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ANNUAL RESEARCH SYMPOSIUM

› FEBRUARY 8-9, 2024 ›



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— ARKANSAS COLLEGES OF — HEALTH EDUCATION

ACHE MISSION

To educate and train a diverse group of highly competent and compassionate healthcare professionals; to create health and research support facilities; and to provide healthy living environments to improve the lives of others.

ACHE RESEARCH MISSION

To utilize innovative research and scientific collaborations for the advancement of health and wellness in our communities and to train highly skilled and compassionate healthcare professionals.



SCOPE OF RESEARCH

Areas of focus for programs and facilities

- Obesity, Metabolomics and Diabetes
 - Hypertension and Cardiovascular Disease
 - Genomics, Bioinformatics, and Personalized Medicine
 - Cancer
 - Neuroscience
-

The biomedical research laboratories will encompass the second and third floors of the Research Institute Health and Wellness Center making it the largest biomedical research lab for Osteopathic schools in the nation.

Comprised of over 120,000 Square Feet

- Clinical Research Center- 4,000 SF
- Vivarium- 35,000 SF
- Center for Rehabilitation Research- 6,000 SF
- Biomedical Research Space- 48,000 SF
- Center for Microscopy and Cellular Imaging- 3,000 SF
- MRI/Micro CT Center for Clinical Imaging- 4,000 SF
- Center for Neuroscience, Aviation, and Aerospace Medicine- 20,000 SF



AGENDA

Thursday, February 8th

5:30 PM	Attendees Check-in, Tours of RIHWC by ACHE Student Ambassadors	Registration Desk
6:00 PM	Appetizers and Vendors Exhibit	West Gallery
7:00 PM	Banquet Dinner	Event Center
7:45 PM	Keynote Speaker- Terry Hinds, PhD "Drug Discovery Technology & Personalized Medicine: The Story of Bilirubin as a Metabolic Hormone"	Event Center

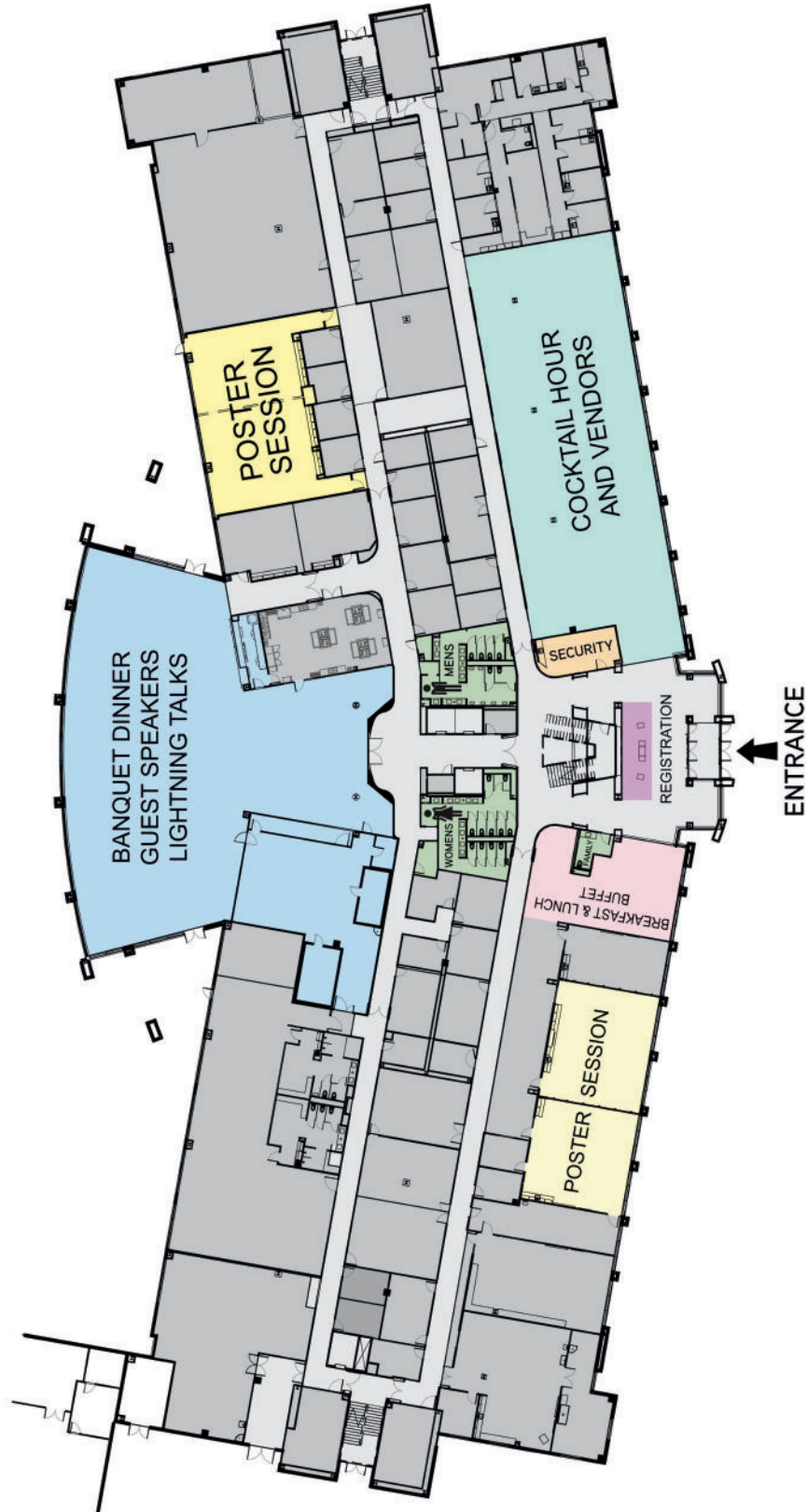
AGENDA

Friday, February 9th

7:45 AM	Attendees Check-in	Registration Desk
8:00 AM	Breakfast Served	East Gallery
8:30 AM	Welcome by ACHE Vice President of Research- Jeffrey L. Osborn, PhD	Event Center
8:40 AM	Morning Speaker- David Stec, PhD "Cardiovascular Complications of Metabolic Diseases"	Event Center
9:40 AM	Break	
10:00 AM	Poster Session	Large Conference Room and Arts Classroom
11:00 AM	Lightning Talks	Event Center
12:00 PM	Lunch Served	East Gallery
12:30 PM	Lunch Speaker- Jeffrey L. Osborn, PhD "Clinical Implications of Diabetes: How New and Novel Treatments for Diabetes Impact Metabolic and Cardiovascular Function"	Event Center
1:30 PM	Poster Session	Large Conference Room and Arts Classroom
2:30 PM	Lightning Talks	Event Center
3:30 PM	Afternoon Speaker- Kyle Flack, PhD, RDN. LD "Moving Through the Translational Continuum, Research for the People"	Event Center

EVENT MAP

ACHE 2024 RESEARCH SYMPOSIUM MAP





POSTER SESSION THEMES

Morning Session

10:00 AM	Case Studies	Arts Classroom
	Demography	Large Conference Room

Afternoon Session

1:30 PM	Biomedical Sciences	Arts Classroom
	Special Interest Reports	Large Conference Room

CONTINUING MEDICAL EDUCATION

Accreditation Statements

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American Osteopathic Association and the Arkansas College of Osteopathic Medicine (ARCOM). The American Osteopathic Association is accredited by the ACCME to provide continuing medical education for physicians.

CREDIT HOURS:

The American Osteopathic Association designates this live activity for a maximum of 3.00 AMAPRA Category 1 Credit™. Physicians should claim only credit commensurate with the extent of their participation in the activity.

DISCLOSURE AND CONFLICT OF INTEREST RESOLUTION:

All conflicts of interest of any individual(s) in a position to control the content of this CME activity will be identified and resolved prior to this educational activity being provided. Disclosure about provider and faculty relationships, or the lack thereof, will be provided to learners.

APTA Credit Designation Statement

This course has been pre-approved by the APTA for 3.0 Contact hours for Arkansas PTs and PTAs. The approval code is APTA-AR #1863.

CONTINUING MEDICAL EDUCATION

Total Credits: 3 Hours

Keynote Speaker- Terry Hinds, PhD
Thursday, February 8th: 7:45-8:45 PM

Morning Speaker- David Stec, PhD
Friday, February 9th: 8:40-9:40 AM

Lunch Speaker- Jeffrey L. Osborn, PhD
Friday, February 9th: 12:30-1:30 PM

Learning Objectives

1. Name current and relevant scientific demonstrations of how the development of Type I and Type II diabetes impacts liver function and bilirubin synthesis to significantly impact long-term dysregulation of systemic metabolic functions.
2. State an overall understanding of the current implications of how altered metabolic functions in diabetes impact systemic renal and cardiovascular function.
3. Recall significant and relevant clinical case studies and information on the overall current treatments for diabetes may impact development of metabolic, renal, and cardiovascular disease.

FEATURED SPEAKER



Terry Hinds, PhD

**Associate Professor of Pharmacology and Nutritional Sciences
University of Kentucky**

The Hinds lab seeks to understand the molecular mechanisms and signaling involved in obesity, fatty liver disease, insulin-resistant diabetes, cancer, and addiction and how these are related to metabolic and cardiovascular diseases. A major discovery from the Hinds Lab is that bilirubin is a hormone that is lower in obesity, and increasing levels 2-3 fold improves liver function and reduces adiposity and insulin resistance. Much of this work has led to three patents for the Hinds Lab for bilirubin nanoparticles and bilirubin-derived compounds for treating these ailments.

FEATURED SPEAKER



David Stec, PhD

**Professor of Physiology and Biophysics
University of Mississippi Medical Center**

Dr. David E. Stec is a Professor in the Department of Physiology & Biophysics and Director of the Cardiovascular-Renal Research Center (CRRC). The University of Mississippi Medical Center recently awarded Dr. Stec the Platinum Research Award (>5 million dollars generated in extramural research funds). Dr. Stec has received extramural research support from the National Institutes of Health and the American Heart Association. His current research focuses on identifying mechanisms by which metabolic diseases such as metabolic-associated steatotic liver disease (MASLD) cause cardiovascular and kidney disease.

FEATURED SPEAKER



Jeffrey L. Osborn, PhD

**Vice President of Research and Professor of Pathophysiology
Arkansas Colleges of Health Education**

Jeffrey L. Osborn, PhD is Vice President of Research and professor of Pathophysiology at ACHE. He moved to ACHE after nearly 20 years as professor of biology at the University of Kentucky. Current research interests of Dr. Osborn's lab group are focused on kidney specific expression of both nuclear and mitochondrial genes in experimental models of hypertension, inflammation of kidney tissues that decrease kidney function and cause high blood pressure (hypertension) and understanding the mechanisms of gestational hypertension, preeclampsia and kidney failure in diabetes. Most recently, Dr. Osborn has identified a model of high blood pressure in experimental animals that very closely mimics human hypertension and preeclampsia during pregnancy.

FEATURED SPEAKER



Kyle Flack, PhD, RDN. LD

**Assistant Professor of Dietetics and Human Nutrition
University of Kentucky**

Kyle Flack, PhD, RD, is currently an Assistant Professor in the Department of Dietetics and Human Nutrition at the University of Kentucky. Dr. Flack's research is characterized as applied exercise and nutritional physiology, conducting interventions centered on obesity treatment and prevention. Dr. Flack has lead clinical trials focusing on understanding the mechanisms underlying weight loss resistance with exercise and dietary interventions and investigating novel treatments to improve the effectiveness of exercise as a weight loss treatment.



— RESEARCH INSTITUTE —
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PROFESSIONAL & GRADUATE STUDENT
ABSTRACTS

Heparin-Induced Thrombocytopenia Type 2 (HIT-2) in a Patient with Essential Thrombocythemia (JAK-2 Positive/BCR-ABL Negative)

Muhammad G. Arnous, MD

Background:

Essential thrombocythemia (ET), marked by excessive platelet production and often associated with the JAK-2 V617F mutation, poses a challenge in distinguishing its thrombocytosis from a potential drop caused by Heparin-Induced Thrombocytopenia Type 2 (HIT-2). HIT-2, a severe complication linked to heparin use, results in life-threatening thrombosis.

Case Description:

A 62-year-old woman with confirmed ET (JAK-2 positive/BCR-ABL1 negative) presented three weeks post VIABAHN-coated stent procedure. Lower limb pain led to a heparin drip and angiography, unveiling non-occlusive thrombi in the left femoral artery and distal to the VIABAHN stent. A substantial platelet count drop from 1297 K/uL to 508 K/uL raised HIT-2 suspicion, confirmed by positive ELISA and serotonin release assay. Heparin cessation and a 48-hour Argatroban regimen were initiated, followed by planned warfarin bridging. Day 2 involved angiography with thrombectomy and tPA Alteplase, contributing to stabilization.

Outcomes:

The patient transitioned to oral anticoagulation therapy (warfarin, aspirin, and Clopidogrel), experiencing clinical improvement. Discharged on day 5, three months of close monitoring showed no thromboembolism recurrence. Ongoing essential thrombocythemia treatment, including interferon injections, was maintained without notable side effects.

Discussion:

This case underscores the challenge of diagnosing HIT-2 in the context of ET and highlights the need for personalized treatment strategies. Successful management, involving heparin discontinuation, Argatroban initiation, and thrombectomy, contributes to limited literature on HIT-2 in ET. This report emphasizes the importance of clinical awareness and tailored interventions in similar cases, shedding light on the nuanced interplay between essential thrombocythemia and HIT-2.

References:

Pontis A, Valaize J, Kerlevo M, Gueret P, Bernard M, Mabo P, Gouin-Thibault I, Nedelec-Gac F. Heparin-induced thrombocytopenia leading to a diagnosis of essential thrombocythemia. *Int J Lab Hematol*. 2021 Aug;43(4):O193-O196. doi: 10.1111/ijlh.13507. Epub 2021 Mar 11. PMID: 33709631.

Greinacher A, Selleng K, Warkentin TE. Autoimmune heparin-induced thrombocytopenia. *J Thromb Haemost*. 2017 Nov;15(11):2099-2114. doi: 10.1111/jth.13813. Epub 2017 Sep 28. PMID: 28846826.

Assessing the role of neurogenesis in learning & memory following exposure to high frequency head impacts (HF-HI) and Controlled Cortical Impacts (CCI)

Attiah, F., Romariz, S., Sloley, S.S., Kanter, M., Harvey, A., Korthas, H., Main, B.M., Burns, M.P.

Hypothesis: We hypothesize that as the severity of the injury increases, doublecortin-positive cells will increase in the dentate gyrus in order to compensate for cell loss following the injury. Since the HFHI model does not cause neuronal death, we expect to see more DCX+ cells in the CCI model when compared to HFHI mice

Materials & Methods: Controlled Cortical Impact (CCI): Briefly, anesthetized mice were placed in a stereotaxic frame, clipped and sterilized before a 10mm midline lesion was made. Skin and fascia was reflected and craniotomy was performed on the right parietal bone. Lector StereoOne impact device was positioned on the dural surface and the injury was performed at 0.5mm, 1.5mm, or 2.00 mm

Results: Relative to sham and HFHI mice, a significant decrease in DCX positive cells of CCI mice was seen. This result may indicate an increase neuronal death or a decrease in neurogenesis at 3 days post CCI. HFHI mice demonstrated a slight decrease in DCX positive cells, however it was not significant relative to sham mice possibly indicating less death in our HFHI model consistent with our earlier findings. As the severity of injury in CCI mice increased from 0.5mm to 2.0mm, a significant decrease in neurogenesis was presented. Our results suggest that injury severity exhibits impaired neurogenesis which reflects poor performance on the MWM test.

Conclusions: The decrease seen in CCI mice could be explained by the vulnerability of new born neurons to TBI and susceptibility of these neurons to death.

Clinical Relevance: Traumatic brain injury (TBI) affects 30% of young adults and children, and high treatment costs can leave patients with cognitive impairments (McCarthy et al., 2005)

References:

- McCarthy ML, MacKenzie EJ, Durbin DR, Aitken ME, Jaffe KM, Paidas CN, Slomine BS, Dorsch AM, Berk RA, Christensen JR, Ding R. The Pediatric Quality of Life Inventory: an evaluation of its reliability and validity for children with traumatic brain injury. *Arch Phys Med Rehabil*. 2005; 86:1901-1909.
- Gao, X., Deng, A., Bryant, Y., Cho, W., Carrico, K. M., Hall, E. D., & Chen, J. (2008). Selective death of newborn neurons in hippocampal dentate gyrus following moderate experimental traumatic brain injury. *Journal of Neuroscience Research*, 86(10), 2258-2270. doi:10.1002/jnr.21677
- Wang, X., Gao, X., Michalski, S., Zhao, S., & Chen, J. (2016). Traumatic Brain Injury Severity Affects Neurogenesis in Adult Mouse Hippocampus. *Journal of neurotrauma*, 33(8), 721-733. doi:10.1089/neu.2015.4097
- Peng, L., & Bonaguidi, M. A. (2018). Function and Dysfunction of Adult Hippocampal Neurogenesis in Regeneration and Disease. *The American journal of pathology*, 188(1), 23-28. doi:10.1016/j.ajpath.2017.09.004
- Chapman DP, Sloley SS, Caccavano AP, Vicini S, Burns MP. High-Frequency Head Impact Disrupts Hippocampal Neural Ensemble Dynamics. *Front Cell Neurosci*. 2022 Jan 18;15:763423. doi: 10.3389/fncel.2021.763423. PMID: 35115908; PMCID: PMC8806157.

Benefits of Acting Creates Therapeutic Success (ACTS): Perceptions of Participants and Care Partners

Kaitlyn Bailey, OTS; Stevie Bruesch, OTS, RYT 500, TIYT; Anna Sanders, OTS; Caitlyn Welch, OTS; Jennifer Moore, PhD., OTR/L, FAOTA, CLA

Purpose: This study was conducted to explore the impact of an occupational therapy community-based performing arts program for individuals with intellectual and developmental disabilities (IDD) on skills needed for occupational performance and engagement. Specifically, the study aimed to determine the perceived benefits of ACTS by the program participants and their care partners. Secondly, it aims to explore whether there is evidence of skill generalization, in alignment with the principles of the Theory of Occupational Adaptation, as participants apply the skills acquired from ACTS into various aspects of their daily occupations.

Participants: ACTS is an occupational therapy led community based performing arts program designed for individuals with IDD; providing opportunities for engagement in the performing arts. Study participants included 17 adults with a diagnosis of IDD and their 14 care partners. Length of time in ACTS did not impact study eligibility.

Methods: Focus groups utilizing semi-structured interview questions were conducted due to their effectiveness in eliciting participant views and opinions (Creswell & Creswell, 2023). Focus group interviews were recorded and transcribed using Microsoft software, coded, and analyzed for themes.

Results: Preliminary themes identified: a) enhanced social interaction, b) improved emotional regulation, c) feelings of autonomy, d) increased opportunity for physical activity, e) greater occupational performance, f) and a sense of belonging to a community.

