimulation). Pharmacological CAP activation via cholinergic agonists has shown promise, however data is conflicting. The goal of this experiment is to determine how the administration of nicotine, a non-selective nicotinic cholinergic receptor agonists influences renal blood flow and expression of fibrotic markers in a preclinical mouse model of AKI. All experiments were conducted in accordance to protocols approved by the Liberty University Institutional Animal Care and Use Committee (IACUC#105.250113). Male C57Bl/6 mice (25-30 grams) were purchased form a commercial vendor and acclimated to group housing. To determine the acute effects of nicotine on renal hemodynamics, renal blood flow (RBF) was estimated using Doppler ultrasound 90 minutes after the administration of nicotine bitartrate (1 mg/kg), I.P.). RBF was estimated by multiplying the time average velocity of blood flow in the renal artery by the renal diameter. To determine how nicotine influences the progression of AKI leads to CKD, mice received either saline or nicotine 90 minutes prior to the induction of unilateral ischemia-reperfusion injury. After 4-weeks, mice were euthanized and kidneys collected for quantification of fibrotic-related genes by real-time RT-PCR. Genes of interested include smooth muscle actin (*Acta2*), tumor growth factor-beta (*Tgfb1*), collagen-1a (*Col1a*), collagen-3a (*Col3a*), and vimentin (*Vim*). Data were analyzed using General Linear Model Procedures and results were considered significant if $P<0.05$. Mice administered NIC had reduced estimated RBF ($P<0.05$) as compared to mice administered vehicle. There was no difference in the mRNA expression of key fibrotic genes between mice administered NIC or vehicle 4-weeks after IRI ($P>0.2$). Our data suggest that NIC exacerbates ischemic AKI, perhaps through a hemodynamic mechanism. Further studies are needed to validate these findings and determine clinical utility.

P53: Dietary Implications on the Renin-Angiotensin-Aldosterone System in Rat Kidneys.

Category: *Basic Science Research*

Authors: Hannah Deerman (OMS-II), Joseph C. Gigliotti, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Introduction: Lifestyle is a major determinant of health and disease burden. Diet represents a central component of lifestyle, yet the mechanisms by which dietary patterns influence the pathological basis of disease remain incompletely understood. As obesity rates continue to rise across Western populations, increasing attention has been directed toward its impact on the regulation of critical physiological systems, namely the Renin–angiotensin–aldosterone system (RAAS). RAAS is a tightly controlled hormonal system that governs blood pressure and electrolyte balance. Given that dietary factors such as sodium, potassium, and macronutrients can modulate RAAS activity, nutrition may play a key role in promoting RAAS dysregulation. It is well established that excess weight gain elevates blood pressure, while weight loss in hypertensive individuals often results in its reduction. This study serves as an investigation on the implications of varying diets on RAAS activity in kidney tissue of rats.

Methodology: All experimental procedures were performed according to protocols approved by the Liberty University Institutional Animal Care and Use Committee (IACUC #87.230502). Weanling male and female Wistar Kyoto rats were purchased from a commercial vendor and group housed 2-3 rats per cage. Rats were given access to standard rodent chow for 1-week to acclimate animals to solid food and new environment. After 1-week, body weights were recorded and animals were randomly assigned to receive unlimited access to one of three commercially available diets: standard rodent chow, a high calorie high-fat diet (HFD), or a high-calorie high-sugar high-fat diet (WD). After 4 and 16 weeks, animals were housed individually in metabolic cages for 24 hours for measurement of food and water intake. Animals were then anesthetized with 3% isoflurane, body weights were collected, and the animals were then euthanized by exsanguination. Tissues of interest were collected, weighed, and processed for quantification of gene expression by RTPCR or fixed in 4% paraformaldehyde for histological processes. Gene specific primers for *Ren1, Il6,* and *Ace2* were created using genetic sequences obtained from the University of California Santa Cruz Genomics Institute Genome Browser and Primer3 software. Proposed primer sequences were validated for accuracy using the Gene Blast Function in National Center for Biotechnology Information (NCBI) for rat RefSeqRNA.

Results: The initial RT-PCR results for *Ren1* and *Il6* were inconclusive due to improper calibration of the PCR machine. After adjustment, a subsequent run with *Ren1* and *Ace2* was performed. The *Ren1* data remained inconclusive, suggesting potential sample contamination. However, a reduction in *Ace2* expression was observed in rats fed high-fat (HFD) and Western diets (WD). These findings suggest that poor dietary quality may downregulate this protective enzyme within the RAAS pathway. Additionally, rats fed the AD exhibited kidneys approximately 10% heavier than those of the chow and HFD groups ($P < 0.04$) in both males and females. Further data on genes such as *Agt* and *Ren1*, along with hemodynamic measurements, are needed to better support and characterize the dynamic changes within the RAAS.

P54: Elucidating Mechanisms for Cholinergic Agonist Influence on Preclinical Model of Acute Kidney Injury

Category: *Basic Science Research*

Authors: Rachel Chiramel (OMS-II), Tavin Smith (OMS-III), Joseph C. Gigliotti, PhD

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Acute kidney injury (AKI) is a major cause of morbidity and mortality and lacks effective treatments. It is a sentinel complication of surgeries involving high ischemia-reperfusion injury (IRI) risk, such as cardiac and vascular procedures. The cholinergic anti-inflammatory pathway (CAP) has shown therapeutic promise in preclinical IRI models via activation by vagus nerve stimulation (VNS), pulsed ultrasound (pUS), or cholinergic agonists. However, outcomes with cholinergic agonists remain inconsistent, possibly due to technical variability in preclinical IRI models. We aimed to determine how injury severity and timing of cholinergic agonist administration affect their efficacy in preventing IRI.

Materials and Methods
Male C57Bl/6 mice (10-14 weeks old) underwent unilateral renal IRI under ketamine/xylazine anesthesia. Injury severity was controlled by clamping the renal pedicle for 20, 25, or 30 minutes to model mild, moderate, and severe AKI, respectively. Mice received intraperitoneal (IP) injections of nicotine (1 mg/kg), the alpha-7 cholinergic receptor agonist GTS-21 (4 mg/kg), or saline vehicle 90 minutes before ischemia. For timing comparisons, a 27-minute ischemic duration was used, with treatments administered 90 minutes before (t = -90) ischemia or at reperfusion (t = 0). Kidneys were harvested 24 hours post-IRI for histologic analysis and RT-PCR of Il6, Kim1, Krt20, Atf3, and Top2a. General Linear Model Procedures in SPSS assessed effects of severity, timing, and treatment. Bonferroni-adjusted $P < 0.05$ was considered significant.

Results
IRI severity positively correlated with acute tubular necrosis (ATN) scores and expression of *Kim1* ($P = 0.01$) and *Top2a* ($P = 0.007$). A significant severity × treatment interaction was observed for *Il6* ($P = 0.009$), *Atf3* ($P = 0.006$), and a trend for *Krt20* ($P = 0.09$). At moderate severity, nicotine downregulated *Il6* ($P = 0.002$), *Kim1* ($P < 0.001$), *Krt20* ($P = 0.04$), and showed a trend for lower *Atf3* ($P = 0.06$) vs. GTS-21. *Top2a* was lower with nicotine than vehicle ($P = 0.008$), and nicotine also reduced *Kim1* in severe AKI ($P = 0.04$). Despite these molecular effects, treatment had no effect on histologic injury across severities. However, reperfusion (t = 0) dosing increased ATN scores across all treatments and significantly upregulated *Il6* ($P < 0.001$), *Kim1* ($P = 0.04$), *Atf3* ($P = 0.006$), *Top2a* ($P < 0.001$), and *Krt20* ($P = 0.02$).

Conclusion
Our data suggest that cholinergic agonists do not prevent histologic injury in renal IRI, regardless of injury severity or timing of administration. However, their severity-dependent effects on gene expression suggest that cholinergic modulation influences the molecular pathogenesis of IRI. These findings support the hypothesis that upstream CAP activation (e.g., VNS or pUS) involving non-acetylcholine mediators may be necessary for effective protection. Further studies are warranted to elucidate the mechanisms by which cholinergic agonists modulate the pathogenesis of ischemic AKI.

P55: REDACTED

Category: *Basic Science Research*

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REDACTED

P56: Mechano-transduction of the Colonic Microvasculature in Rodents

Category: *Basic Science Research*

Authors: Sumeet Singh (OMS-IV), Anthony J.M. Bauer, Ph.D.

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Introduction and Objective: The colon constricts and relaxes in response to changes in intraluminal pressure. The colonic microvasculature is associated with perivascular immune cells, including macrophages, neutrophils, and mast cells. We previously demonstrated that surgical manipulation of the colon induces ileus via an inflammatory response that suppresses intestinal smooth muscle contractility. However, there has been minimal research regarding colonic microvascular reactivity to iatrogenic interventions. This project aimed to explore colonic microvascular mechano-transduction and identify mechanisms causing colonic microvasculature vasoconstriction when quantified amounts of force are applied to the gut wall.

Methods: C57Bl/6 mice were anesthetized, and the colon was removed via laparotomy. Next, the colonic wall submerged in oxygenated Krebs was dissected to produce an isolated submucosal sheet. The preparation was pinned in a Sylgard dish and fixed with 100% ethanol. An Olympus Fluoview confocal microscope imaged cellular structures after staining for microvasculature (isolectin), submucosal ganglia (IB4), neutrophils (Hanker-Yates), monocytes/macrophages (F4/80), and mast cells (avidin). The submucosal microvascular preparation was then pinned in a chamber and perfused with aerated, 37 ºC Krebs solution for a 30-minute equilibration period. Then, an arteriole/venule pair was microscopically imaged using a scope-mounted Panasonic LUMIX GH5 for recording vessel diameters. After equilibration, calibrated von Frey monofilaments (0.008 – 0.07 grams of force) corresponding to 0.078 – 0.686 mN were swept across the specimen 10 to 20 times, and vessel vasoconstriction was recorded. Graded increments in von Frey monofilaments were applied to determine the mechanosensitive vasoconstriction threshold and dose-dependent response. Responses were performed in control Krebs solution, zero-calcium Krebs solution, prazosin (10 μM), tetrodotoxin (20 μM), nifedipine (10 μM), and ruthenium red (10 μM). Vessel diameters and areas during constriction and relaxation were measured using ImageJ (N=4 each).

Results: The submucosal sheet contained an arteriole/venule-capillary network, submucosal ganglia, and perivascular immunocytes. Application of von Frey monofilaments demonstrated a mechanosensitive threshold of 0.078 mN, causing dose-dependent vasoconstriction with increasing gram force. Interestingly, pre-treatment of the microvasculature with prazosin (10 μM), tetrodotoxin (20 μM), or nifedipine (10 μM) did not alter the vasoconstriction. However, the arterioles and venules did not constrict when bathed in zero-calcium Krebs or ruthenium red (10 μM).

Conclusion: The colonic microvasculature exhibited a mechanosensitive, dose-dependent force-induced vasoconstriction. Results from alpha-1 adrenergic receptor blockade with prazosin and TTX sodium channel blockade suggested that the mechanosensitive response was not neurally mediated. In contrast, the vasculature did not constrict in the presence of ruthenium red, a known antagonist of mechanosensitive ion channels (Piezo 1 & 2 or TRPV4) and L-type calcium channels. Since nifedipine did not abolish the vasoconstriction, the data suggest that the vasoconstriction is mediated by the non-selective cation channels Piezo 1 & 2 and/or TRPV4. The abolishment of the mechanosensitive response in zero-calcium Krebs further supports this hypothesis.

P57: Metabolic Stress from Poor Diet Rapidly Impairs Splenic Immune Regulation in Juvenile Rats

Category: *Basic Science Research*

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Childhood obesity and metabolic dysfunction are growing global health concerns. However, while medical providers understand there is a relationship between metabolic dysfunction and disease propensity in adults with poor diet, little research exists on the short-term immunologic effects due to poor diet in youth. The spleen is an important lymphoid organ that plays a central role in filtering blood and coordinating systemic immune responses. High-fat and high-sugar diets can rapidly induce metabolic changes that disrupt splenic immune cell metabolism, leading to altered cytokine production and impaired T cell function within the spleen. These dietary patterns may compromise both innate and adaptive immunity, potentially reducing the spleen's ability to respond to immunologic challenges. This study aims to determine whether changes in splenic immune regulation can be observed in young rats after four weeks of exposure to various high-calorie diets.

All animal experiments were performed in following protocols approved by the Liberty University Institutional Animal Care and Use Committee. Weanling male and female Wistar Kyoto rats were purchased from a commercial vendor and group housed 2-3 rats per cage. Rats were given access to standard rodent chow for 1-week to acclimate animals to solid food and new environment. After 1-week, body weights were recorded and animals were randomly assigned to receive unlimited access to one of four commercially available diets: standard rodent chow, a high calorie high-fat diet (HFD), a high-calorie high-sugar high-fat diet (WD), or a novel American diet (reflective of the nutritional deficiencies common in the average American diet).