Conclusion: Based on thematic analysis, ACTS offers a positive impact on the sensorimotor, cognitive, and psychosocial systems of the individuals in the program.

Clinical Relevance: The results of this study suggest that participation in an occupational therapy led community based performing arts program is recommended by the researchers for individuals who have been diagnosed with IDD to improve occupational performance and engagement.

References:

- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.
- Schkade, J.K., & Schultz, S. (1992). Occupational adaptation: Toward a holistic approach to contemporary practice, Part 1. *American Journal of Occupational Therapy*, 46, 829- 837.
- Schkade, J.K., & Schultz, S. (1992). Occupational adaptation: Toward a holistic approach to contemporary practice, Part 2. *American Journal of Occupational Therapy*, 46, 917- 926.

Rosiglitazone

Evelyn A. Bates, MS; Zachary A. Kipp, Sally N. Pauss, Wang-Hsin Lee, Genesee Martinez, Mei Xu, PhD; Terry D. Hinds, Jr, PhD

Purpose and Hypothesis:

Rosiglitazone, a thiazolidinedione, treats T2DM by improving insulin resistance. Its use has been halted due to a subset of patients developing CHF through unknown mechanisms(1).

Rosiglitazone targets PPAR γ , a nuclear receptor highly expressed in adipose tissue and, to a lesser extent, in cardiac tissue. An important mechanism of PPAR γ regulation is through coregulators that can alter transcriptional activity through protein-protein interaction to drive PPAR γ toward specific pathways(2). We hypothesized coregulator interaction with PPAR γ may regulate its activity differently in adiposity, inducing CHF through adipose-derived peripheral signaling.

Materials and Methods:

To address this, we fed 8-week-old C57BL/6 mice a normal chow (NCD) or high-fat (HFD) diet for 16 weeks. Mice were then injected with rosiglitazone every 48 hours for 4 weeks. In NCD and HFD Rosi mice, we found significantly increased heart weights (p-value<0.05) and various weight changes in five adipose depots. To understand the roles of the PPAR γ coregulator interactome in adiposity, we used our state-of-the-art PamGene PamStation Nuclear Hormone Receptor chip to measure the interaction of PPAR γ with 155 coregulators in five adipose depots and the liver.

Results:

In adipose depots increasing in weight due to Rosi treatment, such as retroperitoneal white adipose tissue (WAT) and mesenteric WAT, more coregulators associated with the PPAR γ complex. Conversely, depots that did not change in weight with Rosi treatment, such as epididymal WAT and inguinal WAT, showed a reduction of coregulators leaving the PPAR γ complex, indicating differential PPAR γ regulation.

Conclusions:

Our data suggests that the coregulator interactome of PPAR γ in adipose depots represents potential therapeutic targets, and understanding how PPAR γ regulation is different in adiposity is crucial to understanding the negative side effects of rosiglitazone treatment.

1. Juurlink DN, Gomes T, Lipscombe LL, Austin PC, Hux JE, Mamdani MM. Adverse cardiovascular events during treatment with pioglitazone and rosiglitazone: population based cohort study. *Bmj*. 2009;339:b2942. Epub 2009/08/20. doi: 10.1136/bmj.b2942. PubMed PMID: 19690342; PMCID: PMC2728804.

2. Koppen A, Kalkhoven E. Brown vs white adipocytes: The PPAR γ coregulator story. *FEBS Letters*. 2010;584(15):3250-9. doi: <https://doi.org/10.1016/j.febslet.2010.06.035>.

Cochlea structural differences in primates with distinct calling patterns (*Homo sapiens*, *Hylobates* sp., and *Papio* sp)

Dalton Black (OMS II), Aiyan Rahman (OMS II), Ahmad Khoncarly (OMS II), Caitlin Yoakum, Ph.D.

Purpose: Inner ear structures such as the cochlea and semicircular canals, which have been correlated to sensitivity of head movements and other locomotion features, vary greatly between primate species (Ekdale, 2015). The semicircular canals have been studied extensively because of the known correlation between locomotive style and head orientation (e.g., El Khoury et al., 2014), but little research has focused on correlations between the cochlea and communication patterns. Communication styles vary greatly among non-human primates, tend to follow that of a Caller/Listener style, and have a smaller variety of call sounds but can modify and alter these calls in various contexts (Cheney & Seyfarth, 2018). Humans use extensive patterns of speech and sounds to communicate, *Papio* has a speech pattern with a loose correlation to the vowel structures of humans (Bov' et al., 2017), while *Hylobates* uses a song-like style of communication for long distances with characteristic 'hoo' sounds for short distances (Clarke et al., 2015). Both *Papio* and *Hylobates* have noted differences in sounds and calls between the sexes.

Materials/Methods: The purpose of this study is to assess cochlea variation based on communication differences between three species of primates (*Homo sapiens*, $n = 15$; *Papio* sp., $n = 8$; *Hylobates* sp., $n = 10$) using CT scans. 3D reconstructions of the inner ear structures were digitally segmented to attain measurements for cochlea length, width, total spiral length, and total volume.

Results: T-tests using size-adjusted variables showed sexual dimorphism in all measurements of *Homo* and *Papio* (all p -values > 0.05), while *Hylobates* showed no significant differences between the sexes. PGLS analyses showed a significant and highly correlated relationship between the length of the cochlea spiral and cochlear volume ($p = 0.014$; $R^2 = 0.973$) when all species were combined, with no overlap in species values. Finally, ANOVAs showed significant differences in cochlea spiral length, cochlea volume, and cochlea length between all three species, with *Hylobates* showing overwhelmingly larger values, *Papio* in the mid-range, and *Homo* with the smallest values in all variables (all p -values < 0.05).

Conclusions: These results appear to support the hypothesis that a larger cochlea is needed for longer and louder calls in primates because it would increase the surface area, and thus nervous structures that interpret sounds. These findings strongly encourage future research in understanding cochlear variation among primate species and the cellular structures that support sound interpretation in different calling patterns.

Citations:

Bov' LJ, Berthommier F, Legou T, Captier G, Kemp C, Sawallis TR, Becker Y, Rey A, Fagot J. 2017. Evidence of a vocalic proto-system in the baboon (*Papio Papio*) suggests pre-hominin speech precursors. PLOS ONE, 12(1): e0169321. <https://doi.org/10.1371/journal.pone.0169321>.
Cheney DL, Seyfarth RM. 2018. Flexible usage and social function in primate vocalizations. Proceedings of the National Academy of Sciences, 115(9): 1974-1979. <https://doi.org/10.1073/pnas.1717572115>.
Clarke E, Reichard UH, Zuberbuhler K. 2015. Context-specific close-range 'hoo' calls in wild gibbons (*Hylobates lar*). BMC Ecology and Evolution, 15(56). <https://doi.org/10.1186/s12862-015-0332-2>.
Ekdale EG. 2015. Form and function of the mammalian inner ear. Journal of Anatomy, 228(2): 324-337. <https://doi.org/10.1111/joa.12308>.

El Khoury M, Braga J, Dumoncel J, Nancy J, Esclassan R, Vaysse F. 2014. The human semicircular canals orientation is more similar to the bonobos than to the chimpanzees. PLOS ONE, 9(4): e93824. <https://doi.org/10.1371/journal.pone.0093824>.

Polyunsaturated fatty acids (PUFA) and its role in mitochondrial dysfunction and the development of insulin resistance and obesity.

Kevin Chen, MD

Purpose:

Saturated fat (SF) is widely recognized as the culprit for cardiovascular disease across the medical profession and is thought to be conventional wisdom to a certain degree. However, the validity to that general notion is flimsy and has no rigorous evidence to support it. This abstract is an exploration of the detrimental effects of replacing SF with PUFA in the diet and how it in fact, promotes insulin resistance.

Description:

Polyunsaturated fatty acids (PUFA) have steadily become a greater proportion of the American diet given the movement away from saturated fats in an attempt to lower LDL cholesterol. The consumption of PUFA in the diet destines its incorporation into the phospholipid layers of cells within the body. The phospholipid layer of the inner mitochondrial membrane (IMM) houses the complexes of the electron transport chain (ETC). Molecules called cardiolipins, stabilize the ETC complexes and maintain the integrity of the conglomerate structure of the ETC along with the membrane potential. Despite the importance of mitochondrial function in metabolism, the effects of PUFA on cardiolipin and mitochondrial physiology remain poorly understood. PUFA in the diet generates cardiolipin composed of n-6 PUFA linoleic acid in greater numbers. This specific composition combined with the reactive oxygen species (ROS) produced from respiration lends to a propensity for the cardiolipin to auto-oxidize, thereby losing its structural integrity and inducing a profound loss of cardiolipin levels. Decreases in cardiolipin levels result in a loss of oxidative phosphorylation activity and subsequently mitochondrial ATP synthesis. Consequentially, spontaneous oxidation of the n-6 phospholipid molecules within mitochondria deranges cardiolipin structure and compromises ETC function, leading to inhibition of ATP synthase and efficiency in ATP production. Mitochondrial mass, structure, and function are altered in insulin resistance. Defects of mitochondria are believed to contribute to impaired fat oxidation and to the accumulation of intramyocellular lipid intermediates which contribute to the pathogenesis of insulin resistance. The impaired fuel utilization due to structural damage to the mitochondria by PUFA in the diet thus has implications in the etiologies of metabolic syndrome and obesity.

Summary of Use: PUFA in the diet has rendered the mitochondria dysfunctional to devastating effects in the general population. Obesity and diabetes rates have climbed to record highs despite considerable investment in energy and resources in combating said conditions. The explosion in the prevalence of these disease states is negatively influencing health outcomes, mortality, and overall quality of life.

Importance to Members: Excess PUFA, particularly linoleic acid, is negatively impacting mitochondrial function and in doing so, crippling cell energy production. The ubiquitous nature

of PUFA in the human food supply is actively harming people as it accumulates in their cells. Moreover, promoting insulin resistance in patients and healthcare workers alike is antithetical to the essential mission of a hospital. It would be prudent for dietary sources of PUFAs to be removed from the food supply within the healthcare setting, let alone in general to promote better health for all persons.

References:

Dasuri K, Ebenezer P, Fernandez-Kim SO, Zhang L, Gao Z, Bruce-Keller AJ, Freeman LR, Keller JN. Role of physiological levels of 4-hydroxynonenal on adipocyte biology: implications for obesity and metabolic syndrome. *Free Radic Res*. 2013 Jan;47(1):8-19. doi: 10.3109/10715762.2012.733003. Epub 2012 Oct 16. PMID: 23025469; PMCID: PMC4038367.

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Transitioning of Pediatric Care to Adult Medicine

Cynthia Chow, MD

Conway Regional Health System, Family Medicine Residency

Optimal health care is achieved when each person, at every age, receives medically and developmentally appropriate care. The goal of planned health care transition is to maximize lifelong functioning and well-being for all youth, including those who have special health care needs. Ensuring continuity of care has been shown to be associated with better uptake of routine health services such as immunization and preventive services. According to the AAP, a well-timed transition from child to adult oriented health care is specific to each person and ideally occurs between ages of 18-21 years. Transitioning is a combined process that includes the coordination of the patient, family and provider to ensure seamless graduation into adult roles and activities. The National Survey of Children's Health found that only 15 percent of youth receive assistance from their health care professionals in planning the transition from pediatric, parent-supervised care to more independent adult care. The goal of this study aims to advance the practice-based implementation of planning, decision-making, and documentation processes of youth who are approaching graduation of pediatric care to instill a fluent conversion to adult care. This study design looks at patients specifically from Central Arkansas Pediatrics who are graduating out of pediatric care and transitioning into adult medicine. The study will include patients who are between ages 16-21 years of age and pre-data set information will consist of patients who have successfully transitioned to Conway Medical Group from Central Arkansas Pediatrics within the last 6 months. Data gathered previously will be compared to the new set of data 6 months after initiation of intervention to ensure effective transitioning. Intervention methods will include pamphlets and handouts given to patients and family that include essential information about the importance of transitioning, encouragement, advice from pediatric providers regarding their next steps after graduation, and information of services provided at Conway Medical Group. The two data sets were gathered and compared which showed that prior to intervention, Conway Medical Group had an average of 19 pediatric patients per month whereas after intervention, there was an average of 77 pediatric patients per month. This was reflective of a 305% increase in average numbers and patients who were able to continue continuity of care.

In conclusion, the transition from pediatric to adult healthcare represents a critical time in an adolescent's developmental trajectory, regardless of background. For youth with chronic conditions and/or developmental disabilities, this changeover can be even more critical with significant and lifelong implications. It is essential for primary care providers to raise awareness in this particular time to help bridge health gaps.

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Incidental Finding of an Extralobar Sequestration: A Case Report

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Introduction

Extralobar Sequestration is a relatively rare type of congenital lung abnormality most often diagnosed via prenatal anatomy scans. Its pathophysiology is not well understood, however, given its potentially serious complications, this case report serves to highlight the importance of prenatal screening as it could lead to rare complications if not addressed.

Case Presentation

73-year-old Vietnamese female initially presented for a syncopal episode. An x ray showed a possible mediastinal mass which was concerning given her prior history of treated TB. A subsequent CT chest ruled out any mediastinal mass but did incidentally show bronchopulmonary sequestration in the left lower lobe measuring 5 x 5.5 cm. She was evaluated by Cardiothoracic surgery who recommended elective left thoracotomy with excision. Care was taken during surgery to identify and avoid injuring the arterial supply coming directly off of the thoracic descending aorta. The sequestration was removed in its entirety once the anomalous arterial supply was isolated. The excised tissue was identified as noncancerous.

Conclusion

Bronchopulmonary sequestration is a rare condition that typically presents as a finding in prenatal anatomic screening, they typically regress however, some lesions, such as those found in our case patient, can develop rare complications such as heart failure through the anomalous artery, mass bleeding, or torsion. The decision between surgical management and observation of asymptomatic sequestrations remains controversial. In this scenario, our patient was discharged in stable condition, and upon follow up, had been found to be asymptomatic on reevaluation.

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Moya Moya: A Case Report

Nancy Damrah PhD, Mohammed Owais MD, Komal Abbas, Mohammed Rasouly

Moyamoya disease (MMD) is characterized by chronic cerebrovascular occlusions of unknown etiology in predominantly female Asian populations with a history of tobacco use. In this case, a 24-year-old female presented with a one-week history of left-sided numbness and tingling. Initial symptoms included severe headache, blurred vision, and left-hand involvement, progressing to the upper and lower extremities. CT angiography revealed high-grade stenosis in the right middle cerebral artery (MCA) M1 segment and the proximal left MCA M1 division. Further MRI clarified an acute infarct in the right anterior cerebral artery (ACA) and MCA watershed distribution. The patient, discharged on a three-month dual antiplatelet and statin therapy, reported complete symptom resolution. A neurosurgery referral was made for potential intervention. This case underscores the significance of prompt diagnosis, intervention, and multidisciplinary management in Moyamoya disease.

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Moyamoya syndrome associated with Sickle Cell disease resulting in hemorrhagic stroke.

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Moyamoya Syndrome is a rare chronic cerebral occlusive vasculopathy resulting in progressive narrowing of the major intracranial vessels. Subsequently, occlusion of the supraclinoid internal carotid arteries and the circle of Willis occur, accompanied by proliferation of arterial collaterals in proximity to the site of occlusion at the base of the brain. Moyamoya syndrome has been associated with diverse pathological conditions such as Down's syndrome, neurofibromatosis, sickle cell disease, trauma, and radiation exposure. Moyamoya, which translated means "puff of smoke" was the term coined by Suzuki and Takaku in 1969 to describe the appearance of the network of collaterals.

Case Description:

32 year old male with history of homozygous S Sickle cell disease, past acute chest syndrome, two cerebrovascular accidents, recurrent priapism, and pulmonary hypertension. He presented to the hospital after being found down at the light rail station and altered.

On examination, he was aphasic and plegic on the right side. Labs showed Hb-8.7, WBC-12.2 and Hct -25.5 and INR-1.3. The differential included ischemic stroke, hemorrhagic stroke, seizure, toxic encephalopathy, traumatic epidural hematoma

Head CT scan demonstrated a large left basal ganglia hemorrhage with intraventricular extension and obstructive hydrocephalus along with early uncal herniation. An external ventricular drain placed and evacuation of the hematoma and a decompressive craniectomy was performed.

A formal diagnostic cerebral angiogram provided the diagnosis of Moyamoya syndrome demonstrating the left supraclinoid internal carotid artery stenosis and basal collaterals supplying the left middle cerebral and anterior cerebral territory.

Discussion:

Patients with Sickle Cell disease and associated Moyamoya Syndrome cerebral vasculature are at increased risk for stroke and hemorrhage. The fragile Moyamoya vessels that form at the base of the brain are thin-walled and dilated or thick walled and stenotic and are prone to hemorrhage. It is important to consider the diagnosis of Moyamoya syndrome in patients with a past history of cerebrovascular accidents. Timely diagnosis and treatment could prevent life threatening hemorrhagic strokes in this population.

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Characteristics of Moyamoya Syndrome in Sickle-Cell Disease by Magnetic Resonance Angiography: An Adult-Cohort Study Paul Kauv,1,*
Novmie Gaudrion,2 Jovanne Hodel,1 Titien Tuilier,1 Anoosha Habibi,2 Catherine Oppenheim,3 Myriam Edjlali,3 Dominique Hervé,4
David Calvet,5 and Pablo Bartolucci,2,6

Cerebral Revascularization for Moyamoya Syndrome Associated with Sickle Cell Disease: A Systematic Review of the Literature on the Role of Extracranial-Intracranial Bypass in Treating Neurologic Manifestations of Pediatric Patients with Sickle Cell Disease Danielle Terrell 1, Amey R. Savardekar 1, Stephen Garrett Whipple 1, Rimal H. Dossani 1, Robert F. Spetzler 2, Hai Sun 3

Moyamoya disease and syndrome: a review Zeferino Demartini Jr.,1,2,3 Bernardo CA. Teixeira,1,2 Gelson Luis Koppe,2,3 Luana A. Maranhão Gatto,3 Alex Roman,4 and Renato Puppi Munhoz5

Moyamoya Disease: A Rare Sickle Cell Trait Neurological Complication Hassan Al-Jafar1*, Khaled Hashem2, Ali Abo Alhasan3, Shashishekhar Lamdhade4, Salma AlDallal1, and Fayza Abdulla Alhajri
Stroke Prevention and Treatment in Sickle Cell Disease Robert J. Adams, MS, MD

Common Genetic Variation in Humans Impacts In Vitro Susceptibility to SARS-CoV-2 Infection

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Purpose/Hypothesis: The purpose of this study is to emphasize the significance of human genetic variations in influencing susceptibility and resistance to viral diseases, particularly in the context of COVID-19 caused by SARS-CoV-2. The main focus is on the *FURIN* gene and its potential role in the SARS-CoV-2 infection process.