After 4 weeks, animals were housed individually in metabolic cages for 24 hours for measurement of food and water intake. Animals were then anesthetized with 3% isoflurane, body weights were collected, and the animals were then euthanized by exsanguination. The spleens were collected, weighed, and processed. After 4 hours of LPS stimulation, spleen tissues were processed to evaluate changes in gene expression of inflammatory genes IL-6 and NF-kB by RT-PCR. Gene specific primers for Il-6 and Nfkb1 were created using genetic sequences obtained from the University of California Santa Cruz Genomics Institute Genome Browser and Primer3 software. Proposed primer sequences were validated for accuracy using the Gene Blast Function in National Center for Biotechnology Information (NCBI) for rat RefSeqRNA. Data were analyzed using General Linear Model Procedures in SPSS, with group difference identified as being significant with a $P<0.05$.

All experimental diets caused a numerical 30-50% reduction in splenic mRNA expression of *Il6* and *Nfkb1* after LPS stimulation, with rats fed a high fat diet having significantly lower (P=0.002) *Nfkb1* mRNA expression as compared to rats fed chow. The results of this study suggest that just a 4-week consumption of a poor diet significantly influenced the splenocyte response to DAMP stimulation. Further studies are needed to describe the mechanisms involved.

P58: Examining the role of Western Diets on pro-inflammatory markers in the Cardiovascular system.

Category: *Basic Science Research*

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Introduction:

Lifestyle is intrinsically involved with cardiovascular health. Diet is a major component of lifestyle and significantly contributes towards health and disease burden, regardless of genetic susceptibility. Cardiovascular disease (CVD) is the leading cause of death in the United States. The correlation between diet and CVD has been attributed to low-grade chronic inflammation. A chronic inflammatory state contributes towards the remodeling of otherwise healthy tissue, leading to atherosclerosis, cardiac remodeling, and coronary artery disease, among others. Activation and attraction of macrophages was found to be a common precursor to many diseased states. The purpose of this study was to investigate the relationship between diets of various qualities and the development of several inflammatory markers, as related to the cardiovascular system.

Methods:

All experimental procedures were performed according to protocols approved by the Liberty University Institutional Animal Care and Use Committee (IACUC #87.230502). Weanling male and female Wistar Kyoto rats were purchased from a commercial vendor and group housed 2-3 rats per cage. Rats were given access to standard rodent chow for 1-week to acclimate animals to solid food and new environment. After 1-week, body weights were recorded and animal were randomly assigned to receive unlimited access to one of three commercially available diets: standard rodent chow, a high calorie high-fat diet (HFD), or a high-calorie high-sugar high-fat diet (WD). After four- or 16-weeks, animals were housed individually in metabolic cages for 24-hours for measurement of food and water intake. Animals were then anesthetized with 3% isoflurane, body weights were collected, and the animals were then euthanized by exsanguination. Heart organ was collected, weighed, and processed for quantification of gene expression by RTPCR or fixed in 4% paraformaldehyde for histological processes. Gene specific primers for *Ccl2, Tgf-β, Lcn2, Vcam1,* and *Gapdh* were created using genetic sequences obtained from the University of California Santa Cruz Genomics Institute Genome Browser and Primer3 software. Proposed primer sequences were validated for accuracy using the Gene Blast Function in National Center for Biotechnology Information (NCBI) for rat RefSeqRNA.

Results:

RNA Primers were produced in-house (*Ccl2, Tgf-β, Lcn2, Vcam1*) and used for an efficiency QT PCR with the 4-week study and *Gapdh* as a housekeeping gene. Initial efficiency PCR showed good binding and specific peaks, but became non-specific in lower concentrations, suggesting contamination of dilution. Subsequent trials are needed to verify the quality of primers and generate data on specific inflammatory markers, followed by statistical analysis to determine significance.

P60: REDACTED

Category: *Basic Science Research*

Authors: Nathaniel E. Sherman (OMS-II), Matthew F. Olson (OMS-II), Matthew J. Karpel (OMS-II), Betsy Schloo, MD, Anthony J.M. Bauer, PhD.

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Abstract: REDACTED

P61: REDACTED

Category: *Basic Science Research*

Authors: Lucy E. Looney (OMS-II), Benjamin J. Offereins (OMS-II), Nathaniel E. Sherman (OMS-II), Matthew F. Olson (OMS-II), and Anthony J.M. Bauer, PhD

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Abstract: REDACTED

P62: Gastrointestinal motility effects of the cystic fibrosis corrector drug Tezacaftor (VX-661)

Category: *Basic Science Research*

Authors: Benjamin J. Offereins (OMS-II)[1], Lucy E. Looney (OMS-II)[1], Nathaniel E. Sherman (OMS-II)[1], Matthew F. Olson (OMS-II)[1], Anthony J.M. Bauer, PhD[1,2]

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Background: Cystic fibrosis (CF) is caused by a F508del mutations in the cystic fibrosis transmembrane conductance regulator (CFTR). This one amino acid deletion prevents the normal movement of chloride and bicarbonate ions across epithelial cell membranes, and many other cell types. This causes a severe decrease in water transport across membranes, often leading to thick sticky mucus that clogs ducts and creates a high risk of infection. Trikafta is a lifesaving triple-drug combination consisting of two CFTR trafficking correctors (Elexacaftor and Tezacaftor) and the channel potentiator Ivacaftor. Correctors ensure the protein is shuttled to the membrane while the potentiator keeps the channel open. However, significant gastrointestinal adverse effects persist, including GERD, abdominal pain, diarrhea, and constipation. Therefore, we sought to characterize the panenteric motility effects of Tezacaftor (VX-661) and assess species differences by using rats and mice.

Methods: F344/NHSD rats and C57Bl/6 mice were used to assess in vitro circular muscle contractility in muscles dissected from the mid-jejunum, and mid-colon. The muscles were kept in a krebs bath warmed to 37° C with fresh Krebs constantly being pumped on at a rate of 0.8ml/min. We then tied the muscle strips to an isometric force transducer to measure contractility. After setting a baseline for 30min we ran either 10μM, 3μM, or 1μM concentrations of Tezacaftor on the muscle strips as these are clinically relevant doses. When running the experiment on the small bowel the Tezacaftor was made up in 100mL of krebs, sonicated and bubbled with 90% O_2. When running the experiment on the large bowel the Tezacaftor was made up in 200mL of Krebs, sonicated, and bubbled. Graphs were assessed for changes in frequency, area under the curve, and tone.