Methods: This study employed a variety of techniques, including the differentiation of induced pluripotent stem cells (iPSCs) into neurons, the cultivation of lung alveolospheres and intestinal organoids, along with the utilization of RNA sequencing, qPCR, Fluorescent in situ hybridization (FISH), immunoblotting, and Fluorescent activated cell sorting.

Results: Our results underscore the significance of *FURIN* in facilitating SARS-CoV-2 infection and demonstrate that the common variant rs4702, located in the *FURIN* gene, influences SARS-CoV-2 infection in vitro. Specifically, using CRISPR-Cas9, we converted the common variant from AA to GG, resulting in reduced *FURIN* expression and decreased SARS-CoV-2 infection in neurons and alveolar cells. This study exemplifies how common genetic variations can directly impact SARS-CoV-2 infection.

Conclusion: This study employed hiPSC-based models to delve into the genetic factors affecting cell-specific responses to SARS-CoV-2. It notably confirmed SARS-CoV-2 infection in post-mitotic human neurons and provided functional validation for the influence of host genes (*ACE2*, *FURIN*, *BSG*, *TMPRSS2*) and the genetic variant rs4702 on SARS-CoV-2 infection in different cell types (neurons, lung, and intestinal cells). *FURIN* emerged as a critical mediator for SARS-CoV-2 infection, and the common variant rs4702, located in the *FURIN* gene, showed in vitro effects on infection. The research underscores the need for larger-scale GWAS to comprehensively explore the genetic factors impacting COVID-19 outcomes and identifies key host genes with potential for drug targeting. However, clinical translation remains intricate, considering the interplay of genetic and environmental elements, cell maturity, and tissue-specific responses to infection. In conclusion, this study highlights the potential of genetic variation in predicting COVID-19 outcomes and aiding in drug discovery.

Clinical Significance: Variability in the host response to SARS-CoV-2 is significant, impacting the severity of COVID-19. This study's critical finding is that a common genetic variant (rs4702) affects SARS-CoV-2 infection in alveolar and neuron cells in vitro. This discovery suggests that genetic variation can influence clinical outcomes, potentially aiding high-risk individual

identification and drug development.

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Immobilization of α -glucosidase on silica-coated magnetic particles: studies in recyclability, storage, and stability as a function of enzyme and ligand density

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Purpose: Green energy

The hydrolysis of cellobiose to glucose by the enzyme α -glucosidase is the rate-limiting step in the enzymatic hydrolysis of cellulose to glucose, which is industrially relevant to the production of biofuels from lignocellulosic feedstock. Due to the investment cost of the enzymes required, the commercial feasibility of bioethanol derived from lignocellulose can only be actualized if the cellulases prove to possess high activity and a long catalytic lifetime. Recyclability, storage, and stability over time remain important parameters. In the present work, α -glucosidase was immobilized on silica-coated iron oxide particles to optimize enzyme recovery, catalytic activity, storage, and stability in the context of a reusable, biologically derived catalyst.

Materials and methods: The synthesized iron oxide particles were coated with silica and functionalized with various densities of (3-aminopropyl)triethoxysilane (APTES) ligand to obtain particles with amine densities ranging from 0 to 3 $\times 10^{-5}$ mol/g particle, which corresponds to 0 to 9 NH_2/nm^2 . Homobifunctional molecule glutaraldehyde was used for covalent linkage between amines on the particle and enzyme. D-glucose-1- α -paranitrophenol was used as glucose analog. Cleaved paranitrophenol was measured by UV/Vis spectroscopy. Results: Two different relationships exist between retained specific activity post-immobilization based upon the concentration of enzyme solution used for immobilization and APTES ligand density. No difference in immobilized specific enzyme activity was observed for any APTES density and increasing in the APTES density led to an increase in storage stability for dilute enzyme presentation. When enzyme load was concentrated, the storage stability remained unaffected by the APTES density, while the specific activity decreased with increasing APTES densities. The particles immobilized at a low enzyme concentration with high ligand density have high specific activity and retain this activity during storage. Recyclability of the particles via neodymium magnet remained constant at $<5.0\%$ despite APTES and enzyme densities through period of study.

Conclusions: The results highlight the importance in studying both the ligand density on particles and the density of immobilized enzyme for optimal enzymatic activity/stability.

Clinical Relevance: Enzyme immobilization stands to potentially revolutionize our approach to energy acquisition and represents a platform for the development of novel strategies for the pharmaceutical and food industries. Also, current studies are underway to explore how this can be used to purify bacterially contaminated water.

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Ratings and experiences in using a mobile application to increase physical activity among university students: implications for future design.

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Purpose

University students have low levels of physical activity and are at risk of mental health disorders. Mobile apps to encourage physical activity can help students, who are frequent smartphone-users, to improve their physical and mental health. Here we report students' qualitative feedback on a physical activity smartphone app with motivational text messaging. We provide recommendations for the design of future apps.

Subjects

Students from the University of California, Berkeley participated in this study and a select group of students provided qualitative feedback on their experience. The majority of participants were female (69.9%), Asian or Pacific Islander (53.4%), with a mean age of 20.2 years, and 63% had elevated depressive symptoms.

Methods

103 students used the app for 6 weeks in the context of a clinical trial and answered open-ended questions before the start of the study and at follow-up. A subsample (n= 39) provided additional feedback via text message, and a phone interview (n = 8). Questions focused on the perceived encouragement and support by the app, text messaging content, and recommendations for future applications. We analyzed all transcripts for emerging themes using qualitative coding in Dedoose.

Conclusions

Overall, participants' opinions about the texting system were very mixed. Qualitative data indicated that participants liked messages on the physical and mental health benefits of exercise, positively framed content and concrete feedback on their steps. Participants disliked messages that did not match their motivations to physical activity, were not context dependent, or had a discouraging tone. Physical activity apps for students should be adapted to their motivations, changing daily context, and mental health issues. Digital interventions can benefit from going beyond a one-size-fits-all approach. Student physical activity text messaging systems should: (1) be personalized/contextualized; (2) provide concrete and varied feedback; (3) incorporate mental health support; and (4) adapt to the user's physical activity barriers/motivations.

Clinical Relevance

University students are an at-risk sample for physical inactivity and mental health disorders. More digital interventions need to be designed for this population. Previous work has long acknowledged that persuasive technologies for physical activity need to accommodate the individual, as changing needs considering personalization is among the top 10 most effective strategies for behavior change. This study helps provide knowledge on how to design effective

text messaging for physical activity promotion in university students.

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Improving Blood Pressure Control through DASH Diet Education

Reagan Garber, DO

Purpose

Blood pressure related diseases are the leading causes of morbidity and mortality throughout the world.

The DASH diet consists of four to five servings of fruit, four to five servings of vegetables, two to three servings of low fat dairy per day, and < 25% dietary intake from fat. It has been shown to decrease blood pressure.

For this project, patients with a diagnosis of hypertension with uncontrolled blood pressure (defined as greater than 140 systolic and/or greater than 90 diastolic) were provided a DASH diet handout from their provider in addition to normal pharmacological interventions. The measured outcome of this study was the change of blood pressure control with goal outcome to have 10% improvement in blood pressure control.

Subjects

Patients within the residency clinic with a diagnosis of hypertension. 7449 were seen in the pre-intervention period and 6450 were seen in the intervention period.

Methods

Updated DASH diet patient handouts were created and resident providers were offered educational time on the DASH diet. Data was obtained through an EMR report for patients with a diagnosis of hypertension before and after the intervention period. Data during both periods was obtained by calculating the number of patients with controlled blood pressure divided by the total number of patients seen during the two periods with a diagnosis of hypertension.

Results

During the pre-intervention period, the clinic had a 68.44% (5098/7449) rate of blood pressure control compared to 71.2% (4593/6450) during the intervention period. Overall there was a 2.76% increase in blood pressure control.

Conclusions

While implementing DASH diet education did increase blood pressure control, it did not meet the goal of having a 10% improvement.

There were several limitations to the study that could have contributed to not meeting the goal level of improvement. First, the study performed over 2 months for both periods.

Another limitation was the accessibility of the DASH diet handouts. The lack of handouts in a patient room limited how many patients received the handout when they met criteria for it.

There were confounding variables that could contribute to the improvement in blood pressure control such as medication adjustments, weight loss, and improvement in medication compliance.

Clinical Relevance

Overall, education on lifestyle modification including the DASH diet is a meaningful way to help improve blood pressure control in addition to standard pharmacologic therapy.

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Smoking Cessation: QI Project

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Approximately 933.1 million people smoke globally. Cigarette smoking is the leading preventable cause of death, responsible for 7 million deaths worldwide and 480,000 deaths annually in the US, which is nearly 1 of every 5 deaths. More deaths are caused each year by smoking than from HIV, substance abuse, MVCs, and firearms combined. If current trends persist, tobacco use will kill more than 8 million people worldwide annually by 2030. Smoking cessation reduces the risk of adverse health effects, including cardiovascular disease, pulmonary disease, cancer, and poor reproductive health outcomes. By addressing smoking cessation, the hope is to prevent these conditions and prolong patients' lives.

Screening each patient for tobacco use and providing combined behavioral counseling and pharmacotherapy to quit smoking are among some of the most valuable preventive health services offered in primary care clinics. Clinician involvement increases the likelihood that patients will successfully stop smoking. The overall goal is to routinely identify individuals who smoke tobacco products and offer them evidence-based help to quit. The USPSTF recommends that a patient's smoking status be evaluated and documented at each clinical encounter. The practice of routinely inquiring about tobacco usage has proven to increase smoking-related discussions and cessation rates.

For this study, Conway Medical Group (CMG) patients were evaluated over a 6-month period. All patients who screened positive for smoking were included.

To increase the number of patients undergoing smoking cessation therapy, both clinical staff and physicians underwent smoker-related education. Staff was reminded to ask and correctly document smoking status at each visit, and if the patient screened positive, to highlight this on the physician intake forms to ensure that it was brought to the physician's attention. Physician education included a presentation on 9/8/2022 by Dr. Lily Fran Guastella covering motivational interviewing for smoking cessation and current treatment options. In addition, a smoking cessation poster was displayed throughout the CMG clinic prompting patients to ask their doctor more about quitting.

Post-data was collected after both educational interventions were completed and poster implementation was in place. The total number of patients actively quitting increased by greater than 4-fold (3% to 13%).

Therefore, there is evidence to support that brief (<5 minutes) clinician motivational interviewing to quit at each visit can increase smoking cessation rates, even though not all patients will be ready to quit instantly. Smokers must be informed that effective treatments exist,

and that the clinician is ready and willing to help them overcome any obstacles. With continued staff, physician, and patient education, smoking cessation promotion will be an ongoing aspect of quality improvement at CMG.

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Extended Survival: Lung Compensation Post-Pneumonectomy

Madelyn Frye, Colton Grindal, Rachel Latterich, Heather Guzik, MA, Caitlin Yoakum, PhD, Joanne Peterson, PhD

A pneumonectomy is a surgical procedure where an entire lung is removed from the thoracic cavity. Due to the reduction in respiratory function and capacity, indications for the operation usually are limited to neoplasms and malignant growths in the lung. Close care needs to be given as there is high risk of post-operative complications and mortality, especially in patients over 40 years of age.¹ Over time, pulmonary function and capacity begin to improve post-surgery, suggesting that the remaining lung not only improves in function but also in size.^{2,3,4} This compensatory lung growth has been well observed in animal models, but sparsely documented in humans.^{3,5,6,7} In our case study, we present a patient who underwent a pneumonectomy at age 43, lived for 24 years with little known complications, and eventually died due to chronic obstructive pulmonary disease (COPD). Given the high rate of postoperative complications in his age group, our patient's outcome was unique. Postmortem, significant compensatory lung growth was observed which would have recovered significant levels of lost pulmonary function. Certain lifestyle habits such as pulmonary rehabilitation, post-operative counseling, and exercise have been indicated to improve pulmonary function, decrease length of stay in hospital, and reduce risk of postoperative complications.^{8,9,10} As care plans of pneumonectomy patients are developed, physicians should consider the addition of these components to the plan of care to increase compensatory growth, leading to better prognosis.

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Exploring Factors Associated with Human papillomavirus Vaccination Decision-making among Caregivers in Sebastian County (Arkansas) and Surrounding Areas

Cindy Fuller PhD, Marya Ali OMS2 at ARCOM

The objective of this study is to gain insight into the perspectives of parents or caregivers of Fort Smith area children aged 9-17 years regarding factors influencing their decision on whether to vaccinate their child with the Human Papillomavirus (HPV) vaccine (Gardasil 9) over the next three years. Researchers will explore socio-demographic factors, knowledge of HPV and Gardasil 9 vaccine, and perceived barriers and behavior regarding the Gardasil 9 vaccine using an anonymous survey distributed in local physician offices. The relationship between these factors and willingness to vaccinate with the Gardasil 9 vaccine will be assessed using descriptive statistics. We anticipate that the results of this survey could be used to weigh the relative factors that a primary care physician could use to address HPV vaccine hesitancy. Understanding parental perspective and areas of major concerns in regard to the Gardasil 9 vaccine may assist health care providers and public health community leaders in focusing on the factors that appear to cause the strongest vaccine hesitancy directly with parents/caregivers.

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Small Bowel Adenocarcinoma: A Case Report

Samantha Halen, Amber Mawji, Paul Maher, MD

Background & Purpose:

Small bowel adenocarcinomas (SBAs) are a rare malignancy of gastrointestinal (GI) cancers, accounting for less than 10% of GI malignancies and fewer than 1% of all cancer cases in the United States. Due to their rare occurrence and nonspecific presentation, they frequently elude early diagnosis, resulting in delayed treatment and poor prognosis. Improvement in diagnostic protocols has yet to be established.

Case Description:

We present a case of a 52-year-old Caucasian female who presented with persistent nausea, vomiting, and unexplained weight loss. Diagnostics including laparoscopic examination and computed tomography (CT) scans, confirmed a diagnosis of stage IIA SBA localized to the jejunum. The patient underwent successful segmental resection of the distal jejunum, followed by six cycles of FOLFOX chemotherapy. The chemotherapy was well-tolerated, and a 4-year postoperative follow-up revealed no evidence of disease recurrence.

Outcomes:

In this atypical presentation, the significance of a 4-year postoperative follow-up with no recurrence points to the importance of early detection. This signifies the need for more effective diagnostic protocols that lead to an early diagnosis and improved patient outcomes.

Discussion:

The case underscores the importance of maintaining a high index of suspicion for SBA, particularly in patients who are otherwise healthy but present with GI symptoms. Given the scarcity of research in SBA, there is a pressing need for additional research aimed at improving early detection methods.

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Creutzfeldt Jakob Disease (CJD)

Khadijah Hamid, DO Family Medicine PGY-2

Creutzfeldt Jakob Disease (CJD) is a neurodegenerative disorder, also known as, transmissible spongiform, encephalopathy or prion, disease which can affect both humans and animals. CJD is a rare disease affecting one in a million people yearly and has a 100% fatality. Normally, there is a prion protein known as, PrP which is encoded by the, prion gene (PRNP) on chromosome, 20. In prion diseases, there is an accumulation of, PrP^{Sc}, which is the, abnormally misfolded, form of the original prion protein. The exact accumulation mechanism of the protein is unknown. Eventually the misfolding results in neuronal degeneration, gliosis, and, spongiform change" which has serious neurological manifestations. There are various categories of CJD including sporadic, familial, iatrogenic, and variant CJD with sporadic being the most common. This neurodegenerative disease is also divided into three stages which reveal, the progression of the disease. Stage one includes symptoms such as gait imbalance and, dizziness, stage two includes worsening cognitive function, and stage three involves the most serious symptoms such as decorticate rigidity, respiratory failure and eventual death. This poster will cover a case presentation in which a, 57-year-old, overall healthy and active male develops dizziness, gait disturbance, and cognitive symptoms requiring further investigation and resulting in the eventual diagnosis of this rare and devastating neurodegenerative condition. This poster will cover the patient's symptoms, diagnosis, prognosis of his condition along with the social and mental implications this disease has on the patient and his family.

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Patient Colorectal Cancer Screening Participation Rate Improvement: A QI Project

Zhexiang He, DO; Taylor Dilday, MD; Gina McNew, MD; Martin Moix, MD.

Purpose

Colorectal adenocarcinoma, commonly referred to as colorectal cancer, ranks as the third leading cause of cancer-related mortality worldwide.

In the United States, the estimated number of new colorectal cancer cases 2023 is projected to reach 153,020, making up 7.8% of all new cancer cases.

The 2017 colorectal cancer statistics reveal a decline in colorectal cancer incidence across all states between 2009 and 2013 except Arkansas. The Arkansas Center for Health Improvement reports that the incidence and mortality rates for colorectal cancer in Arkansas stood at 43.1 per 100,000 and 13.7 per 100,000 in the population, which are higher than the nationwide figures. In our efforts to enhance our patients' colon cancer screening participation rates and reduce the incidence of colorectal cancer in the community.

Subjects

The participants in this study are individuals between the ages of 45 and 74 years who had scheduled appointments with resident physicians at the Residency Continuity Clinic located in rural Arkansas. The data collection period is between May 2023 and September 2023.

Methods

The process involved providing the survey sheet to the patients, who were responsible for completing the initial questions. Subsequently, resident physicians engaged in a discussion with the patients regarding the importance of colonoscopy. After physician intervention, patients completed the final questions.

This evaluation aims to assess whether physician intervention has had a positive impact on increasing patient participation in colonoscopy procedures.

Results

During five months, a total of 124 patients participated in our intervention. 55 patients reported their colorectal prevention screen are up-to-date, 50 patients reported that their colorectal prevention screen are either overdue or never be screened, 19 patients did not know their screening status.

After physician intervention, 13 patients from the „Änot up-to-date,Ä group and 3 patients from „Äunsure,Ä group agreed for gastroenterology referral. One patient from the „Änot up-to-date,Ä group decided to choose Cologuard test.

The colorectal prevention screening rate was 44.4% before the intervention, and the expected screening rate will increase to 58.1% if all patients who decided to pursue colorectal prevention screens.

Conclusion

This study shows the potential for healthcare providers to make a substantial impact on colorectal cancer prevention by actively promoting and discussing screening options with patients.

Clinical Relevance

Physician intervention can lead to increased participation rates, contributing to the reduction of colorectal cancer incidence and improving public health outcomes.

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Removal of golden tooth crown in the cecum: a case report

Zhexiang He, DO; Ebrahim Karimjee, DO; Ruba Zein, DO; Martin Moix, MD; Grey Kendrick, MD

Introduction

Foreign body incidents represent a frequent reason for visits to the emergency department, particularly among the pediatric population. Among children, coins are the most frequently ingested foreign objects. In adults, food bolus impaction at the level of pre-existing esophageal strictures or rings is the primary cause of foreign body obstructions. The upper esophagus is the most common site of obstruction for foreign bodies, followed by the middle esophagus, stomach, pharynx, lower esophagus, and duodenum. Foreign bodies in the lower gastrointestinal tract are uncommon. In this case report, we present an incident where a foreign body was discovered in the cecum.