Results: In rats, VX-661 (10 uM) decreased jejunal resting muscle frequency, area under the curve, and tone an average of 1.6±2.24 bpm, 11.5±6.54 g/s and 0.022±0.62 g, respectively. A paired T-test analysis shows p-values of 0.027, 0.025, and 0.035 respectively. Based on this data all three measures showed a statistically significant decrease. From basic visual assessment of the graphs a dramatic decrease in activity can be seen in the rat jejunum with as little as 1μM of Tezacaftor. Contractions from the proximal colonic pellet-forming region only showed a statistically significant decrease in the strength of the contraction which corresponds with the area under the curve. VX-661 (10 uM) decreased colonic resting muscle frequency, area under the curve, and tone an average of 0.08±0.063 bpm, 40.7±18 g/s and 0.012±0.44 g, respectively. A paired T-test analysis shows p-values of 0.12, 0.0018, and 0.10, respectively. (N=4 for jejunum and N=5 for colon, SEM)

Discussion: We can see clear differences in contractility and impact of Tezacaftor between the small bowel and large bowel. The small bowel appears to be much more sensitive to Tezacaftor. Furthermore, the drug does not appear to washout of the tissue. The large bowel appears to be less sensitive requiring 10μM of drug to show a visual decrease in activity. Tezacaftor also appears to washout in the large bowel unlike the small bowel. The decrease in spontaneous activity seen could explain the adverse events associated with Tezacaftor and Trikafta.

P63: Mouse Mammary Tumor Virus Mediated Vaccine-based Treatment of Murine Cancer

Category: *Basic Science Research*

Authors: Noah Campbell (OMS-II), Justin Kim (OMS-II), Anh William Mai (OMS-II), Morgan McDowell (OMS-II), Yingguang Liu, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Context: Mouse mammary tumor virus (MMTV) is a known oncogenic retrovirus in murine models that promotes mammary carcinoma and lymphoma by infecting epithelial cells and evading immune surveillance. Gene knockdown methods offer an avenue to evaluate the role of MMTV in tumor development and therapeutic response. While MMTV's role in tumor growth is established, its potential application as a vaccine-based treatment remains to be explored.
Objective: To determine whether MMTV gene knockdown reduces the anti-tumor efficacy of vaccine-based treatments in murine models of cancer.
Methods: Two in vivo experiments were conducted. In Experiment 1, 30 BALB/c mice were subcutaneously inoculated with 4T1 mammary carcinoma cells and grouped based on tumor size. Mice were divided into three groups: Control, random RNA knockdown (KDR), or MMTV-specific knockdown (KDD). Control mice received fresh culture medium, while each of the treatment groups received a 4T1 supernatant-derived vaccine. The medium or culture supernatant was mixed with an equal volume of Freund's Incomplete Adjuvant. A booster dose was administered after 1 week. Tumor size and body weight were monitored every 4 days for 4.5 weeks; BALB/c mice were weighed daily due to early mortality.
In Experiment 2, 40 C57BL/6 mice were subcutaneously inoculated with MC38 cells infected with a low dose of MMTV (Inf-1). Mice were assigned to four cohorts: Control, KDR, KDD, and BT-20 (a human breast tumor cell line). KDR and KDD mice received the MMTV-infected slow-growing MC-38 Inf-10 tumor vaccine with or without MMTV knockdown with boosters given weekly. Tumor size and weight were measured biweekly.
At the end of both studies, mice were sacrificed, and tissue samples were collected. In Experiment 1, lung tissue was cultured postmortem to assess metastasis.
Results: In Experiment 1, no significant difference in tumor mass was observed among the groups despite observing larger tumors in KDD (Mean ± SD: Control: 0.912g ± 0.508; KDR: 0.834g ± 0.377; KDD: 0.940g ± 0.386). Cell cultures showed reduced metastasis in the MMTV-treated group compared to KDD group. In Experiment 2, tumor mass was lower in the KDD (1.583g ± 0.634) and KDR (1.660g ± 0.935) groups compared to Control (1.803g ± 1.101) and BT-20 (1.824g ± 0.537), but not statistically significant. Interestingly, Inf-10 cells with MMTV knockdown grew into small tumors in 3 or the 10 mice while none of the Inf-10 cells with random RNA treatment grew into tumors.
Conclusion: We hypothesized that MMTV-mediated vaccine treatments would decrease tumor growth and slow metastasis. We predicted KDR would have the least tumor mass and KDD a smaller reduction due to MMTV inactivation in the vaccine line. However, our data did not show significant tumor reduction, though metastasis did decrease with MMTV supernatant treatment. Consistent with MMTV's immunomodulatory role, MMTV knockdown enabled infected cells to grow while control cells did not. These results suggest MMTV may serve as an immunomodulatory murine cancer therapy to prevent metastasis. Further work should test different vaccine forms, dosing, or tumor models for greater effect. Interestingly, C57BL/6 mice in Experiment 2 showed immune checkpoint activation, as chronic tumor exposure led to immune inhibition, manifesting as slow early growth followed by rapid expansion.

P64: Human Tryptase Effects on Breast Cancer Cell Viability *In Vitro*

Category: *Basic Science Research*

Authors: David Luke Dreyfuss (OMS-II), Olivia Curley (LUCOM), Christopher Kepley, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Despite advances in modern cancer approaches, the ability to effectively treat solid tumors has lagged behind that of adoptive cell transfer for blood cancers. Therapies that take advantage of innate immunogenic mechanisms show promise for alternative cancer treatments. The presence of mast cells (MC) has been linked with both positive and negative outcomes in the progression of solid tumors in a tissue-specific fashion. However, it is still unclear which chemical mediators found inside MC granules are linked with a change in cancer cell viability. Tryptase is a granule mediator that is linked to angiogenesis, tissue repair, coagulation, bronchoconstriction, and is one of the most common markers for MC activation. Its direct role in cancer viability has not been thoroughly explored. Here we examine the relationship between tryptase concentrations and viability and morphology changes of Her-2 positive human breast cancer in vitro. AU565 breast cancer cells were plated in media containing tryptase concentrations of 100ng/mL, 1300ng/mL, and 2600ng/mL and allowed to incubate for three days. Cells were assessed for changes in morphology under a microscope. Viability was determined using propidium iodide staining with flow cytometry. It was found that the presence of tryptase in high concentrations results in a significant decrease in three-day survival compared to controls with some moderate changes in cell morphology. These results reinforce that tryptase may play a role in the anti-tumorigenic activity of MC, particularly in conditions where there are high levels of degranulation. Further study of the *in-vivo* effects of tryptase-mediated apoptosis, angiogenesis and immune-cell recruitment are needed so that rationally designed, MC-based adoptive cell transfer strategies can be implemented.

P65: Effects of Chymase on Breast Cancer Cell Viability In Vitro

Category: *Basic Science Research*

Authors: Grace Garner (OMS-II), Taylor Hord (OMS-II), Olivia Curley, Christopher L. Kepley, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Introduction: Mast cells' influence on cancer growth and metastasis has shown contradictory results in various studies, with some reporting mast cells to be anti-tumorigenic while others reported tumor-promoting effects. To further explore these incongruities, we are investigating mediators stored within mast cells to determine their independent effects on cancer cell viability. With a better understanding of the mediators' effects on cancer cells, the goal is to develop rationally designed, tumor-targeting adoptive cell transfer immunotherapy utilizing genetically altered mast cells. Mast cells produce and release chymase upon FcεRI and non-FcεRI mediated mechanisms. The purpose of this study was to assess how chymase affects breast cancer cell viability and morphology *in vitro*.

Methods: AU565 human breast cancer cells were cultured in media with or without various concentrations of chymase for three days. All experiments were performed in triplicate with at least 3 separate donors. Cells were counted for viability using trypan blue exclusion and propidium iodide uptake using FACS analysis. Cell morphology was also imaged using a Millicell® cell imager. The data was analyzed for significance using ANOVA and HSD tests.

Results: We show that chymase at each concentration has a weak to no effect on cancer cell viability and a slight effect on cellular morphology. Using concentrations ranging from 0.5 µg/ml to 5 µg/ml of chymase for 3 days there was no significant ($p<0.05$) decrease in cell viability compared to non-treated cells. When compared to the positive and negative controls, the breast cancer cells treated with chymase displayed a rounder shape, smaller size, and greater detachment from the flask.

Conclusion: This study suggests that treatment with chymase alone has a negligible effect on breast cancer cell viability *in vitro*, indicating that it is not responsible for anti-tumorigenic or tumor-promoting effects previously demonstrated by mast cells. While this excludes chymase from potential therapeutic uses, it supports the possibility of chymase being genetically deleted in a tumor-targeting mast cell immunotherapy. The morphological changes associated with chymase should be explored further *in vivo* using mouse models, to assess for any effect on tumor progression or metastasis.

P66: The Effects of Tumor Necrosis Factor on Cancer Cell Viability

Category: *Basic Science Research*

Authors: John Cramer (OMS-II), P'Anté Rolle (OMS-II), Olivia Curley, Christopher L. Kepley, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Mast cells (MC) secrete several key mediators involved in immune stasis and disease processes. For example, tumor necrosis factor alpha (TNF-α) is prestored in MC granules and released immediately following FcεRI-dependent and FcεRI-independent activations. TNF-α recruits cells such as cytotoxic leukocytes but is also a known direct cytotoxic inducer of apoptosis. We sought to further understand this mechanism through in vitro experiments examining the effects of different TNF-α concentrations on cancer cell viability. Three concentrations were applied to independently cultured breast cancer cell lines (AU-565 and MDA-MB-231) to assess dose-dependent effects after three days. The TNF-α–treated cells were then analyzed by Fluorescence-Activated Cell Sorting (FACS) to quantify apoptosis and by microscopy to identify morphological changes compared to controls. We showed that TNF-α induced morphological features of apoptosis, including cell shrinkage, cytoplasmic blebbing, and nuclear fragmentation in AU-565 cells, and cell rounding, cytoplasmic blebbing, and nuclear fragmentation in MDA-MB-231 cells. These observations highlight MC-derived TNF-α's potential as a modulator of apoptosis in breast cancer cells and may explain the potent anti-tumor effects observed when MC are activated during interactions with cancer cells.

P67: The Effects of Granulocyte Macrophage Stimulating Factor on Cancer Cell Viability in vitro and in vivo

Category: *Basic Science Research*

Authors: Tatfiq Ahmed Fahmi (OMS-II), Olivia Curley, Claire Whitman (OMS-II), Christopher L. Kepley, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Previous research has shown that mast cells (MC) can induce cancer cell apoptosis through the release of mediators they produce following FcεRI and non-FcεRI mechanisms. However, it is not clear which mediators induce this response. Mast cells produce copious amounts of Granulocyte Macrophage Stimulating Factor (GMCSF) which is primarily known for stimulating the immune system by activating and recruiting white blood cells. The purpose of this study was to determine what direct effect GMCSF has on cancer cells *in vitro* and *in vivo*. Several human cancer cell lines including AU565, BT474, and MDA-MB-231 were incubated with varying concentrations of human GMCSF and the morphological changes and viability were assessed. We show that GMCSF had a significant effect on cancer cell viability at certain concentrations. For *in vivo* studies, tumors were established in Nu/Nu immunocompromised mice after injection with AU565 cancer cells. Mouse tumors were injected with or without varying concentrations of GMCSF and tumor size and lifespan measured. We show GMCSF may have a direct killing effect on cancer cells in addition to the well-established immune stimulation actions described previously. These results also suggest this mechanism contributes to anti-tumor effects of MC and provide guidance in rationally designing MC for cancer immunotherapy strategies.

P68: Examining the Effects of Human Mast Cell Activation on Natural Killer Cell Recruitment

Category: *Basic Science Research*

Authors: Tatfiq Ahmed Fahmi (OMS-II), Olivia Curley, Christopher L Kepley, PhD

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Both mast cells (MC) and natural killer (NK) cells are innate immune cells that have basic functions in normal anti-pathogen function. Mast cells release a wide variety of immune stimulating mediators following IgE and non-IgE-dependent activation that orchestrate several processes including immune cell recruitment. However, little information is available examining the interplay between MC and NK cells, especially in terms of how NK cells are recruited to MC-containing tissues. To examine this, we developed a migration assay to understand the ability of IgE and non-IgE activated human, skin-derived MC to recruit human NK cells. The assay tested three mast cell mediators: Histamine, Granulocyte Macrophage Stimulating Factor (GMCSF), and Tumor Necrosis Factor Alpha (TNF-α) at varying concentrations to check for NK cell migration. The assay showed a positive cell migration for TNF-α. The experiment needs to be repeated with further counting to get statistical significance which we are planning to do. These studies implicate an important interplay between MC and NK cells and provide insight into how NK cells are recruited to MC-containing tissue sites during immune responses.

P69: Association between ctDNA levels and Stage III Melanoma Prognosis: A Systematic Literature Review

Category: *Systematic Review/Meta-analysis*

Authors: Deborah Shim (OMS-II)[1], Enoch Pan (OMS-II)[1], Yanghwa Hong (OMS-II)[1], Joomee Shim, MD[2]

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Although there have been advances in treatment in the form of immune checkpoint inhibition and targeted therapies, malignant melanoma continues to make up a large portion of skin cancer related deaths, and it requires close monitoring throughout clinical management due to its characteristic rapid growth. Current serologic biomarkers such as lactate dehydrogenase (LDH) and S100 have been limited in their specificity and sensitivity for reliably evaluating treatment response or disease recurrence. Circulating tumor DNA (ctDNA) has emerged as a promising biomarker with higher sensitivity for assessment in malignant melanoma cases. However, its prognostic value and clinical utility has yet to be established as standard of care in the treatment of malignant melanoma across its disease stages. Specifically, stage III malignant melanoma is a critical transition point between local and metastatic disease, and its risk of recurrence and response to treatment are highly variable across cases. The objective of this meta-analysis is to evaluate the role ctDNA may have as a prognostic and monitoring tool for stage III malignant melanoma by evaluating reported hazard ratios between stage III malignant melanoma patients with detectable ctDNA levels and patients without detectable ctDNA levels throughout their medical management. A comprehensive systematic literature review of the ClinicalTrials.gov, Cochrane, MEDLINE, and PubMed databases was conducted to identify studies that evaluated ctDNA as a biomarker in stage III malignant melanoma patients using the following MeSH terms: (ctDNA OR circulating tumor DNA) AND (stage 3 melanoma OR stage 3 malignant melanoma OR stage III melanoma OR stage III malignant melanoma). No date restrictions were applied, and all eligible studies available up to September 2025 were considered. Based on predefined inclusion and exclusion criteria, 15 articles were obtained and will be further analyzed for associations between ctDNA detection and reported hazard ratios. These findings are expected to contextualize ctDNA's potential prognostic and clinical role in malignant melanoma management.