Case description

A 72-year-old female patient with a medical history of hypertension, atrial fibrillation, prior myocardial infarction, acid reflux disease, diverticulitis, irritable bowel syndrome, and a family history of colon cancer presented at the gastroenterology clinic for colorectal screening. The patient reports sporadic abdominal spasms and sensations of her inside was moving. She has experienced periodic pain and intermittent rectal bleeding which she attributes to hemorrhoids. Her most recent colonoscopy was five years ago, during which polyps were removed. After discussing with the patient, colonoscopy was scheduled for further evaluation. During the colonoscopy, we observed moderate diverticulosis in the sigmoid colon and identified stage II internal hemorrhoids. Furthermore, a foreign body located the cecum, which we successfully removed using a Roth net.

Subsequently, the patient recalled that she had lost one of her golden teeth crowns several months earlier, though she couldn't recall if her symptoms began around that time.

Outcome

At a follow-up visit, the patient reported that her abdominal pain symptoms were showing improvement.

Discussion

Ingestion of foreign bodies is common even among adults. Most foreign bodies traverse the gastrointestinal tract without requiring any intervention. However, in our case, the foreign body became lodged in the cecum for an extended period, likely due to its weight and density. Complications associated with foreign body ingestion encompass a range of symptoms such as nausea, vomiting, chest pain, abdominal pain, as well as more severe outcomes like perforation, penetration, bleeding, or obstruction.

The manifested symptoms of abdominal pain and rectal bleeding in our patient were likely attributed to the irritation caused by the foreign body in the cecum, particularly during bowel contractions. After successful removal of the foreign body, the patient reported an improvement in symptoms.

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Isolated Rectal Neurofibroma: a case report

Zhexiang He, DO; Shuja Khan, MD; Arthor Slaton, MD; Owen Maat, MD.

Introduction

Neurofibromas are considered benign peripheral nerve sheath tumors containing Schwann cells, fibroblasts, and perineurial cells. They commonly associate with familial disorders, such as neurofibromatosis type 1 (NF1), NF2-related schwannomatosis (formerly neurofibromatosis type 2, NF2), germline PDGFRA-mutant syndrome (formerly/neurofibromatosis 3b, INF/NF3b) intestinal neurofibromatosis, or multiple neuroendocrine neoplasia IIb. However, isolated colonic neurofibromas are very rare, and only a few cases were reported in the literature during the last several decades. We will report a rare case of isolated colonic neurofibroma.

Case Description

The patient is a 55-year-old female with a medical history of coronary artery disease (CAD) with a stent on Plavix. She was referred to the gastroenterology clinic due to abdominal pain associated with bleeding that had been occurring for a week. The patient described experiencing left lower quadrant abdominal pain with severe cramping and constipation. During this period, she had a bowel movement with blood and pus, which alleviated her pain. The episode occurred two months before her visit to the clinic. She mentioned that her symptoms have now resolved, and she is having regular daily bowel movements.

She underwent colonoscopy which revealed multiple nonbleeding diverticula which were found in the sigmoid colon, along with grade/stage II internal hemorrhoids. In the distal rectum, three sentinel polyps of benign appearance, ranging in size from 4 mm to 10 mm, were discovered. They were removed through a single piece polypectomy using a hot snare. The pathology report revealed that the polyps in the distal rectum were neurofibromas with SOX10 +, desmin -, CD117 -, DOG1 -, CD34 -.

Discussion

Neurofibromas represent benign tumors emerging from peripheral nerve sheath components, comprising Schwann cells, fibroblasts, and perineurial cells. While multiple neurofibromas are commonly associated with hereditary syndromes like NF1 and NF2, isolated neurofibromas exist but are not well-described in the literature.

Histologically, neurofibromas manifest as proliferative entities composed of Schwann cells with characteristic wavy nuclei, axons, fibroblasts, and perineurial cells.

While NF1-associated neurofibromas harbor the risk of malignant transformation into malignant peripheral nerve sheath tumors (MPNSTs), the malignancy potential for isolated colonic neurofibromas remains uncertain due to their rarity. MPNSTs are notably aggressive, contributing to low survival rates.

The clinical significance of isolated colonic neurofibromas is yet to be defined; therefore, the optimal management strategy remains uncertain. Close monitoring is advocated to both exclude the possibility of neurofibromatosis and be vigilant about the risk of malignant transformation.

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A 55-year-old Female with Plummer-Vinson Syndrome: A Case Report

Zhexiang He, DO; Russell Kline, OMS IV; Gina McNew, MD; Martin Moix, MD.

Background

Plummer-Vinson syndrome is an extremely rare condition with presentation as a classic triad of dysphagia, upper esophageal web, and iron deficiency anemia. There is no data available for the epidemiology because of the rarity of the disease. The name of Plummer-Vinson came from two physicians, Henry Stanley Plummer and Porter Paisley Vinson, who reports on a series of patients with dysphagia, iron deficiency anemia, and spasm of the upper esophagus in 1912 and 1919. After over one century after Plummer and Vision reported the first case, the etiology of Plummer-Vision syndrome remains unclear. Several proposed mechanisms include autoimmunity, genetic predisposition, and nutritional iron deficiencies but have not been proven. This case is a middle-aged female patient with a past medical history of dysphagia present with iron deficiency anemia, which is highly suspicious Plummer-Vinson syndrome.

Case Description

We present the case of a 55-year-old female with a history of dysphagia who presented with iron deficiency anemia, raising suspicion for Plummer-Vinson syndrome. The patient exhibited symptoms such as odynophagia, chronic fatigue, exertional dyspnea, and pica. Physical examination revealed conjunctival pallor, smooth tongue, angular cheilitis, and brittle nails. Laboratory findings confirmed microcytic hypochromic anemia with iron deficiency. Upper gastrointestinal endoscopy revealed the presence of an esophageal web just below the upper esophageal sphincter.

Outcome

Esophageal dilation was performed, leading to significant improvement in dysphagia symptoms. The patient's hemoglobin remained stable after iron supplementation.

Discussion

Plummer-Vinson syndrome is a rare condition, and its true prevalence is not well established. It has the classic triad of dysphagia, esophageal web, and iron deficiency anemia. The syndrome is associated with an increased risk of squamous cell carcinoma of the pharynx and esophagus. The pathogenesis of the syndrome is unclear, with iron deficiency, genetic predisposition, and autoimmune processes among the proposed mechanisms. Prompt diagnosis and management of Plummer-Vinson syndrome are crucial to improve the patient's quality of life and reduce the risk of developing malignancy.

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High Grade Neuroendocrine Tumor with Duodenal Invasion: A Case Report

Zhexiang He, DO; Sweehoney Vujjini, MD; Grey Kendrick, MD; Owen Maat, MD.

Introduction

Neuroendocrine neoplasms are a relatively rare and heterogeneous tumor type, contributing to about 0.5% of all malignancies. In the United States, the incidence rate was 5.86 cases per 100,000 per year. The most common primary site is the gastrointestinal tract, which contributes to 62-67% of cases, followed by the lung (22-27%). Pancreatic neuroendocrine tumors are rare, which contribute to about 7% of all neuroendocrine tumors and 1-2% of pancreatic neoplasms. Pancreatic NETs can metastasize to nearby lymph nodes, the liver, and even other organs, although local duodenal invasion is extremely rare. In this case report, we describe the presentation of a 66-year-old male with gastrointestinal bleeding attributed to pancreatic neuroendocrine tumors featuring duodenal invasion.

Case description

A 66-year-old male with a past medical history of hypertension, myocardial infarction, and diverticulosis presented to the emergency department due to progressing fatigue. He also reported one episode of dark stool that was attributed to hemorrhoids. After his PCP visit, a low hemoglobin level of 6.6 prompted a referral to the emergency department.

In the emergency department, his H&H were 6.6/22.0. Chemistry and liver enzyme levels were unremarkable. The CA 19-9 was 40.2 U/mL. A CT scan of the abdomen/pelvis revealed a 6.7 x 7.6 cm mass surrounding the pancreatic head. This mass closely abutted several branches of the superior mesenteric artery, the main portal vein, and the superior mesenteric vein, also inseparable from the second portion of the duodenum.

An EGD was performed and revealed extensive ulceration with surrounding polypoid tissue in the second portion of the duodenum. Pathology indicated a positive diagnosis of high-grade neuroendocrine carcinoma (NEC3) with ulceration. The tumor displayed positive markers including pankeratin, CAM 5.2, cytokeratin 7, synaptophysin, IMSM1, and CD56. The Ki67 proliferation rate was 30%.

Outcome

The patient was referred to a biliary surgeon and an oncologist. Both specialists recommended neoadjuvant chemotherapy followed by surgical resection.

Discussion

Pancreatic neuroendocrine tumors (NET, Æs) account for fewer than 2% of pancreatic malignancies. Most of them are present with abdominal pain and weight loss, and very few present with gastrointestinal bleeding. Our patient has extensive ulceration in the second portion of duodenum which has not been reported so far. Surgical resection has been proposed as the definitive treatment. Our patient has undergone neoadjuvant chemotherapy due to the size of the tumor and will undergo Whipple, Æs procedure later.

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Carcinoid Tumor in the Ampulla: a Case Report

Zhexiang He, DO; Sweehoney Vujjini, MD; Martin Moix, MD; Owen Maat, MD.

Introduction

In 1867, Theodor Langhans provided the first histological description of carcinoid tumors. These tumors are believed to originate from enterochromaffin cells located in the crypts of Lieberkuhn throughout the entire gastrointestinal system. The annual incidence rate is around 2.5 cases per 100,000 population for Caucasians and 4.0 cases per 100,000 population for Black individuals. The appendix has been the most common location, followed by the ileum, rectum, and stomach. Carcinoid tumors originating from the ampulla of Vater are rare.

We report a case of a carcinoid tumor originating from the ampulla of Vater, which causes symptoms including nausea, vomiting, and abdominal pain.

Case description

The patient is a 69-year-old Hispanic woman with PMHs of hypertension, hypothyroidism, and anemia presented at Emergency Department with complaints of abdominal pain, nausea, and vomiting for a few days. The patient mentioned intermittent abdominal pain that started approximately four months ago.

While in the emergency department, the patient had WBC 19,000 and an elevated total bilirubin level of 1.3. Imaging reveals mild dilation of the common bile duct, with a maximum diameter of 8 mm.

The patient underwent ERCP, and a benign-appearing stricture was observed at the ampulla. The cholangiogram showed diffuse dilation of the common hepatic duct and common bile duct at 9 mm in diameter.

The pathology report indicates superficial small bowel mucosa with the presence of a low-grade neuroendocrine carcinoma (NE-1), carcinoid tumor. INSM1 and synaptophysin stain were positive, and the Ki67 proliferation rate was found to be less than 1%.

Outcome

Patient underwent another two episodes of ERCPs for total resection of the carcinoid tumor. During her latest clinic appointment, the patient reported that she had been diagnosed with uterine cancer and had been scheduled for evaluation at a tertiary university hospital.

Discussion

Neuroendocrine tumors (NETs) occurring in the ampulla of Vater are exceptionally rare, with approximately 150 documented cases to date. Our patient was presented with atypical symptoms, including abdominal pain, nausea, and vomiting. In addition to the characteristics of the tumor, a lower income level and residing in a rural area have been associated with poorer survival rates for patients with NETs.

Our patient successfully underwent a complete resection of the low-grade tumor. Remarkably, a new diagnosis of uterine cancer has emerged, raising concerns about the possibility of an unusual presentation.

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Assessment of Physiological Responses in Students with Learning Disabilities Using the Stress Performance Evaluation (SPE) Method

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Stress induces a physiological response in the brain, increasing cortisol, heart rate, and blood pressure, which may hinder academic performance. Test anxiety can affect students' performance, especially those with learning disabilities (LD). Students with LD may experience stress during testing, leading to more frustration, fear, and anxiety. I developed a method to evaluate these stressors and analyze the best scenarios for individuals during testing, which I called the stress performance evaluation (SPE) method. SPE considers the correct answers and the percent of change in heart rate (heart rate before and after testing). To validate the SPE method, three students were used to quantify how different testing scenarios affect children with LD, their stress levels, and the best placement for testing. All students showed a significantly higher heart rate in a large group using paper and pencil than in a small group using a computer. SPE holds the potential to enhance future testing parameters, enabling a deeper exploration of factors influencing the academic performance of students in K-12, and can hold valuable insights for students in higher education and beyond.

Neurocranial Growth in the OIM Mouse Model of Osteogenesis Imperfecta

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Introduction: Osteogenesis imperfecta (OI) is a disorder of type I collagen characterized by abnormal bone formation. The OI craniofacial phenotype includes midfacial underdevelopment, as well as neurocranial changes (e.g., macrocephaly and platybasia) that may also affect underlying nervous tissues. This study aims to better understand how OI affects the integrated development of the neurocranium and the brain.

Methods: Juvenile and adult mice with OI (OIM) and unaffected wild type (WT) littermates were imaged using in vivo micro-computed tomography (microCT). Virtual endocast models were used to measure brain volume, and 3D landmarks were collected from the cranium and brain endocasts. Geometric morphometric analyses were used to compare brain shape and integration between the genotypes.

Results: OIM mice had increased brain volumes (relative to cranial centroid size) only at the juvenile stage. No significant difference was seen in cranial base angle (CBA) between OIM and WT mice. However, CBA was higher in juvenile than in adult OIM mice. Brain shape was significantly different between OIM and WT mice at both stages, with OIM mice having more globular brains than WT mice. Neurocranial and brain morphology were strongly integrated within both genotypes, while adult OIM mice tended to have lower levels of skull-brain integration than WT mice.

Conclusion/Discussion: These results suggest that neurocranial dysmorphologies in OI may be more severe at earlier stages of postnatal development. Decreased skull-brain integration in adult mice suggests that compensatory mechanisms may exist during postnatal growth to maintain neurological function despite significant changes in neurocranial morphology.

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Correlation of Mental Foramen Size to Diet in Primates

Joel Jacob (OMS II), Brittany Tran (OMS II), Caitlin Yoakum, Ph.D.

Purpose/Hypothesis: The mental nerve is a branch of the inferior alveolar nerve that innervates the lower lip, buccal mucosa, chin, and mandibular teeth (Betz & Fane, 2023). This nerve exits through the mental foramen, allowing for the processing of different foods for ingestion and sensation of different textures in foodstuffs (Yoakum & Terhune, 2023). Nerve size in the opposing maxillary foramen - the infraorbital foramen - has been shown to correlate to both foramen size and diet in primates (Muchlinski & Deane, 2014). However, specific studies on the mental nerve shows that while it correlates to foramen size, it cannot be used as a proxy for the foramen. If primates predominantly consume diets such as fruits, they should have more nervous tissue and a larger mental foramen because of the tactile sensation needed at the anterior portion of the mouth when testing different foodstuffs for smell and texture (Burini & Leonard, 2018). The primate species chosen for this study were selected based on their primary diet contributing more than 50% of their total diet in order to establish a correlation between foramen size and diet.

Methods/Materials: Mandibular segments of microCT scans of *Callithrix* sp. (gumnivore; $n = 9$), *Colobus* sp. (folivore; $n = 9$), *Chiropotes satanas* (granivore; $n = 3$), *Pithecia pithecia* (granivore; $n = 4$), and *Saimiri sciureus* (frugivore; $n = 10$) were created in 3DSlicer (Fedorov et al., 2012) to take measurements of mental foramen area, circumference, length, and width. It was also noted when specimens had more than one mental foramen (Accessory Mental Foramen or AMF).

Results: Paired t-tests showed no significant differences between the right and left side (all p -values > 0.05) in each individual, indicating no asymmetries. ANOVAs for the mental foramen area showed significant differences between gumnivores and both frugivores ($p = 0.040$) and folivores ($p = 0.002$). Folivores were also significantly different from frugivores ($p < 0.001$) and granivores ($p = 0.032$). However, ANOVAs for circumference only showed significant differences between frugivores and all other diets (p -values < 0.05). Lastly, ANOVAs showed significant differences between measurements in one mental foramen vs. multiple mental foramina for most variables (α set to 0.05).

Conclusions: These results lead to two main conclusions: 1) Primates that eat a frugivorous diet can be separated from most other diets using both area and circumference of mental foramen, and 2) having multiple foramina correlates to a larger area and circumference, indicating more nervous tissues in those individuals.

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Adult-Onset Nesidioblastosis: A Rare Post-Surgical Complication

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Background and Purpose:

Nesidioblastosis is a rare functional disorder of the β cells of the pancreas that results in recurrent episodes of hyperinsulinemic hypoglycemia. Most cases of adult-onset hyperinsulinemic hypoglycemia are due to insulinoma, while nesidioblastosis accounts for only 0.5-5% of cases. Nesidioblastosis often presents in young children, and adult-onset is uncommon and typically occurs after bariatric surgery. Symptoms include post-prandial weakness, fatigue, and syncope. Treatment includes dietary modifications, pharmacological interventions, and in severe cases, surgical pancreatectomy. Hypoglycemia has the potential to cause brain damage or death if left untreated. Early identification and treatment of nesidioblastosis is imperative for preventing complications and improving outcomes.

Case Description:

This case will explore a 57-year-old African-American female with recurrent, uncontrolled episodes of hypoglycemia. The patient underwent an uncomplicated Roux-en-Y gastric bypass surgery in 2018 that resulted in a one-hundred-pound weight loss. In March 2021, she presented to the emergency department for a syncopal episode and a blood glucose level of 47 mg/dL. Despite lifestyle changes, she continued to have recurrent syncopal episodes with blood glucose levels <50 mg/dL. Octreotide pharmacotherapy initially improved her symptoms, but she continued to experience recurrent episodes of severe hypoglycemia (<30 mg/dL) even with increased medication dosages. A calcium-stimulated hepatic vein sample revealed increased insulin secretion from the head of the pancreas. A 72-hour fast ruled out an insulin-secreting tumor, and this was when nesidioblastosis was first suspected.

Outcomes:

In August 2021, a Whipple procedure was performed to remove the head of the pancreas. Surgical pathology revealed atypical cells without evidence of cancer in the pancreatic head, which was consistent with a diagnosis of nesidioblastosis. A follow-up visit three months after surgery revealed stable blood glucose levels, and the patient was presumably cured. However, in February 2023, she presented to the clinic stating that the hypoglycemic episodes had returned. Presently, the patient continues to have hypoglycemic episodes.

Discussion:

This case was particularly interesting due to the rarity and treatment-resistant nature of the patient's condition. The recurrence of symptoms following aggressive surgical intervention suggests the need for further workup and likely lifelong pharmacological management. Several reports show that pasireotide, a novel somatostatin analog, has been effective in modulating glucose levels after partial pancreatectomy failure. This may prove to be a viable treatment intervention in this patient's condition. Currently, a multidisciplinary medical team is involved

due to the life-threatening risks of uncontrolled hypoglycemia.

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Characterization of Novel Oncolytic Viruses Expressing IL-2 and PD-1 in Pancreatic Cancer Cell Lines

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Purpose/hypothesis/clinical relevance:

Pancreatic adenocarcinoma (PDAC) is a significant and deadly gastrointestinal malignancy, often diagnosed at advanced stages with limited treatment options currently available. This highlights the urgent need for improved early detection and treatment approaches. Clinical trials are investigating vesicular stomatitis virus (VSV)-based oncolytic virotherapy as a potential treatment for solid tumors, including PDAC. VSV selectively replicates in cancer cells and triggers immunogenic cell death, leading to an immune response against both virus and tumor antigens. However, concerns regarding VSV's neurotoxicity have been raised.

To address this concern, researchers have developed an engineered hybrid VSV-derived oncolytic virus (VxC) with the glycoprotein of Coccal virus, enhancing its safety profile for clinical use. Despite promising results in targeting cancer cells and inducing cell lysis, oncolytic virotherapy has faced challenges in eliciting a robust immune response. To enhance the immune response, researchers have explored using immune checkpoint inhibitors like PD-1 and increasing T-cell activation through IL-2.

Results/Conclusion (methods/subjects):

In this study, we successfully demonstrated that VxC can be engineered to express functional species-specific IL-2 and a single chain fragment against PD-1. This innovative approach aims to simultaneously bolster immune cell infiltration within the tumor and overcome immunosuppression, which is often associated with treatment resistance. Our findings revealed varying degrees of sensitivity among the tested pancreatic cell lines, indicating potential differences in their response to oncolytic VxC vectors. Pan02, a mouse pancreatic cancer cell line, exhibited the highest sensitivity to all four viruses, as confirmed by the MTS assay and crystal violet results, showing significant cell death after 48 hours of infection. The viral progeny kinetics demonstrated successful replication and spread in all three cell lines. The real-time analysis further supported the effectiveness of the viruses in inducing cell death, especially the VxC and hybrid viruses. When testing the viruses on human pancreatic cancer cell lines, HPAF-II displayed higher sensitivity, while MiaPaCa-2 showed greater resistance, emphasizing the importance of considering the cellular context in virotherapy efficacy. Interestingly, our study also revealed the production of mouse-specific and human-specific interleukin-2 by the viruses, indicating their ability to stimulate the immune response and enhance tumor cell killing. Overall, these results suggest that the engineered viruses hold promise as potential candidates for oncolytic virotherapy in pancreatic cancer treatment.

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Wear patterns by sex in Cayo Santiago Macaques

Eric Horan (OMS II), Ashly Romero, Ph.D., Caitlin Yoakum, Ph.D.

Purpose/Hypothesis: Previous research on the *Macaca mulatta* individuals that live on Cayo Santiago, Puerto Rico has focused on various aspects of the teeth in relation to environmental, genetic, and dietary differences, but no study has assessed wear asymmetries between the left and right molar teeth of each individual (Hardin, 2020). All diets cause wear to a degree and many adaptations have been selected for evolutionarily to accommodate diets that are more tough/stiff (Daegling et al., 2011; Guatelli-Steinberg et al., 2022). *M. mulatta* in the wild is considered a truly omnivorous primate, where they preferentially eat fruit but will also eat seeds, flowers, leaves, crops, insects, and many other sources dependent on season (Hauser et al., 1993). The Cayo Santiago *M. mulatta* are fed a diet of predominantly „Ámonkey chow,Ä and supplement their diets with opportunistic foodstuff on the island (e.g., small vertebrates, fruit) (Romero et al., 2023).

Methods/Materials: To assess asymmetries and variation in the wear of the Cayo Santiago *M. mulatta*, we used 3D scans ($n = 20$; 10 female, 10 male) of mandibles to calculate wear using a wear index (total wear divided by occlusal surface area) on the first and second mandibular molars (M1 and M2) from the left and right side of each individual.

Results: While the left side showed a slightly larger range of wear (2.3-65.7%) than the right (4.1-60.7%), t-tests showed no significant differences between males and females (all p -values > 0.05) for both teeth and paired t-tests showed no significant differences between the left or right sides in either males or females (all p -values > 0.05). Visually females appear to have more variation in the amount of wear across all ages although wear is not significantly patterned by sex. M1 has a slightly wider range of wear (2.3-65.7%) than M2 (4.1-60.7%) but there were no significant differences between M1 and M2 for either the left ($p = 0.12$) or right ($p = 0.15$) side. Linear regressions showed there is a significant and high correlation between left and right-side wear index for M1 ($p < 0.001$; $R^2 = 0.63$) and M2 ($p < 0.001$; $R^2 = 0.88$).

Conclusions: Overall, this study shows that the tooth wear in the Cayo Santiago macaques are symmetrical within each individual and is not patterned by sex between individuals.

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Investigating the mechanisms of CNS HIV-1 infection using a human iPSC-derived microglia xenografted mouse model

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Purpose: The purpose of this study is to address the challenges associated with understanding HIV-1 latency in the central nervous system (CNS), particularly in microglial cells, which serve as a major viral reservoir [1]. Given the limitations in accessing human brain tissue and the shortcomings of existing models, we sought to develop a chimeric mouse model that allows for robust xenografting of human induced pluripotent stem cell (iPSC)-derived microglia into the forebrain. Utilizing a genetically engineered dual fluorescent reporter system, we seek to track the frequency and kinetics of HIV-1 infection in microglia at a single-cell resolution.

Subjects: Immunodeficient mice harboring a human macrophage colony stimulating factor 1 (mCSFh) knockin allele (Jackson Labs Strain# 017708) were used, with controls lacking the human CSF1 gene. Mice were Rag2/Il2rg knockouts, therefore unable to produce functional T, B, and NK cells.

Materials and Methods: Custom iPSC lines containing a Cre-recombinase-dependent dual fluorescent reporter were generated for differentiation to hematopoietic progenitor cells (HPCs) using a published protocol [2]. Approximately 500k HPCs were injected into each M-CSFh neonatal (P0-P2) mouse forebrain, followed by intraperitoneal injection of human peripheral blood mononuclear cells (PBMCs) between 6-10 weeks. A Cre-expressing HIV-1 was later injected into each animal (250ng, IP). Mice were euthanized at four weeks post-infection for forebrain histological analysis using RNAscope and IHC.

Results: Xenografted human HPCs differentiated into mature microglia within two months, as confirmed by antibody staining for P2RY12 and Iba1. At four months, microglia were found to be abundant throughout the forebrain. Histological analysis revealed many HIV-positive microglia throughout various regions of the forebrain, confirming migration of HIV-1 from PBMCs to the CNS.

Conclusions: The dual approach of HPC injection in forebrain tissue with subsequent PBMC and peripheral HIV delivery successfully produced CNS infection, providing an animal model to study HIV encephalitis and numerous therapeutic opportunities.

Clinical Relevance: Our mouse model is a useful tool for investigating the genetic mechanisms governing CNS HIV-1 infection and latency at a single-cell level. A major advantage of our model is that it uses iPSC-derived microglia, which enables human genetic analysis, including therapeutic gene manipulation, to be explored in vivo. We hope to provide a quantitative medium to develop new molecular and epigenetic strategies for reducing the HIV-1 latent reservoir and to

test the impact of therapeutic inflammation-targeting drug interventions on CNS HIV-1 latency.

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Differences in Palatal Shape and Depth Across Ontogeny in Rhesus Macaques

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Purpose: Palate size in rhesus macaques has been previously studied comparing male and female differences in palate length and width, concluding that there were significant sex differences across all palatal dimensions up to age 4, but this study did not address palatal depth or shape¹. Studies in other mammals such as *Idelphis albiventris*, *Lepilemur-cheirogaleidae*, and members of the *Cercopithecidae* family have shown that environmental and weaning stages can contribute to changes in dimensions of the palate^{2,3,4}. The goal of this study is to assess differences in palate shape and depth across ontogeny, including the analysis of dental arcade shape.

Materials/Methods: We used 3D Slicer to collect linear (both depth and straight) measurements and 3D landmarks across the palate for four different age groups by measuring a total of 25 individuals (Group 1: 3 females and 3 males under 1 year old, Group 2: 6 females between ages 3-4, Group 3: 4 females between ages 5-6, and Group 4: 6 females between ages 6-10)⁵. A series of linear and geometric morphometric (GM) analyses were performed on the landmark data to assess differences in palate size and shape.

Results: Paired t-tests established significant differences (all p-values < 0.05) between all straight and depth measurements in each age group. A series of ANOVA tests showed that Group 1 was significantly different from Group 4 (all p-values < 0.05) in each measurement except for the distance between the first incisor, although the posterior aspect of the mouth showed more differences amongst all groups in comparison to the anterior aspect. These results and PCA analyses show that younger and smaller specimens (when size-adjusted) have a deeper palate and a wider dental arcade. Finally, an ANOVA that assessed shape changes with age was significant ($p < 0.001$).

Conclusion: These results together indicate that as rhesus macaques age, the dental arcade narrows and the palate becomes shallower, with more changes happening in the premolar portion of the arcade posterior to the canine.

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An atypical presentation of primary angiitis of the central nervous system

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Background and Purpose

Primary angiitis of the central nervous system (PACNS) is a rare vasculitis with a prevalence of 2.4/1,000,000 individuals that primarily involves inflammation of the small and medium-size vessels in the brain, leptomeninges and spinal cord (1,2). This disorder has a spectrum of outcomes from complete resolution to rapid decline and death (3). The inflammation in these blood vessels results in the development of occlusions and/or aneurysms with ischemia and hemorrhages. We report a biopsy-proven case of PACNS presenting with features of a common vasculopathy, giant cell arteritis (GCA). The aim of this case report is to bring awareness to PACNS and consider more investigation when a patient presents with clinical symptoms of GCA.

Case

A 77-year-old male presented to the emergency department (ED) with a left-sided temporal headache with ear pain, nausea, vomiting, and speech difficulties that started five to seven days earlier. He had difficulty following commands, anomia, apraxia, and expressive aphasia. He did not have facial droop, weakness, numbness, tingling, or scalp tenderness. The visual field was intact bilaterally with no focal weakness.

Outcomes

A CT, CBC, and CMP were ruled unremarkable. ESR and CRP were markedly elevated to 80 and 121. A lumbar puncture was drawn to rule out an infectious process and was unremarkable except for protein level of 146. Patient was started on prednisone for possibility of giant cell arteritis. General surgery performed a temporal artery biopsy, which was ruled negative. This prompted further work-up including MRI of the brain which showed enhancement in the left, temporal hemisphere. Leptomeningeal biopsy was conducted on the surrounding leptomeningeal vessels and it showed inflammation indicating PACNS (4). The patient's inflammatory markers and mentation normalized on high-dose prednisone.

Discussion

In cases where GCA is suspected, a bilateral superficial temporal artery biopsy is obtained as a criterion standard for making a diagnosis (5). The negative temporal artery biopsy along with protein in the CSF, abnormal MRI, and abnormal leptomeningeal biopsy led to the diagnosis of PACNS. In summary, many misdiagnosed rare diseases are approached with symptomatic treatment which affects the quality of life of the patients. We believe that our case highlighted key findings in diagnosing a rare disease with a variety of clinical presentations, biomarkers, and radiology findings to encourage systematic prognostication process to fill missing gaps in diagnosing and treating rare diseases.

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Osteopathic manipulation treatment as a Treatment Modality for Physician Burnout

Aisha Khan, MS; Amina Khan, MS

Purpose: The effects of physician burnout reach beyond that of the professionals themselves, rather, they lead to increased healthcare costs, and decreased quality of patient care resulting in increased medical errors. Physician burnout is classified as a public health crisis and is prevalent even amongst residents and medical students. Interventions have focused on advocating for flexible workload schedules, mindfulness techniques, and access to mental health resources. As osteopathic students, we place emphasis on the role of treating with our hands. Early intervention can aid with symptoms of depression and anxiety, as they are related to burnout. The efficacy of osteopathic manipulative treatment (OMT) should be examined as a method for improving the aforementioned symptoms.

Description:

Osteopathic manipulative treatment has been an effective form of treatment for several conditions, including pain relief. Treatments are utilized to promote relaxation and overall well-being. OMT has been showcased to reduce stress and anxiety symptoms within patients who suffer from chronic pain. A meta analysis of several studies focused on stress and anxiety levels of patients before and after treatment periods. Research has showcased patients who received the treatment to have significant reductions in stress and anxiety levels as compared to those who did not receive the treatment. OMT has been shown to reduce muscle tension through studies done on chronic pain, patients who received an average of four sessions over a period of two weeks showed significant reductions in muscle tension and improvements in stress and anxiety disorders compared to those who received no treatment. Overall, osteopathy can be a highly effective form of treatment to promote relaxation within the body which can apply broadly to the current issue with increasing physician burnout. Scores statistically showcased a significant decrease in self perceived fatigue and distress for the OMT group. Osteopathic manipulative treatment represents a potential modality which can be used to treat the symptoms of physician burnout. It has been demonstrated that there has been a betterment in the overall mental health concerns of those who have been treated with OMT, with this establishing there to be a link between decreased burnout throughout its utilization.

Summary of Use: The purpose of this special interest report is to identify means through which physician burnout can be combated via the use of OMT.

Importance to Members: As osteopathic medical students, we are trained to perform OMT and are aware of the prevalence of physician burnout. Thus, by addressing the utilization of a skill we are taught in depth and its relationship to fatigue and distress associated with burnout, we gain the ability to address and assist in treating this.

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Spinal Cord Mapping with SSEPs in Cervical and Thoracic Surgeries

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Purpose: To improve postoperative outcomes during cervical and thoracic surgeries by reducing the incidence of surgical deficits through the utilization of intraoperative neurophysiological monitoring.

Description: Intraoperative neuromonitoring (IONM) is a collection of methods used to surveil a patient's nervous system during a surgery. IONM is done by delivering electrical impulses to a patient's nervous system to monitor the response. This can greatly reduce the chances of long-term complications from a surgery. Cervical and thoracic spinal cord tumor resections can lead to postoperative deficits. The area in which our patient data was gathered focuses on one of the major contributions of IONM to surgery, monitoring during intramedullary tumor resections. These tumors have a very high incidence of postoperative deficits due to anatomical distortion. Mapping of the spinal cord using SSEP is a safe method that can be used to determine the location of the median raphe separating the sensory tracts. This allows the surgeon to know precisely where the myelotomy should be performed. Recorded distortions during the study were caused by displacement of the tracts, cord rotation, edema, neovascularization, and local scar formation. The study was done on eight women and two men with thoracic and cervical spinal cord lesions. The individuals were evaluated on the effectiveness of dorsal column mapping in guiding the surgeon to find the midline for the myelotomy. In seven of the patients, the surgeons could not identify the midline anatomically with certainty. However, dorsal column mapping allowed for accurate identification of the midline. While the associated risks for patients undergoing cervical and thoracic surgeries remains high, the utilization of IONM can aid in creating a safer patient outcome.

Summary of Use: intraoperative neurophysiological monitoring should be used as a modality to decrease the incidence of neurological complications during cervical and thoracic surgeries.

Importance to Members: Dr. Faisal Jahangiri is a past president of the American Society for Neuro Monitoring and the CEO of Global Innervation LLC, which is the research lab in which Aisha Khan serves as a research assistant. Dr. Jahangiri has supervised several surgical procedures which have aided in data collection which drives the need to incorporate IONM within cervical/thoracic surgical procedures. Both members have worked extensively within the field of IONM.

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Understanding locomotion in relation to inner ear morphology in three species of primates

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Purpose/Hypothesis: The semicircular canals are a system made up of three interconnected tubes that assist the body's response to balance and rotational movements (Cox & Jeffery, 2010). Previous research has studied the effects of locomotion on semicircular canal orientation in primates, but little work has been done on comparing the structures between primate species with different movement patterns while accounting for size (Gonzales, 2019). This study aims to analyze the morphological differences between *Homo sapiens* (humans), *Papio sp.* (baboons), and *Propithecus verreauxi* (lemurs) with the expectation that lemurs will need relatively larger canals for better movement control. Each of these species has a unique obligatory locomotion pattern with humans using bipedality, baboons utilizing terrestrial quadrupedalism, and lemurs utilizing vertical clinging and leaping (Malinzak et al., 2012; Le Maître et al., 2017).

Materials/Methods: Using microCT scans, the left semicircular canal was digitally segmented in baboons (n = 8), lemurs (n = 8), and humans (n = 15) using the program 3DSlicer (Fedorov, 2012). Measurements were taken using these segmentations of the three semicircular canals in regard to length, width, volume, and angular orientation of each canal.

Results: After size adjustments, T-tests showed significant sexual dimorphism across all variables (all p-values < 0.05) in both humans and baboons, while lemurs showed no sexual dimorphism in any variable (all p-values > 0.05). A series of ANOVAs showed that lemurs were significantly different from humans and baboons in all three canal circumferences and volumes while all three species were significantly different from one another in canal surface area ($\alpha = 0.05$). Overall, even when adjusted for size, lemurs were exponentially larger than both baboons and humans for all measurements.

Conclusions: These results supported our hypothesis in that because lemurs use a form of locomotion (vertical clinging and leaping) that requires intense adjustment after large leaps through the upper limbs of trees, they need much more control for adequate stability. Canals that have more volume and area have more of the nervous structures that control and adapt to movements, allowing movements to be more precise and dramatic. Future research is needed to ascertain differences in morphology in other forms of locomotion to determine which types of locomotion would require the largest, and therefore most accommodating, inner ear structures.

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Conundrum in Bronchiolitis

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Purpose: Currently, the diagnosis and treatment of bronchiolitis is ambiguous and not well defined. This article takes a unique perspective on the current diagnosis and treatment options for bronchiolitis, and investigates the issues with how it is currently being diagnosed in the United States that might be preventing us from finding the appropriate treatment. It will also dive into the true meaning of the word „Bronchiolitis,“ and determine if this word is being used appropriately in the medical community.

Description: The diagnosis of bronchiolitis is arbitrarily defined as a child typically under the age of two years old and the presence of lower respiratory symptoms such as wheezing. The diagnostic criteria is not well defined and may even be fundamentally erred if one considers the pathophysiology of true bronchiolitis. This article summarizes what we know about the disease, how it is being treated currently, and will address future considerations when treating bronchiolitis.

Summary of Use: Healthcare providers can use this article as a reference to consider when examining a child under 2 years of age that presents with wheezing. Though bronchiolitis may be at the top of the differential in scenarios such as this, it is important to consider treatment for asthma, as asthma has similar symptoms. After bringing into light the ongoing issues of the clinical diagnosis of bronchiolitis, this article will encourage researchers and healthcare professionals to consider looking for different symptoms based on the pathophysiology of bronchiolitis.

Importance to Members: This article will be important to healthcare providers working with the Pediatric population, especially those working with children under 2 years of age, which is the age group in which bronchiolitis is most common.