P70: Comparing Venous Blood Gases to Arterial Blood Gases in Assessment of Acid-Base Status

Category: *Educational Project*

Authors: Jessica Azar (OMS-II), Cheandri Ackermann (OMS-II), Moses Choi (OMS-III), Chris Cole (OMS-III), Melanie Tadros (OMS-II), Abigail McLaughlin (OMS-III), Ryan Minervini (OMS-III), Maziar Montazer (OMS-IV), Charles R. Joseph, MD.

Affiliation: Liberty University College of Osteopathic Medicine, Lynchburg, Virginia

Using venous blood gases (VBGs) as an alternative to arterial blood gases (ABGs) has been extensively studied for assessing acid-base status in select acutely ill patients. The goal of this study was to evaluate the correlation between VBG and ABG samples to determine whether VBG could be used as an accurate and safer alternative for evaluating various acid-base states, thereby reducing certain ABG-associated risks including pain and discomfort, thrombosis, aneurysm, ecchymosis, needle stick injuries, and nerve damage. A literature review was performed, encompassing patients with trauma, respiratory failure, cardiac failure, and metabolic syndromes. In doing so, factors impacting sample comparison, including accessibility based on patient setting, post-draw cellular metabolism, and potential need for mathematical corrections when using VBG, were considered. This study indicated that pO_2 had a poor correlation coefficient but may be compensated for by using pulse oximetry. For patients with acute cardiac failure, VBG is a good indicator for blood pH, lactate, electrolytes, and HCO_3^-. Comparable results were found in patients with acute respiratory failure; however, due to the nature of these patients' disorders, PCO_2, PO_2, and SpO_2 require close monitoring, in which ABG may be required. In patients with acute trauma and metabolic syndromes, VBG proved to be a strong predictor of acid-base disturbances, including pH, HCO_3^-, PCO_2, base excess, anion gap, electrolytes, hemoglobin, hematocrit, and P50. However, due to concerns with accurate O_2 monitoring, pO_2 values remain a limitation for adjusting respiratory settings. VBG can be utilized for acid-base status and other parameters, but further analysis and continued usage of ABG are required to accurately reflect pO_2 values. The overall accessibility of ABG and VBG was also considered, as they vary with the patient's setting and blood sample handling procedures. This variability may require more specific protocols or mathematical adjustments when comparing VBG to ABG to avoid significant metabolic and gas composition changes. The use of point-of-care (POC) blood gas analyzers has also shown promise. However, PO_2 measurements may be less consistent, demonstrating greater variability and a tendency toward systematic underestimation at higher oxygen tensions. This difference may be most clinically significant when precise oxygen assessment is critical. Additionally, further evaluation of lactic acid from VBG vs ABG is required to provide a better predictor of accurate utilization of VBGs in lieu of ABGs.

P71: Developing A Central Histology Lab to Support Academic Research

Category: *Educational Project*

Authors: Matthew Karpel (OMS-II), Betsy Schloo, MD

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Background:
The LUCOM Research Department currently relies on a system that requires significant time and resources for training in basic histology techniques, limiting the productivity of ongoing academic research projects. Tissue processing, tissue embedding, microtomy, cryo-sectioning, and staining are all skills that take specialized training and are also inherently time consuming, taking days to create high quality slides. This presents a need for a more robust and centralized histology lab. This would streamline workflows, improve the quality of research, and allow individual research labs to focus more on experimental design and data analysis rather than procedural learning.

Objective:
To support research by providing high quality histology processing for future and ongoing research projects and provide educational opportunities in pathology for students.

Methods:
Existing LUCOM laboratory space and resources were used to prepare and examine tissue samples . Standard operating procedures (SOPs) for tissue processing, embedding, sectioning, and staining were adapted from established protocols. A workflow, training materials, and documentation were developed to ensure safety and constantly high quality results.

Results:
Over 8 weeks the laboratory produced consistent stained sections for qualitative and quantitative analysis. The laboratory was able to assist multiple student-led research projects with pathology related tasks.

Conclusion:
This project has demonstrated that a high quality student run histology lab can be successfully implemented in a medical school setting. The lab provided educational opportunities for students in histology, promoted peer-to-peer learning, and expanded institutional research capacity.

P72: Caring for the Whole Family: The Impact of Care on Biological Children in Foster, Adoptive, and Kinship Families

Category: *Basic Science Research*

Authors: Lindsey Newsom (OMS-II)[1]; Autumn Harms[2]; Jack Berry, PhD[2]; Amanda Howard, PhD[2]; Nicole Wilke, PhD[3]

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Biological children in foster, adoptive, or kinship homes are a crucial part of the family unit, yet their experiences are often overlooked because they remain with their biological parents. The addition of new siblings, however, can significantly disrupt their daily lives and shape long-term family dynamics. This study addresses this gap by examining the best and most challenging aspects of being a biological child in a caregiving family through retrospective accounts. A total of 196 adults who were raised with foster, adoptive, or kinship siblings completed a survey that included sibling caregiving experience questions and two open-ended prompts exploring positive and difficult experiences. Thematic analysis revealed six themes representing the best parts of participants' experiences: personal growth and character development, strengthened family identity and belonging, special sibling relationships, memorable experiences and everyday joys, faith and spiritual growth, and complex emotions and ambivalence. Six themes also captured challenges: loss of parental attention and resources, emotional and relational strain, premature maturity and parentification, household chaos and trauma exposure, social challenges, and insufficient family preparation and support. Findings highlight that biological children encounter both meaningful benefits and unique challenges, underscoring the need for systemic, trauma-informed, and family-centered approaches in practice, policy, and training.

P73: Pediatric Literacy Development at Lynchburg Family Medicine Residency

Category: *Educational Project*

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Reading is vital for child development in several spheres and helps develop both cognitive and social-emotional skills. The American Academy of Pediatricians states that “reading aloud to children from infancy through kindergarten is crucial for their development, boosting brain growth, strengthening the parent-child bond, and building foundational language and literacy skills. Unfortunately, many children struggle to reach their literacy goals in early childhood. Early reading and reading to children are less likely in those with lower economic status due to factors like fewer books at home, less reading exposure and limited access to early education. This makes encouraging literacy and reading to children by supplying parents with books an ideal intervention.