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Pegylated bilirubin nanoparticles (PEGBR) and treatment of obesity and metabolic dysfunction associated fatty liver disease (MAFLD)

Zachary A. Kipp; Genesee J. Martinez; Lucy C. Taylor; Christopher D. Anderson, MD; John E. Hall, PhD; Donald F. Stec, PhD; Andrew J. Morris, PhD; David E. Stec, PhD; Terry D. Hinds, PhD

Purpose: The prevalence of obesity and its related comorbidities, including diabetes and metabolic dysfunction associated fatty liver disease (MAFLD), are on the rise globally, indicating the importance of new therapeutics for these diseases. Interestingly, serum bilirubin levels are negatively correlated with obesity, diabetes, and MAFLD. We have previously generated pegylated bilirubin nanoparticles (PEGBR) and demonstrated their therapeutic potential in the treatment of obesity and MAFLD. However, it's unknown whether their beneficial effects are due to bilirubin's antioxidant properties or its hormonal function by binding to and activating the nuclear receptor peroxisome proliferator-activated receptor alpha (PPARα). **Materials/Methods:** To determine this, we used female and male hepatocyte-specific PPARα knockout mice (PparaHepKO) and floxed (Pparaflox) control mice on a high-fat diet for 30 weeks to induce adiposity and MAFLD.

Results: The mice were treated with vehicle or PEGBR (30 mg/kg) for six weeks. In female Pparaflox mice, PEGBR significantly lowered body weight, but not in the female PparaHepKO mice. A similar trend was seen in the male Pparaflox mice but was not statistically significant. PEGBR significantly reduced hepatic fat mass and triglycerides in the female and male Pparaflox mice but not in the PparaHepKO mice. Using lipidomics, we determined the lipid composition of the liver and how PEGBR changed it. In the male Pparaflox mice, PEGBR significantly reduced 109 lipid species, whereas, in the male PparaHepKO mice, PEGBR only reduced 7 species (93.6% reduction). In the female PparaHepKO mice, there was a 2.7% reduction in the number of lipid species significantly decreased by PEGBR compared to Pparaflox controls. Male Pparaflox mice had an increase in plasma high-density lipoprotein cholesterol and a decrease in very-low-density particle number with PEGBR, but this was not seen in the male PparaHepKO or female mice. In addition to protecting against the development of MAFLD, PEGBR significantly reduced fasting blood glucose and insulin levels only in the Pparaflox mice.

Conclusions/Clinical Relevance: Overall, the data indicates that the protective effects of bilirubin on obesity, MAFLD, and glucose tolerance are due to its hormonal function through PPARα. This study also confirms the therapeutic potential of bilirubin nanoparticles for obesity and its associated comorbidities.

Partnering with Communities to Understand SDoH and Shared Micro mobility with Ride for SMILIES

Ganesh Kumar OMS II, Ashley Bright OMS II, Kaitlynn Walker OMS II, Klare Aziz OMS I, (Dr. McClain Advising Faculty)

Purpose: NSF grant installed 8 bike stations and 40 bikes/e-bikes in Fort Smith in 2021 with free 30-minute use and .50 cents 30 minute thereafter. Education targeting social determinants of health (SDoH) is essential to promote health equity at individual, family, and community levels. Shared Micro mobility (SMM) programs providing bikes/scooters offer a solution, increasing access for lower-income unemployed residents to essential services (healthcare services, groceries, work commute).

This qualitative study embedded OMS with community participants in a community-based research project to explore the impact of a bikeshare program, as citizen scientists within a framework of SDoH.

Participants: Individuals 18 or older were eligible to participate following informed consent and the Our Voice Discovery Tool application training.

Methods: Community Based Participatory Action Research (CPBAR) framework guided this IRB approved, citizen science photovoice project exploring, “What makes it easy or hard to ride a bike using the bikeshare program in Fort Smith?” using the “Discovery Tool” digital app. Data included geo-coded photos, narrative explanations, and positive/negative ratings. Descriptive statistics identified demographics and inductive/deductive coding drove thematic and content analysis. OMS considered SDoH by geo-mapping bike stations to essential community resources, assessing increased access through bike share use for transit. Following informed consent, participants completed thirty-minute to sixty-minute community walks at 3 bike-share stations with follow-up focus groups.

Results: 27 community members and 4 OMS participated. 325 photos were obtained with narrative comments from 3 walks. Deductive analysis identified initial themes of Safety, Maintenance, and Comfort. Initial inductive analysis identified themes of Access, Safety, Education and Health. Medical students identified opportunities for increased access with bikeshare to groceries, resources, health/dental clinics, community shelters/adult education. Access was further increased with combined use of public transit and bike share.

Conclusions: This project supports previous findings that Shared Micro mobility can increase access to essential services as an approach to address SDoH and increase health equity in communities. Citizen science was an effective approach to engage the community in voicing the benefits and barriers of the bike share to drive change in city policies and transportation initiatives. Students found value using citizen science to better understand SDoH and engage in practical assessment of access.

Clinical Relevance: Poverty is correlated with poorer health outcomes and increases risk of premature death. Poverty impacts SDoH, limiting transportation access and increases barriers to healthcare, food, and essential resources.

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Establishing a recombinant expression system to study bacterial pore forming toxins

Rachel Latterich (OMS-II); Vi Le (OMS-II); Joshua Burns

The most potent, naturally produced toxins in nature are produced by bacteria, yet most of these toxins remain poorly understood. Bacterial toxins are generally classified by function and consist of three large groups: AB toxins, super antigens, and pore forming toxins. Pore forming toxins are further classified by the structure of the pore formed and are identified as either alpha or beta pore forming toxins. Among the beta pore forming toxins there is a superfamily of protein toxins that utilize cholesterol as a receptor and are collectively identified as the cholesterol dependent cytolysin/membrane attack complex/perforin (CDC/MACPF) family of pore forming toxins. CDC family members are predominantly found in Gram-positive species including *Streptococcus*, *Clostridium*, and *Listeria*. However, CDC like proteins isolated from Gram-negative bacterial species and several eukaryotic phyla have also been characterized. The CDC family member perfringolysin O (PFO), produced by *Clostridium perfringens*, has been established as a model for CDC pore formation. Previous work using PFO and other CDC proteins have identified that CDC type pore formation is a stepwise process whereby soluble monomers bind to susceptible membranes, undergo oligomerization, and form a stable pre-pore intermediate before collapsing into the membrane. However, molecular interactions necessary for stable pore formation in PFO are absent in other CDC members including pneumolysin (PLY). Our long-term objectives are to characterize barriers in PLY that facilitate transition from water-soluble monomers into a membrane inserted pore and to develop these proteins into a nanotechnology platform to deliver cell specific therapies. To evaluate the differences in CDC member proteins, we adapted an *E. coli* based recombinant expression system utilizing a pET expression vector. The genes coding for PFO and PLY were optimized to reflect an *E. coli* codon bias. Protein expression is regulated using a T7 promoter under Lac operon repression. A 6X-His tag and ampicillin resistance were also included to facilitate colony selection and downstream purification using immobilized metal affinity chromatography. Site directed mutagenesis was used to induce site specific mutations into the wild type sequences. Bacterial plasmids were isolated using a plasmid isolation kit and submitted for Sanger sequencing analysis.

Optimization of the cloning procedures for CDC member proteins is an essential step in growing our understanding of CDC pore formation and developing CDC proteins into a stable nanopore technology.

FK506-Binding Protein 51 (FKBP51) as a New Signaling Mechanism Regulating Obesity and Diabetes

Wang-Hsin Lee, Evelyn A. Bates, M.S., Agil B. Maharramov, Genesee J. Martinez, Zachary A. Kipp, Mei Xu, Ph.D., Terry D. Hinds, Jr, Ph.D.

Purpose and Hypothesis:

FK506-binding protein-51 (FKBP51) is a molecular chaperone protein that has great potential to serve as a treatment target for non-alcoholic fatty liver disease (NAFLD) and type II diabetes (T2DM). FKBP51 has been known to regulate nuclear receptors such as glucocorticoid receptor (GR) and peroxisome proliferator-activated receptor α (PPAR α) [1]. However, the connections between FKBP51 and other PPAR family members, such as peroxisome proliferator-activated receptor β (PPAR β), are yet to be identified. FKBP51 can also inhibit protein kinase B (AKT) activation, which may impact the insulin receptor signaling pathway [1]. It has been reported that FKBP51 knockout mice presented less adiposity, reduced liver steatosis, and increased insulin sensitivity and insulin clearance, indicating that FKBP51 plays a role in insulin resistance and fatty liver development [2]. However, how FKBP51 regulates insulin resistance, especially in the liver, still needs to be unveiled. It has been shown that insulin receptor (IR) alternative splicing is associated with insulin sensitivity [3] and that PPAR α activation is critical in reducing insulin resistance [4]. Thus, we hypothesize that FKBP51 can regulate hepatic insulin resistance through insulin receptor alternative splicing and PPAR α activation.

Materials and Methods:

We developed an FKBP51 knockout mouse hepatocyte cell line, 51KO AML12, and treated the cells with 100 nM insulin for 1 hour. We measured RNA and protein expressions in the cells through RT-PCR and western blotting.

Results:

We found that 51KO AML12 had increased phospho-AKT Ser473 (pAKT S473) and IR isoform B (IR-B), indicating increased insulin signaling activity. We also found increased expressions of both IR isoform A (IR-A) and IR-B in 51KO AML12. In addition, we found an increased ratio of IR-B: IR-A in 51KO AML12 treated with insulin.

Conclusion:

These data indicate a great potential for FKBP51 to be a novel treatment target for hepatic insulin resistance and T2DM.

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Etherified Carboxymethylcellulose Matrix Regulate Tissue Growth Factors

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Background: Manuscript submitted to Burns & Trauma Page 2 of 34 Etherified Carboxymethylcellulose Matrix (eCMC) is a revolutionary application of carboxymethylcellulose (CMC) in wound care, known for its potential in hemostasis and tissue regeneration. This study aims to investigate the mechanism of eCMC in tissue healing by establishing a rat burn model and administering eCMC as a treatment. The objective is to analyze cytokines and inflammatory mediators using a Cytokine Array and histochemical staining to understand the effects of eCMC on tissue regeneration.

Methods: A rat burn model was created, and eCMC was applied as a treatment. Tissue samples were collected at multiple time points to assess the expression of cytokines and inflammatory mediators using a Cytokine Array. Additionally, histochemical staining was performed to evaluate tissue regeneration factors.

Results: eCMC induced the expression of endogenous cytokines, particularly VEGF and PDGF, while inhibiting inflammatory cytokines such as CINC-1, CINC-2, and MMP-8. This dual action facilitated wound healing and mitigated the risk of infection.

Conclusion: eCMC demonstrates promising potential for enhancing skin regeneration. Further research is warranted to delve into the precise mechanism of eCMC's cytokine regulation. In vitro and in vivo studies should be conducted to comprehensively investigate the therapeutic capabilities of eCMC in wound healing.

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Patients with history of VTE started on a JAK inhibitor have lower risk of subsequent VTE with concurrent AC use

Jeffrey A Lowell, MD, PhD; Garvita Sharma; Keith Sultan, MD

Introduction:

In recent years, physicians have utilized Janus Kinase inhibitors (JAKi), such as tofacitinib and upadacitinib, to treat various autoimmune diseases and inflammatory bowel diseases, such as Ulcerative Colitis and Crohn's disease 1,2,3. Post-marketing observations including the ORAL surveillance trial have identified venous thromboembolism (VTE) as a potential risk of JAKi use, with a warning included in the FDA prescribing information 4,5. However, there remains uncertainty regarding JAKi-associated VTE risk in patients with a history of VTE. Specifically, it has not been defined whether concurrent pharmacologic VTE prophylaxis (PVTEP) and JAKi use can reduce the risk of VTE in this population.

Hypothesis

The goal of this study was to evaluate the risk of VTE with concurrent use of a JAK inhibitor and anticoagulant, particularly in a background of patients with history of a prior VTE

Subjects, Methods and Materials:

Bioinformatics search for all patients in the Northwell Health electronic health record system with a history of VTE and a prescription for a JAKi from 1/1/2000-6/30/2023 was performed. Manual chart review to extract patient demographics, disease type, and concurrent use of Anticoagulant (AC) including warfarin, rivaroxaban, and apixaban. New VTE events while on JAKi were recorded. Descriptive analysis was performed for all available data.

Results and Conclusions:

A total of 160 patients were treated with JAKi. Of which, 84 patients had a history of VTE. The most common disease being treated was Rheumatoid Arthritis 68/84 (81%). Among patients with a history of VTE, 5 of the 38 patients not taking concurrent AC would go on to experience a VTE event (5/38, 13%). For those without a history of VTE, 30 patients would experience a VTE event while on JAKi (30/76, 39%). Four patients (one with prior VTE history) experienced blood clots within 90 days of stopping JAKi (median 20.5 days). No clots were reported while taking any AC. Eliquis (n=14 instances/patients), Xarelto (n=17 instances/patients), Warfarin (n=15 instances/patients), Enoxaparin (n=2 instances/patients). One patient stopped their AC while still on a JAKi (Xeljanz) and subsequently developed a VTE event.

Clinical Relevance:

The potential for VTE in patients taking JAKi without concurrent AC seems high. It is much lower for those who are taking concurrent AC.

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Radical Fringe Promotes Ovarian Cancer Growth and Drives Notch-Mediated Expression of Proteins that Control Cancer Stem Cells and Immune Suppression

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Ovarian cancer is often diagnosed at later stages leading to higher rates of recurrent disease and chemoresistance making the identification of new therapeutics a priority. The Notch signaling pathway plays a prominent role in tumorigenesis and represents an important underexplored pathway for ovarian cancer therapeutic development. O-fucose is a major component of the glycosylation present on Notch receptors that modulates signal transduction of this pathway. In particular, the Fringe enzymes extend O-fucose on Notch EGF repeats modulating molecular interactions with the ligands Delta and Jagged. Radical Fringe (RFNG) is amplified in a large number of ovarian cancer patients and is associated with reduced overall survival. In this study, we use mass spectrometry to analyze the O-fucose glycosylation on endogenous Notch 1 receptors confirming the loss of RFNG-mediated glycosylation in our RFNG-KO ovarian adenocarcinoma cell lines. Our in vivo xenograft model demonstrates that RFNG activity promotes ovarian tumorigenesis. We show that RFNG expression activates Notch signaling and controls the levels of key Notch regulated proteins that have roles in cell cycle control (CDK6), stem cell maintenance (GPC3), and immune suppression functions (CD33, SELL, and CD47). Therefore, we conclude that RFNG is a target for the development of novel therapeutics that can block tumor growth and remove immune suppression.

Glucocorticoid resistance driven eicosanoid and monoacylglyceride synthesis leads to hepatic lipid accumulation.

Genesee J. Martinez, Zachary A. Kipp, Wang-Hsin Lee, Evelyn A. Bates, David E. Stec PhD, and Terry D. Hinds, Jr. PhD

Purpose/Hypothesis: Adiposity and obesity induced by a high fat diet can lead to multiple metabolic complications, including type II diabetes, cardiovascular disease, and non-alcoholic fatty liver disease. The glucocorticoid receptor (GR) regulates metabolism and has two isoforms (GR α and GR β) that arise from the GR gene (NR3C1) due to the alternative splicing of exon 9. The GR α isoform is the classical receptor that binds to glucocorticoids. However, the GR β isoform has a truncated C-terminus. It cannot bind glucocorticoid steroids, and as a result, this isoform induces a glucocorticoid-resistant state when its expression is increased. A high fat diet can also cause an increase in the GR β isoform leading to a glucocorticoid resistant state. We hypothesized that increasing levels of GR β from long-term excess glucocorticoid exposure or a high-fat diet induces adiposity by affecting lipid metabolism and lipogenesis, causing fat to accumulate in the adipose and liver tissues.

Materials/Methods: We first overexpressed GR β (GR β -Ad) or control (Vec-Ad) using adenovirus delivery and fed the mice a normal chow diet. Lipid accumulation within five days was measured using oil red o staining. Western blotting was used to measure the de novo lipogenesis enzyme fatty acid synthase (FAS) expression. We used mass spectrometry lipidomic analysis to measure hepatic lipid content. Real-time PCR was used to measure mRNA expression of de novo lipogenesis, peroxisome proliferator activated receptor α (PPAR α), and eicosanoid related genes.

Results: The GR β -Ad mice had significantly higher lipid accumulation within five days. Western blotting analysis revealed a significant increase in the GR β -Ad livers for fatty acid synthase (FAS) expression, and there was a remodeling of the hepatic lipid content as measured by mass spectrometry lipidomic analysis.

The data indicate an increased level of monoacylglyceride lipid species and some species of long-chain triacylglycerides and diacylglycerides. mRNA analysis revealed a significant increase in Carbohydrate-responsive element-binding protein (ChREBP), PPAR α , and Cyp2j6, indicating an increase in de novo lipogenesis and eicosanoid synthesis.

Conclusions: We conclude that glucocorticoid resistance due to increased levels of GR β drives de novo lipogenesis and increases eicosanoid synthesis, possibly via synergism with PPAR α .

Clinical Relevance: A better understanding of the GR isoforms and glucocorticoid resistance could benefit people with obesity and other metabolic disorders to improve obesity-associated comorbidities.

A Look at Syphilis Data in Kansas and the Trend toward Heterosexual Infections

Zachary J. Meyer, OMS-III; Mark Stillwell MD

Purpose/Hypothesis: The purpose of this study was to examine the syphilis data in Kansas from 2010 to 2021 and identify trends in primary and secondary syphilis, with a specific focus on the increasing incidence of heterosexual infections. We hypothesized that there would be a rising trend in heterosexual transmission rates during this period.

Subjects: Our study analyzed data from the state of Kansas, covering primary and secondary syphilis cases over twelve years. The data included information on the number of cases, gender distribution, incidence rates per 100,000 population, and age-group specific data.

Materials/Methods: We conducted a comprehensive retrospective analysis of syphilis data in Kansas, utilizing annual reports from 2010 to 2021. Our analysis involved examining gender-specific trends, age group distributions, and calculating incidence rates. We also investigated the impact of the COVID-19 pandemic on syphilis cases in 2020.

Results: Our analysis revealed a significant trend toward heterosexual infections in Kansas during the study period. In 2021, a total of 301 primary and secondary syphilis cases were reported, with 238 cases among men and 63 among women. The incidence rate per 100,000 population was 10.3, marking a substantial increase compared to previous years. Young adults aged 20-34 years consistently showed the highest incidence rates. The COVID-19 pandemic in 2020 had a noticeable impact on syphilis cases, with a surge in cases among men.

Conclusions: This study confirms our hypothesis of a rising trend in heterosexual syphilis transmission rates in Kansas. The disproportionate increase among young adults and the impact of the COVID-19 pandemic underscore the need for targeted prevention strategies and improved access to testing and treatment services. Public health efforts should focus on addressing this concerning trend.

Clinical Relevance: The increasing prevalence of heterosexual syphilis transmission in Kansas has significant clinical relevance. Syphilis can lead to severe health complications if left untreated, including neurological and cardiovascular issues. Identifying and targeting the factors contributing to this trend are essential to mitigate the impact on public health and promote safer sexual practices in the state.

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Improving Resident Handoff

Mayela L. Milanese Arauz, MD; Andrew Bergeron, MD; Muhammad O. Khan, MBBS

Purpose

For each inpatient shift change, residents will access the EMR handoff template for the assigned FM team patients and they will fill it out during handoff. Then, during night shift, all the pages and rapid response for the FM team will be recorded. We will use these numbers and compare it to the other physicians' teams that the night shift covers for but does not get handoff report on. We are using this data to determine if using a standardized EMR handoff template improves patient care by decreasing the number of pages and rapid responses on those patients.

Subjects

This quality improvement will be performed by Family Medicine Mercy Residents, who are already instructed by the hospital to use the EMR handoff tool during shift change report.

Background

Medical errors in the hospital occur every day and communication errors account for almost two thirds of all the medical errors reported in the hospital (Studeny et al., 2017). Effective and thorough communication between residents and physicians has been shown to improve patient safety and prevent medical errors (Starmer et al., 2014). Handoff communication is essential to ensure patient safety, improve patient care, and improve patient outcomes (Müller et al., 2018). The objective of this quality improvement project is to follow a standardized format for providing shift change handoff report between the inpatient day team and inpatient night team.

Methods

The night team will record the number of pages/rapids they have each night from the FM team and from the other 5 physician teams that they cover for. The number of pages/rapids between the groups will then be compared.

Results

The number of pages and rapids for the FM team are significant less than the pages and rapid responses from the team that did not provide verbal nor EMR handoff.

Conclusions

Safe and effective patient handoffs will significantly prevent patient harm because it ensures proper continuity of care for that patient (Raeisi et al., 2019). There are different handoff methods already being used in many hospitals and academic centers such as I-PASS and SBAR. This quality improvement project aims to prove that using our EMR handoff tool we can improve resident to resident communication during shift change handoff, that will translate into

improved patient care and patient outcomes.

Clinical Relevance

Improving communication between residents and physicians improves patient safety and therefore patient outcomes.

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Covid-19 Associated Pulmonary Aspergillosis (CAPA)

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Background and Purpose

Covid-19 Associated Pulmonary Aspergillosis (CAPA) is a rare secondary infection that carries a high mortality rate. Most of the CAPA cases reported have been in hospitalized patients, especially those in ICU care that required mechanical ventilation (Machado et al., 2020). This case report aims to present the case of a patient with mild to moderate Covid-19 pneumonia that developed CAPA in the outpatient setting. The hypothesis is that his comorbidities, which included hypertension and uncontrolled diabetes, might have compromised his immune system and made him vulnerable to CAPA.

Case Description

A 48-year-old African American male with Covid 19 pneumonia developed CAPA one month after infection. He did not require oxygen supplementation nor receive antiviral or steroid treatment for Covid. He was treated with oral Levaquin and symptomatic treatment. Over a month after his Covid-19 pneumonia diagnosis, his constant cough led to a follow up chest x-ray that showed the development of a new large right lower lobe pleural effusion. The patient was hospitalized, and his hospital course included a chest CT that showed a cavitary lesion and right pleural effusion suspicious for lung abscess and/or empyema. Initially he was treated with broad spectrum antibiotics and a chest tube to drain the pleural effusion. Pleural fluid analysis provided the diagnosis of invasive pulmonary aspergillosis.

Outcome

After a couple of weeks, the patient was discharged home with oral voriconazole. He was seen in continuity clinic for follow up and his symptoms were significantly improved, and blood pressure and diabetes were under controlled. Even though he was lost to follow up, this patient did very well overall and was on the route to complete recovery.

Discussion

CAPA incidence might be low overall, but its mortality rate among critically ill patients ranges from 36% to 74% and survival rates are not improved with early detection and/or appropriate treatment with antifungals (Rouz[√]© et al., 2022). In this case, CAPA affected an immunocompetent patient, but one can hypothesize he was at that moment immunocompromised due to his uncontrolled diabetes which allowed for this opportunistic fungal infection to thrive. Another explanation is that, like in IAPA, Covid-19 might have caused mucociliary clearance dysfunction and parenchymal lung tissue damage that allowed fungi spores to reach the lungs (Dimopoulos et al., 2021).

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Dietary behavior and its effects on dental wear of the fourth premolar in *Mandrillus* and *Colobus*.

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Purpose/Hypothesis: *Mandrillus* and *Colobus* are old world primates that reside in similar forested areas but eat different primary diets. *Mandrillus* is considered a *frugivore* as their diet consists of 45% fruit fiber, 42.6% of crushed seeds, and varying amounts of flowers, leaves, herbs, woody tissue, vertebrates, and invertebrates depending on age of the individual and season of year (Hongo et al., 2017). In opposition, *Colobus* is considered a *folivore* with 87% of their diet coming from leaves and the remaining 13% coming from a mixture of fruit fibers and seeds (Matsuda et al., 2020). All food causes wear on teeth, either macrowear or microwear with some species exhibiting higher rates based on many factors such as grit, chewing cycles, enamel thickness, and age of eruption. Previous studies have shown that folivores exhibit higher degrees of microwear, have thinner enamel, and typically have accelerated dental eruption schedules when compared to similarly sized frugivores (Godfrey et al., 2001; Pampush et al., 2018; Shellis et al., 1986). Other studies have noted that *Colobus* has longer average lifespans (20-30 years) than *Mandrillus* (14-22 years) in the wild which can account for higher wear accrual (Setchell et al., 2005; Jensz et al., 2011).

Subjects/Materials/Methods: This work examines dental wear of the fourth premolar (P4) in adult *Mandrillus* (*M. sphinx* and *M. leucophaeus*, $n = 11$) and *Colobus* (*C. guereza* and *C. polykomos* $n = 11$) using both wear score (WS) and dental wear index (WI) with the expectation that *Colobus* should exhibit higher wear rates for both measures.

Results: T-tests did not support previous studies in that *Mandrillus* showed significantly higher wear rates (WS = 3.67-5.34, WI = 11.9-9.9%) than *Colobus* (WS = 2.17-4.5, WI = 2.8-16.6%) in both wear score ($p = 0.005$) and wear index ($p < 0.001$).

Conclusions: This data provides evidence for the fallback food hypothesis in that the *Mandrills* in this sample could have experienced a lower supply of their preferred food (fruit), due to habitat loss or predation, and higher rates of competition with their larger body size - and had to fallback, on tougher or harder foods like leaves and seeds that their teeth have not evolved to process (Marshall & Wrangham, 2007). Overall, these results indicate that more study is necessary to examine why some *Mandrill* species would exhibit higher rates of premolar wear and to examine extenuating factors that help to protect *Colobus* premolars from dental wear.

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Hydrocephalus: Understanding the Role of the Brain Parenchymal Tissue to Inform Future Non-Invasive Treatment Strategy

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Purpose: To review the typical treatment strategies for hydrocephalus and consider new, innovative interventions through an understanding of the active role of brain parenchymal tissue in the pathogenesis of hydrocephalus.

Subjects: N/A

Methods: Articles were gathered using PubMed and Google Scholar. There were no exclusion criteria regarding the type of article or year published. Each source was reviewed for relevance to etiology, pathophysiology, and connections to clinical treatment.

Results: Treatment for hydrocephalus traditionally has involved surgical shunt placement or endoscopic third ventriculostomy (ETV) with or without choroid plexus cauterization (CPC). However, these surgical interventions have high failure rates and complications that necessitate re-intervention, further increasing morbidity and mortality rates. To date, there are minimal nonsurgical treatment strategies, and many have proven to have limited benefit, with many patients still requiring surgery. Prior studies have illustrated the dynamic nature of the interstitial matrix suggesting that any disruption to the integrity can adjust tissue pressure. Nagra G (2010) was then able to provide data specifying that disturbance to the beta-1 integrin-laminin interactions contribute to pressure changes and the development of hydrocephalus. Thus, an understanding of this etiology could be useful when considering non-invasive therapeutics for hydrocephalus treatment, which could improve treatment outcomes and reduce side effects.

Conclusions: Experimentally, anti-inflammatory agent α -trinositol and platelet-derived growth factor BB isoform (PDGF-BB) can decrease skin tissue pressure and counteract edema development, respectively. Furthermore, studies have used magnetic resonance elastography (MRE) to illustrate that low brain stiffness associated with hydrocephalus has been reversed with shunting. Diffusion tensor imaging (DTI) is another modality to gather quantitative data on brain tissue mechanics. Going forward, MRE and DTI data can be applied to evaluate the impact of non-surgical therapeutic modalities on potentially reducing hydrocephalus symptoms and reversing matrix damage.

Clinical Relevance: Understanding the active role of the extracellular matrix in regulating interstitial fluid pressure can inform future non-invasive treatment strategies, which can be analyzed through MRE and DTI data. These interventions could be a way to effectively treat hydrocephalus, while reducing dependence on shunts.

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Benign Prostatic Hyperplasia: Treatment Utilizing Temporary Prostatic Stents

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Purpose:

Benign prostatic hyperplasia (BPH) is a benign condition in which the prostate gland hypertrophies. As the gland enlarges, it may lead to benign prostatic obstruction (BPO) which can lead to urinary incontinence, dysuria, and urinary tract infections (UTIs). Acute urinary retention (AUR) is a painful and discomforting condition associated with significant morbidity due to BPO. Management requires insertion of a urinary catheter. This systemic review assesses the efficacy of Exime2 urethral stent implantation (EUSI) compared to traditional urethral stents.

Description:

Single use clean intermittent catheterization (CIC) is routinely utilized in draining the bladder via a catheter inserted into the urethra. Once the urine is voided, the catheter is removed. This is critical in reducing bladder pressure and preserving renal health. In the United States, about 300 to 800 persons use catheters daily, with an average of 85 million pounds of waste generated annually. Exime urethral stent implantation (EUSI)⁴, a silicone-based catheter intended for temporary use for up to one month requiring a minimally invasive procedure has been generated as an alternative to CICs.

Summary of Use:

Patients with a prostate volume of 120 mL and intravesical prostatic protrusion of <5 mm on ultrasound underwent the manual insertion of the catheter during an outpatient procedure under local anesthesia⁴. The device was introduced via the urethra and patients were discharged upon successful voiding. Of the 61 patients, 55 demonstrated spontaneous urination immediately post-procedure, 3 patients developed urinary tract infections, and 3 patients demonstrated bladder clot retention⁵. Overall, 90% of patients demonstrated successful treatment⁵.

Importance to Members:

EUSI appears to be effective in treating acute urinary retention while reducing waste. This can be helpful in treating patients with prostatic obstruction while minimizing the risk for urinary infections. Prolonged use of Exime (one month), may also reduce medical waste and patient efforts in catheter management.

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Expression and Purification of Bacterial Pore Forming Toxins

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Bacteria deploy a wide array of virulence mechanisms to facilitate colonization and infection of eukaryotic hosts. Often bacteria produce potent protein toxins. Bacterial toxins are the most lethal naturally occurring proteins in nature, and most are poorly characterized. Bacterial toxins are broadly classified into three major types: AB toxins, super antigens, and pore forming toxins. Pore forming toxins are further classified as alpha or beta pore forming toxins based on the structure of the pore formed. Among the beta pore forming toxins, there is a superfamily of proteins that utilize cholesterol as a receptor and collectively are known as the cholesterol dependent cytolysin/membrane attack complex/perforin (CDC/MACPF) family of pore forming toxins. CDC family members are predominantly found in Gram-positive species including *Streptococcus*, *Clostridium*, *Listeria*, and others. CDC family members have also been found in Gram-negative bacterial species and several eukaryotic phyla. The archetype member of the CDC family of protein toxins is perfringolysin O (PFO) and is produced by *Clostridium perfringens*, an anaerobic bacterium that is associated with the development of gangrene and gastrointestinal disease. Studies using PFO have identified that CDC pore formation is a stepwise process whereby soluble monomers bind to susceptible membranes, undergo oligomerization, and form a stable pre-pore before collapsing into the membrane. However, molecular interactions necessary for stable pore formation in PFO are absent in other CDC members including pneumolysin (PLY), a virulence factor produced by *Streptococcus pneumoniae* and a facultative human pathogen native to the upper airway that is associated with pneumonia, bacteremia, and meningitis. In order to assess differences in how PFO and PLY transition from water soluble monomers into large, oligomeric, membrane bound pores, we produced recombinant forms of wild type PFO, PLY, and variants using an *E. coli* expression system. Wild type proteins were then purified using immobilized metal affinity chromatography and characterized using SDS PAGE gel electrophoresis and functional assays. These studies have established essential protocols necessary for the study of CDC pore formation generally, and the characterization of unique molecular interactions utilized by CDC members during the process of pore formation specifically. These studies will additionally aid in the development of future vaccine platforms and biotechnology applications.

Gender Differences in the Authorship of Gastroenterology Clinical Practice Guidelines

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Introduction

Gender disparities exist in gastroenterology with women being underrepresented in clinical practice and leadership positions. However, few studies have evaluated gender differences in authorship of gastroenterology clinical practice guidelines. This study aimed to assess gender disparities in authorship of gastroenterology guidelines and their cited articles over time.

Methods

We reviewed luminal gastroenterology guidelines from the American College of Gastroenterology, American Gastroenterological Association, and American Society for Gastrointestinal Endoscopy to compare authorship of current guidelines (defined as published from 2019-2022) to their retired guideline (defined as the previous guideline that was replaced by the current guideline). We evaluated the gender of first and senior authors of guidelines and their cited articles via a name-based gender prediction software, which does not account for the author's self-reported gender identity. Author institutions, faculty rank, the strength of recommendation supported by the cited article, and the cited article study type (randomized controlled trial (RCT), systematic review, meta-analysis, observational, etc.) were collected to evaluate factors associated with female authorship.

Results

We reviewed 10 current guidelines, 9 retired guidelines, and 2046 cited articles. There were less female than male first authors for current (30%, 70%) and retired (33%, 66%) guidelines (p -value=1.0). Similarly, there were less female than male senior authors for current (0%, 100%) and retired (33%, 66%) guidelines (p -value=0.09). Proportions of female first authors (p -value<0.0001) and senior authors (p -value=0.0003) of cited articles increased over time (Figure 1). Women were less often to be first authors of cited RCTs, systematic reviews, and meta-analyses than observational studies (34% vs 67%, p <0.0001). Cited articles that supported a „Äústrong,Äù guideline recommendation were less often first-authored (19% vs 81%, p =0.0184) and senior-authored (8% vs 92%, p =0.0040) by women. Among cited articles, lower gastrointestinal tract location predicted female first-authorship (OR 1.62, 95% CI 1.16-2.24, p =0.0041) and senior authorship (2.69, 1.68-4.31, p <0.0001). The majority of male first and senior authors were at the professor rank. However, female first and senior authors varied in their faculty rank.

Conclusions

First and senior authors on pivotal articles were less likely to be female however, female authorship increased over time. Female authors were less common on higher level of evidence studies, such as RCTs, and articles that supported guideline statements with a „Äústrong,Äù recommendation. Further studies are needed to assess if the proportional increase in female

authors is due to a small subset or representative of the number of women practicing in gastroenterology.

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Rapid Response Workshop Effect on Interns' Confidence Level

Pontea P. Niaki, MD, Mayela L. Milanes Arauz, MD, Austin L. Ciccati, DO, Elizabeth McClain, PhD, and Christopher Fortson, MD

PURPOSE

The purpose of this study is to examine if implementing an interactive rapid response workshop can aid in improving interns' confidence in performing tasks independently during rapid responses.

HYPOTHESIS

A standardized rapid response workshop will improve interns' confidence level.

SUBJECTS

The participants were eight family medicine residents (experimental group) and eight were internal medicine residents (control group), both at Mercy Hospital Fort Smith in Arkansas.

METHODS

There were rapid response workshops where each resident in the experimental group was presented with two critical care case scenarios and a worksheet for the residents not directly role playing. Data collection included pre and post workshop confidence levels. The dependent variable was the workshop, while the independent variable was the scale of confidence level.

RESULTS

The Mann-Whitney U test showed that the experimental and control groups did not demonstrate a statistical difference in reported level of confidence in preworkshop ($U = 19.500$, $p = .152$) or post workshop ($U = 30.00$, $p = .83$). Therefore, we are rejecting our alternative hypothesis and accepting the null hypothesis. The Wilcoxon signed-rank test showed that our brief rapid response workshop did not elicit a statistically significant change in the level of confidence ($Z = -1.000$, $p = 0.317$) in the experimental group. However, the control group did demonstrate a statistically significant change in level of confidence ($Z = -2.449$, $p = 0.014$).

CONCLUSION

The interactive rapid response workshop did not show a statistically significant difference in interns' confidence levels.

DISCUSSION

Although there was no statistical significance in confidence level on pre and post-workshops in the experimental group, there was a noticeable decrease in confidence level reported. In contrast, the control group showed a statistically significant increase in reported confidence level. This might be secondary to the workshop making interns self-aware of areas in which they lack medical knowledge. Also, the result findings could be due to internal medicine (IM) residents having more exposure to acute care medicine than family medicine (FM) residents. Our study was limited in assessing this factor.

Some of the weaknesses of the study include small sample size leading to type II error.

Confounding variables can also be present since we used FM residents for the experimental

group and IM residents for the control group. Also, the control and experimental group were not matched by gender contributing to confounding variables. In addition, selection-bias from limited data collection from one hospital further threatens the external validity of this study.

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Case Presentation: Stiff Person Syndrome A Rare Neurological Disorder

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BACKGROUND & PURPOSE

Stiff-person syndrome is a rare neurological disorder that manifests with muscle rigidity and painful spasms in the axial and proximal muscles that is often misdiagnosed. SPS is classically a diagnosis of exclusion. Encephalograms, metabolic panels and imaging are usually benign. Continuous EEG monitoring may be helpful in excluding differential diagnoses (Crisp et al., 2020). Subtypes of the disorder include a classic form, forms of partial SPS, and progressive encephalomyelitis with rigidity and myoclonus (PERM) (McKeon et al., 2012). The subtypes of the disorder are distinguishable by autoantibody profiling. PERM is characterized by typical symptoms with rapid neurological decline and dysautonomic phenomena include dysphagia, dysarthria, and hyperekplexia (Papadopoulou et al., 2014).

CASE DESCRIPTION

A 67-year-old female presented with complaints of shortness of breath and chest pain which rapidly generalized into whole body pain. Extensive cardiac work-up was negative. On day 4 patient began having seizure like activity, initially suspected to be panic attacks as they responded well to anxiolytics. On day 5, a rapid response was called when the patient became unresponsive, diaphoretic, tachycardic, and then began exhibiting myoclonic activity. Her symptoms escalated, resulting in generalized stiffness, sluggish pupillary response and incontinence of bowel. Her CSF Paraneoplastic antibody panel resulted positive for GAD antibodies. This led to the diagnosis of SPS rather than psychogenic pseudo-seizures.

OUTCOMES

Patient started on diazepam with titrated dose until symptomatic relief. Treatment with diazepam improved most of her symptoms, although her dysphagia remained requiring PEG tube placement before her discharge home.