Lynchburg Family Medicine Residency (LFMR) serves children from a variety of backgrounds but the preponderance of children at LFMR are covered by state funded insurance (Medicaid) and lower income families. The purpose of this quality improvement project was to increase shared reading for our families at LFMR by researching the feasibility of several literacy/book-giving programs and then implement the selected program. We evaluated multiple programs such as Imagination Library, developing our own unique Centra literacy program, and others. Due to existing familiarity and structure, we decided that the best fit for our clinical practice at LFMR was the Reach Out and Read (ROR) program. ROR is a national program that, in partnerships with the physician, leverages the well-child visit, using books and shared reading to support parents and caregivers in fostering early literacy. Books are given at every well child check from birth through age five, new books are introduced by the physicians in a way that encourages families to centralize reading in a child’s early education.

After administrative and stakeholder approval, the application to the ROR program was started. This lengthy process required multiple pieces of practice information, including demographics evaluation of patients, numbers of predicted books needed and potential cost to launch the program. The application was submitted at the conclusion of my research month at LFMR. Steps toward final approval and implementation are ongoing. Future projects would include assessing the benefit of starting this literacy program, attitudes, and buy-in from providers.

P74: Integrating Clinical Context into Preclinical Biomedical Education: A Team-Based Learning Module on Diverticulitis

Category: *Educational Project*

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Introduction: Medical education increasingly emphasizes clinical relevance in preclinical years to enhance engagement and applied learning. This integrates a real patient encounter through a diverticulitis case summary, designed to strengthen understanding of microbiology and antibiotic principles. A preparatory lecture, *Pharmacology of Antimicrobial Agents* by Dr. Steve Phipps, provides foundational content. Clinically anchored exercises reinforce conceptual understanding and critical thinking, demonstrating the effectiveness of case-based learning. This project highlights the value of student-led curricular design, emphasizing learners as active contributors to meaningful educational innovation.

Methods: First-year students will receive an overview of antibiotic classes and a diverticulitis case summary, including causative pathogens and treatment considerations. The TBL session will include an individual readiness assurance test (iRAT), a team readiness assurance test (tRAT), and application exercises requiring students to connect microbial classification with therapeutic decision-making. This structure will prioritize active learning, collaboration, and clinical reasoning. To address the broader need for clinically relevant content across the curriculum, the finalized TBL will be disseminated via the Medical Education Portal.

Results: Students are expected to show improved scores from iRAT to tRAT performance, reflecting the benefits of collaborative learning. Application exercises are anticipated to deepen understanding of bacterial classification, antimicrobial coverage, and clinical reasoning. The session can be adapted across preclinical courses and paired with clinical shadowing experiences to contextualize learning. The student-developed format of the session highlights the value of translating real patient encounters into educational tools. By engaging students in designing education resources, this study fosters ownership of learning, strengthens applied reasoning, and contributes to peer-reviewed medical education scholarship.

Discussion/Conclusion: This TBL module illustrates the potential for case-based learning to integrate pre-clinical science concepts with clinical practice. Next steps include IRB approval, refinement of the TBL design, and distribution via the Medical Education Portal to promote expanded implementation. Beyond its educational impact on participants, the development of this module aims to provide student creators with a unique opportunity to translate shadowing experiences into learning tools, bridging real patient encounters with foundational sciences. This aims to strengthen students' clinical reasoning and interdisciplinary awareness while showcasing the impact of student-led efforts in transforming shadowing into meaningful, scholarly involvement. Expanding case-based materials across preclinical curricula is anticipated to reinforce knowledge and support the development of scholarly work in medical education.

P75: Integrating Clinical Application and Anatomy Education: A Team-Based Learning Module on the Pericardium Using a Case of Post-COVID-19 Pericarditis

Category: *Educational Project*

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Although clinical applications are increasingly incorporated into pre-clerkship anatomy education, there remains room to further enhance the connection between foundational anatomy and modern clinical scenarios. Strengthening this connection may also help improve medical student empathy and academic success. Compared to traditional lecture-based instruction, case-based learning improves medical students' academic performance and engagement (Maia et al., 2023). To address this gap, this project aims to contextualize anatomy instruction with clinical practice through the implementation of a team-based module on the pericardium using a case of post-COVID-19 pericarditis.

While case-based and team-based learning (CBL/TBL) have demonstrated effectiveness in medical education, this study will evaluate whether a CBL/TBL module enhances students' understanding of pericardial anatomy and encourages empathy toward patient experiences compared to traditional lecture-based instruction. A group of students will read a pre-written case, "Acute Pericarditis Following SARS-CoV-2 Infection," and complete an Individual and Team Readiness Assurance Test (iRAT/tRAT) prior to the start of the learning module. A control group of students will attend a traditional lecture on the anatomy of the pericardium without the case presentation and will complete an assessment equivalent to the iRAT/tRAT. Both groups will receive questions based on the learning objectives of the lectures, including items designed to assess humanistic and empathy-related outcomes.

Anticipated results are expected to show higher scores on the iRAT/tRAT among students who participated in the CBL/TBL activity. Overall student empathy is also expected to be greater compared to the control group. In addition, with the growing recognition of post-COVID-19 pericarditis in clinical practice and literature, there may be an increased value in integrating this clinical vignette early in the curriculum given its relevance in the post-pandemic era. The significance of the anticipated findings would support the regular implementation of CBL/TBL activities in pre-clinical education to not only foster early development of critical thinking and diagnostic reasoning skills, but also to cultivate compassionate, patient-centered physicians.

P76: Longitudinal Analysis of Sleep Habits, Academic Performance, and Burnout Among Osteopathic Medical Students Using Wearable Sleep Trackers

Category: *Basic Science Research*

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Background:
Sleep quality encompasses factors such as sleep latency, consistency of sleep/wake times, and environmental conditions. Sleep quality can be improved by consistently sleeping and waking at the same time and reducing phone usage before bed. Medical students frequently report poor sleep habits, which may affect both health and academic performance. Prior studies have examined the effect if sleep on academic outcomes, but current literature lacks longitudinal data and standardized definitions of academic success. Our study seeks to fill this gap by collecting and analyzing data that is automatically uploaded from wearable devices and by tracking burnout with surveys. This study will follow and track sleep habits of osteopathic medical students during their second year and during dedicated board prep.
Objective:
To assess longitudinal changes in sleep patterns and quality of sleep in second-year osteopathic medical students using wearable trackers and completing surveys. The study will analyze collected sleep data and look for an association with academic performance and burnout.
Methods:
This is a prospective, longitudinal, mixed methods study. Approximately 75 students from the OMS-II cohort at Liberty University College of Osteopathic Medicine (LUCOM) will be allowed to participate. (All OMS-II students will be invited to participate, but funding is not available for more than 75 student to be a part of the study.) A recruitment e-mail will invite students to participate, and up to 75 second years will be randomly selected. Participants will be provided with Fitbit Inspire 3 wearable devices, which will track objective sleep metrics such as sleep efficiency, sleep latency, sleep duration, wake-after-sleep onset, NREM, and REM. All data will be transmitted to and stored in Fitbit's cloud platform. In addition to the data collected from the Fitbit devices, students will complete sleep quality and stress surveys at the end of each semester. These surveys will inquire about stress levels, stress management, and other metrics of burnout. Inclusion criteria include enrollment in the DO program at LUCOM and willingness to wear Fitbit devices in bed every night until a student sits for COMLEX Level 1. Exclusion criteria include known sleep disorders or refusal to wear monitoring devices. De-identified academic performance metrics (e.g., course grades, COMSAE scores, and Level 1 result) will be collected from the Office of Medical Education. Statistical analysis will include correlation and regression modeling to assess associations between sleep patterns, academic outcomes, and burnout. Osteopathic significance includes the potential to inform strategies for improving student wellness and academic performance through sleep hygiene interventions.
Results:
At the time this abstract was submitted, data collection had not yet started.
Conclusion:
This study is exploring the longitudinal relationship between sleep habits, academic performance, and burnout among osteopathic medical students. Our results may provide insights into sleep habits of med students, guide the development of targeted wellness interventions, and highlight the importance of sleep hygiene for medical students during all stages of their education.

P77: Effects of Physical Activity on Academic Performance and Resilience in Medical Students

Category: *Educational Project*

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The rigorous and demanding nature of medical education often contributes to high levels of stress and academic pressure, which can lead to burnout, symptoms of depression and anxiety, low energy, and persistent fatigue (Briggs et al., 2021; Stratakis et al., 2024). Multiple studies have demonstrated that physical activity benefits medical students by combatting stress, anxiety, and burnout (Khosravi, 2021; Lindwall et al., 2014; Raditya & Sutarina, 2021). Many medical students, however, struggle to maintain a consistent exercise routine.

The goal of this study is to determine if there is a correlation between physical activity and academic performance, alertness, and focus of medical students. Specifically, is there a relationship between physical activity and improved academic performance? Does physical activity increase alertness and focus of students?

In this non-randomized, cross-sectional study, participants will be recruited from current first- and second-year LUCOM students by email. Participants must agree to engage in low-intensity physical activity – defined as engaging in any form of movement, (e.g. walking, yoga, or stretching) – for at least 15 consecutive minutes twice a week on two separate days. While participants will be encouraged to meet this baseline requirement, they may also engage in more rigorous physical activity (e.g. running, weightlifting, swimming) for longer durations if they choose. The intervention will be implemented following fall break and will conclude during spring break. Participants will be expected to complete pre- and post-intervention surveys. They will also be asked to complete biweekly surveys throughout the duration of the study. The pre- and post-intervention surveys will assess participants' self-efficacy and will utilize the Behavioral Regulation in Exercise Questionnaire-3, which consists of 23 items. Surveys administered once every two weeks will assess the following: participants' attention/focus using five items adapted from the Attention-Related Cognitive Errors Scale, three items to assess self-reported energy levels and quality of studying, type and intensity of physical activity performed (categorized as mild, moderate, or vigorous), whether the physical activity was conducted alone or with a partner, perceived benefits of the physical activity, level of enjoyment of physical activity, and if the participants associated any feelings of pressure or obligation with engaging in physical activity. Academic performance will be evaluated by obtaining de-identified exam scores from the LUCOM Office of Medical Education with the consent of participants.

If our hypothesis is correct, medical students will benefit academically and mentally from consistently engaging in physical activity. We predict that physical activity (even low intensity exercising) will improve participants' academic performance, focus, attention, and self-efficacy. If this is confirmed to be true, future studies would include participants from multiple medical schools to determine the generalizability of the results of this study.

P78: Seeking an understanding of the role of encouragement in the motivation and perceived outcomes of students at LUCOM

Category: *Basic Science Research*

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Background
Many medical students deal with high levels of stress and anxiety, which can lead to a decrease in motivation and self-efficacy. While several studies have explored wellness interventions using encouragement, few have evaluated the role of peer-to-peer encouragement in the context of medical school. Fostering a sense of connection among peers may help reduce feelings of isolation and may improve students' social, emotional, and intellectual well-being. We are seeking to investigate these connections among the medical students participating in this study in the hopes of improving the mental health of medical students in the short term and, ultimately, enhancing future patient care in the long term.

Objectives
To evaluate whether weekly messages of encouragement improve academic self-efficacy, motivation, self-fulfillment, and campus connectedness in first- and second-year osteopathic medical students.
To explore the strength of emotional connection between the giver and receiver of encouragement.

Methods
This is a prospective, within-subjects intervention conducted at Liberty University College of Osteopathic Medicine using repeated survey measures. Participants from the classes of 2028 and 2029 were recruited via email. Preliminary surveys will be distributed during recruitment to assess home state, hobbies, and medical specialty of interest to help match participants during Phase 3 of the intervention. Inclusion criteria include willingness to participate in all three phases and to complete post-phase surveys. Each phase is scheduled to last five weeks. In Phase 1, participants will receive weekly encouraging messages from an anonymous source through email. In Phase 2, they will be paired with self-identified friends and will exchange encouragement at least once per week. In Phase 3, they will be assigned acquaintances to send encouragement to and receive encouragement from at least once per week. In Phases 2 and 3, subjects will be given themes ("I believe in you," “Hang in there,” “I am praying for you,” etc.) to use as a guide for the encouragement they are sending. Validated surveys assessing academic self-efficacy, campus connectedness, self-fulfillment, and motivation will be administered at the end of each five-week phase. Additionally, participants will be asked questions to assess whether they strengthened or developed an emotional connection with their partners during Phases 2 and 3.

Results
This study is ongoing, and recruitment is underway. The study will begin shortly after recruitment and continue into the Spring 2026 semester, with a break between Phase 1 and Phase 2 to accommodate the students’ winter break. All data will be obtained by late spring of 2026, which is when Phase 3 concludes.

Conclusions
This study has the potential to provide valuable insights about low-cost, scalable interventions that may enhance the well-being, motivation, and success of medical students during the formative years of their education. We expect that encouragement will increase levels of academic self-efficacy, motivation, self-fulfillment, and campus connectedness based on past studies that have evaluated these

variables in other academic environments. This project aligns with osteopathic principles by addressing student well-being while promoting community, empathy, and peer connections.