DISCUSSION

SPS severity and progression can vary among individuals; however, patients commonly experience discomfort, stiffness, and muscle spasms in a multitude of locations. There are several different phenotypes reported in literature; one of special interest in our case is PERM. PERM often has a more rapid development of symptoms as observed in our patient.

It is important to differentiate SPS from other similar etiologies as certain medications that these patients are commonly on should be avoided, such as SNRIs. Patient's on SNRIs have shown to have worsening symptoms and EMG activity (Newsome, 2016). While SPS is a diagnosis of exclusion, a thorough neurological investigation which included performing CSF analysis aided in getting the correct diagnosis for this patient.

Even though there is no cure, treatment focuses on symptomatic management and disease

modifying therapy or immunotherapy. Once a diagnosis is made, prompt symptomatic treatment with diazepam will be the most important next step.

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Benefits of Introducing Point of Care Ultrasound (POCUS) to our Resident's Continuity Clinic

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Purpose

POCUS may be the only option in reducing wait times, cost and patient burden on imaging services in underserved settings, consequently improving health care disparities.

Description

Point-of-care ultrasound is the use of an image-producing ultrasound device for diagnostic and procedural guidance, by the clinician himself, at the point of care, in real time allowing for direct correlation with signs and symptoms of patient's illness and/or disease. There is solid evidence base for Point of care ultrasound (POCUS) improving traditional examination techniques in the diagnosis and management of the acutely unwell medical patient and it is expanding rapidly in other healthcare settings. An example is in the outpatient primary care setting. This is the setting where a significant number of cardiac pathologies are first discovered. POCUS can be used as a quick and qualitative initial screening for these unsuspected pathologies and their etiologies. This is a study showing the benefit of POCUS in reducing the rate of referral for echocardiogram by 33%. This is particularly important in underserved areas as it serves as a gatekeeper, significantly reducing the patient burden and wait times on the available services. According to Lee and Decara, "Indeed, POCUS may be the only option in underserved settings where a high-end machine may be cost-prohibitive and where POCUS availability may help reduce resulting health care disparities."

Summary of use

At this time, we have purchased the POCUS ultrasound and the residents at Mercy Internal Medicine clinic are in the process of getting POCUS trained. Ultimately residents will be able to use this POCUS to provide care to patients. This is the phase 1 of the project which presents the baseline data. Over the next year, the phase 2 of this project will be presented showing the improvement in lag time, an increase in uptake of USS imaging and reduction in cost to the patient.

Importance to members

In our patient population, many patients rely on the public transportation or the Medicaid bus to get to appointments. Extra appointments for imaging or ultrasound come with the extra limitations on finances, logistics, childcare, transportation, time off work, and even loss to follow-up.

2998 ultrasound orders were placed in from the FTSM internal medicine clinic between January 2021 to December 6, 2023. Of these 2785 (91%) of patients had their ultrasound done after a day of ordering. The most common anatomical site that was imaged was the abdomen 24.5%, and the Head being the next most common site at 18.1%, the Chest constituted 17.6% of the orders and the Upper extremity was the least ordered with 1.3%. When patients who are already burdened by social and economic factors are unable to access healthcare, it makes for a vicious cycle that sustains these limitations that keep the individual encumbered. POCUS could alleviate some of these limitations by reducing the number of follow-up appointments for imaging particularly ultrasound.

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Case Review of Congenital Ectopic Coronary Artery Disease

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BACKGROUND AND PURPOSE

Coronary artery anomalies (CAAs), rare congenital conditions affecting approximately 1% of adults, are associated with adverse cardiac events, including sudden cardiac death. This article reviews three recent clinical cases involving CAAs, delving into their origins, clinical presentations, diagnostics, treatments, and outcomes. CAAs involve irregularities in coronary artery origin, distribution, and termination. Notably, the left coronary artery arising from the right sinus (0.15%) and the right coronary artery from the left sinus (0.92%) are common variations. Other anomalies include the left circumflex artery (LCX) originating from the right coronary sinus and the left main coronary artery or Left anterior descending artery (LAD) emerging from opposite sinuses, leading to diverse clinical presentations.

CASE DESCRIPTION

Case 1 features a 70-year-old female with hypertension presenting with exertional angina. Surgical revascularization was performed after coronary angiography revealed an ectopic LAD. In Case 2, a 72-year-old male with hypertension presented with chest pain and NSTEMI. Coronary angiography showed an ectopic LCX and significant stenosis in LAD and RCA, treated with PCI. Case 3, involving a 49-year-old female with hypertension and syncope, was managed medically as angiography revealed an anomalous RCA origin without significant obstructive disease.

OUTCOMES AND DISCUSSION

Treatment approaches for CAAs are patient-specific due to limited guidelines. Case 1 underwent coronary artery bypass surgery, Case 2 received PCI, and Case 3 was treated medically. Diagnostic methods encompass stress testing, coronary angiography, and coronary CT angiography (CCTA). CCTA is particularly valuable for distinguishing benign and clinically significant ectopic origins. For intramural courses, coronary unroofing is the preferred surgical technique, while absent intramural courses may require coronary translocation or reimplantation. Percutaneous coronary intervention (PCI) primarily addresses downstream atherosclerotic lesions without directly addressing the CAA. Treatment choice depends on patient-specific risk factors and pathology.

CONCLUSION

In summary, CAAs pose challenges in interventional cardiology, warranting early and accurate diagnosis to prevent adverse events. A personalized approach, considering patient characteristics, is crucial due to the lack of robust guidelines. Advanced imaging technologies like CCTA and MRA aid in assessing CAAs' clinical significance and guiding treatment decisions. Further research is required to establish optimal treatment strategies, including investigating CAAs' prevalence in specific regions such as Arkansas.

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Epidemiology of Chlamydia Trachomatis in Arkansas and Surrounding States from 2016 to 2020

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Purpose/Hypothesis

This study analyzes Chlamydia cases and rates in the United States, particularly in Arkansas and its neighboring states Louisiana, Mississippi, Oklahoma, and Texas, from 2016 to 2020.

Subjects

The research cohort includes individuals of both genders (female and male) and represents all age categories. Asian, Multiracial, Native Hawaiian/Other Pacific Islander, and unknown are grouped as "Others."

Materials/Methods

Data on Chlamydia cases and rates were collected from the Centers for Disease Control and Prevention (CDC) and state health department websites. Microsoft Excel was used for statistical analysis, and comparisons were made between years, states, age groups, gender, and races.

Results

When each state was ranked based on prevalence, Mississippi and Louisiana were always in the top 3 while Arkansas shifted each year ranging from number 9 to 18. Comparing the surrounding states, Missouri and Texas ranked lower ranging from 15 to 25. Total female reported cases were higher than male in Arkansas and border states. Rate per 100,000 is highest in unknown races while lowest in Asian, multiracial and Native. Arkansas and neighboring states showed variations in disease rates by age group, with highest consistent patterns among 15-24-year-olds from 2016 to 2020. The lowest rate of disease was observed in less than 15 and over 45 year-olds. Despite annual fluctuations, an overall decrease in disease rates was observed in 2020 in all categories.

Conclusion

Chlamydia remains a significant public health concern, with persistent regional, age-specific, and racial disparities. Tailored interventions, screenings and research are crucial to reduce Chlamydia prevalence. Data limitations, especially in 2020, may stem from reduced screenings during COVID-19. Further research into specific age group behaviors, attitudes, and risk factors can inform more targeted and effective interventions.

Clinical Relevance

The rate of *C. trachomatis* infection was found to be associated with the age at which individuals first engaged in sexual activity, lower income, and limited access to insurance (Gupta et al 2021) It was most prevalent (12%) among women who initiated sexual intercourse at a young age, specifically before the age of 15 (Sessa et al., 1994). This suggests heightened susceptibility in young adults, possibly due to socio-behavioral factors.

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Nicotine consumption is regulated by an estrogen negative feedback loop via estrogen receptor beta by its control of olfactomedin expression

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Purpose/Hypothesis: Estrogen is associated with enhanced nicotine use in women, with enhanced vulnerability to nicotine use disorders being associated with higher levels of circulating estrogen (1,2). In ovariectomized (OVX) female rats, estradiol (E2) treatments increased estrogen receptor α (ER α) and not ER β in a key brain reward region, the nucleus accumbens core (NAcore). We previously determined that the Olfactomedin1 (OLFM1) promoter was enriched by only by ER α . Therefore, we hypothesized that ER α and OLFM1 might be important in the reward circuitry for regulating nicotine use in females.

Materials/Methods: We wanted to determine whether ER α or ER β regulates the expression of the OLFM isoforms. We used rat nucleus accumbens neurons that express both ER isoforms and the OLFMs. We next performed dual luciferase assays with Cos7 cells with treatments of nicotine and E2. We then treated OVX female rats with E2, nicotine, E2+nicotine, or vehicle. Lastly, we treated human female neuron-like cells with estrogen and nicotine and performed advanced PAM gene analyses.

Results: We found that two-hour E2 treatments induced the expression of OLFM1 and OLFM3. However, nicotine only suppressed the E2-induction of OLFM1 and OLFM2. The dual luciferase assay found that the OLFM3 promoter was enriched with estrogen treatment. The treated rats showed Olfm1 and Olfm2 significantly increased in the NAcore with E2 treatment, and nicotine treatment suppressed the E2-induced OLFM expression. The PAM gene nuclear hormone receptor coregulator analysis of the treated neuron-like cells shows that estrogen and nicotine induced different changes in the interactome of ER α and did not cause much change in ER β . Furthermore, particularly differential coregulators were identified for further studying.

Conclusions: Nicotine suppressed the E2-induced OLFM expression. Nicotine and estrogen alter the coregulators of ER α , which may lead to changes in ER α transcriptional activity that could potentially have effects in nicotine consumption behavior.

Clinical Relevance: These new findings suggest that ER α -induction of the olfactomedins might serve as a feedback loop for driving nicotine addiction processes, which is suppressed when nicotine is on board. These results indicate potential new targets for therapeutic cessation of nicotine use in women.

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Wear and topographic changes in two closely related Platyrrhine species, *Saimiri sciureus* and *Saguinus Oedipus*

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Purpose: Diet is a major contributor to wear in the premolars and molars - the primary masticatory teeth. Many researchers have argued that the majority diet consumed by a species (i.e., fruit or leaves) alters the rate at which teeth wear over time (Berthaume et al., 2020).

Saimiri sciureus and *Saguinus oedipus* are both categorized as frugivores because they primarily consume fruit - although each species consumes varying levels of grit (Savage et al., 2020; Lima & Ferrari, 2003). Their teeth have evolved to consume this diet with dull, lower cusps and large basins to act as crushing rather than shearing teeth. However, both species eat insects opportunistically although *S. oedipus* has been shown in observational studies to eat higher amounts of insects regularly (Garber, 1980; Jones et al., 1973).

Materials/Methods: This study assesses topographic variables of the first mandibular molar (M1) in *Saimiri sciureus* (n = 16) and *Saguinus oedipus* (n= 9) to establish how small variations in frugivory affect tooth wear. The R package MolaR was used to calculate Dirichlet, Normal Energy (DNE; surface complexity), Relief Index (RFI; 3D surface area ratio to 2D area), Orientation Patch Count (OPCr; calculates the orientation of varying surfaces), Slope (average cusp height), and Area Relative Curvature (ARC; sharpness of cusps) of the occlusal surface of each tooth (Pampush et al., 2016).

Results: Mann Whitney U tests showed no significant differences (all p-values > 0.05) in wear between the left and right sides of each individual or between males and females in each species, indicating no asymmetrical wear or differences in wear patterns between sexes. Kruskal-Wallis analyses showed significant differences (p-value = 0.044) in DNE, with *S. sciureus* having higher DNE scores and therefore sharper teeth than *S. oedipus* in teeth with 0-9.9% wear. As wear increases above 10% on the tooth's surface, *S. sciureus* DNE scores are maintained while *S. oedipus* DNE scores increase.

Conclusions: This indicates that *Saimiri* teeth maintain normal masticatory function with wear while *Saguinus* teeth are increasing in sharpness. These results suggest that *Saguinus* may opportunistically consume tougher/stiffer objects as older individuals after their teeth have sharpened. More research is needed to assess differences in topographic values in later stages of wear (i.e., past 30%) to determine if tooth functionality continues to improve or maintain sharpness levels through use.

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Hypercalcemia: A Marker of Steroid Under replacement and noncompliance in Addison Disease

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Introduction: Addison's disease, also known as primary adrenal insufficiency, is a rare long-term endocrine disorder affecting around 9-14 per 100,000 people in the developed world. It is characterized by the inadequate production of cortisol and mineralocorticoids leading to electrolyte abnormalities including hyponatremia and hyperkalemia. One of the possible complications of Addison disease is hypercalcemia which is noted in around 5-6 percent of patients at the time of diagnosis. Monitoring adequacy of steroid replacement therapy and Addison's disease is mostly based on signs and symptoms. We presented rare case of Addison's disease where elevated calcium levels served as a marker of noncompliance with steroid replacement.

Case Presentation: Our patient is a 20-year-old male with past medical history of autoimmune polyglandular syndrome with Addison's disease and hypothyroidism, anxiety and depression; who presented for regular follow-up. He was on steroid and thyroid hormone replacement therapy. He had a recent fall which resulted in left clavicle fracture. No significant findings were noted on clinical examination. Labs showed mildly elevated calcium of 10.1 mg/dL (N 8.6-10), elevated creatinine at 1.2 mg/dL (N 0.67-1.17) and elevated phosphorus of 4.7 mg/dL (N 2.5-4.5). He reported compliance with current treatment regimen. On follow-up after 1 month, labs showed persistent elevation in calcium, creatinine and phosphorus levels at 10.2 mg/dL, 1.2 mg/dL and 5.3 mg/dL respectively. Patient's mother reported that patient was missing some doses of his recommended hydrocortisone and fludrocortisone. After counseling, he resumed recommended treatment regimen. Labs were repeated after 1 month and they revealed normalization of calcium, creatinine and phosphorus levels at 9.1 mg/dL, 1 mg/dL and 4.4 mg/dL respectively.

Discussion: Patients with Addison's disease on steroid replacement therapy are regularly monitored for over replacement or under replacement based on symptoms and signs including postural hypotension, energy levels, weakness, dizziness and cushingoid features. Our patient was under replaced and he only had lab abnormalities with consistent elevation in calcium, creatinine and phosphorus levels. Hypercalcemia in Addison's disease is postulated to be due to various causes including increased resorption from bone and decrease removal by the kidneys. On resumption of treatment, his calcium levels normalized. His fall could possibly have been due to dizziness resulting from under replacement. There have been numerous case reports of Addison's disease and adrenal crisis initially presenting with hypercalcemia. This case is one of the rare instances where under replacement of steroid therapy in Addison's disease was diagnosed on the basis of elevated calcium levels, and not on the basis of signs and symptoms. The implications of noncompliance with therapy in Addison's disease is Addisonian crisis which has a high mortality rate. Our case report therefore demonstrates that hypercalcemia can serve as a marker of noncompliance with therapy in Addison's disease and this can help us in increasing compliance and adherence and thereby reducing the incidence of adrenal crisis.

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Inner ear morphology of the great apes and their influence on locomotion

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Purpose: Semicircular canals are a system of fluid-filled tubes in the inner ear that help aid the body in balance, head movements, and gaze. Semicircular canal structure locomotion has been studied extensively among primates in one of two models: 1) comparing species using the canal radius (Spoor et al. 2007) and 2) measuring perpendicularity relative to the other canals or canal orthogonality (Malinzak et al. 2012). These models have been used extensively to determine sexual dimorphism between and within species (Gonzales et al. 2018). Measuring canal radii, area, and length of the canals have found that larger areas and radii correlate with increased locomotor agility (Cox et al 2009) while specific canals - such as the lateral semicircular canal - play a predominant role in the movement of quadrupeds (Maitre et al., 2017). Despite this, few studies have compared canal structure between species that utilize different locomotion patterns.

Materials/Methods: This study strives to examine the different morphology between three primate species: Hylobates sp. (gibbons, $n = 9$), Gorilla gorilla (gorillas, $n = 10$), and Homo sapiens (humans, $n = 15$). The left semicircular canals of these species were digitally segmented using 3D slicer and several measurements were made on the anterior, posterior, and lateral axis including total surface area, total volume, individual areas, individual lengths, and angular measurements.

Results: T-tests found that gorillas showed the most sexual dimorphism ($p\text{-value} < 0.05$), humans showed dimorphism in some variables, and gibbons showed no dimorphism ($p\text{-value} > 0.05$). ANOVAs were conducted that showed that gibbons were significantly different from humans and gorillas in length and volume of all three canals (α set to 0.05) while surface area showed significant differences between all three species.

Conclusions: These results support our hypothesis that because gibbons are arboreal, they rely more on climbing, swinging, and leaping, and would therefore have larger semicircular canals that would support these agile movements. These larger canal volumes and areas potentially explain the controlled movements the gibbons make compared to the less agile bipedalism found in humans and quadrupedalism found in gorillas. While our data shows these findings, much more research is required to further uncover which axes play a role in controlling specific types of movements.

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Keratoderma Blennorrhagicum

Glister Kate Reasoner, OMS IV and Tony DeMondesert, MD

Keratoderma Blennorrhagicum is a rare extraarticular sign of Reiter's Syndrome, its frequency being 15-20% of cases. Reiter's Syndrome is often triggered by GU or GI infections such as Campylobacter, Shigella, and Salmonella. However, at lesser frequency associated with Irritable Bowel Disease. In this article, we present a case of ulcerative colitis with initial negative stool cultures then with superimposed campylobacter infection leading to question if Reiter's with IBD is increasing in prevalence.

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Mandibular foramen variation in primates and its relationship to diet

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Purpose/Hypothesis: The wear and tear of the teeth has changed evolutionarily throughout the years and numerous authors have suggested a strong general relationship between molar tooth structure and diet (Kay, 1975). As teeth continue to be challenged by coarse factors, it is noted that there will be changes to the surfaces of the teeth (Bartlett & Dugmore, 2008; Galbany et al., 2014). The mandibular teeth and associated soft tissue, with the possible exception of buccal aspect of the molars, are innervated by the Inferior alveolar nerve (IAN), a branch of the mandibular nerve that travels through the mandibular foramen (Engel et al., 2019). The relationship between the IAN and the mandibular canal is pivotal due to the IAN's connection with teeth, mastication, and ultimately dietary adaptations (Yoakum & Terhune, 2023). Prior work of the IAN, mandibular foramen, and mandibular canal has shown augmented importance to humans; however, there is minimal research and data on the mandibular canal, mandibular foramen, and IAN when juxtaposed to primates. Nonetheless, the significance of the IAN within the mandibular canal and mandibular foramen in primates is due to the IAN's role in sensation, mastication and plausible dietary indications and contraindications in primate species.

Materials/Methods: The purpose of this study is to assess variation in cross sectional areas of the mandibular foramen in *Callithrix* sp. (gumnivore; n = 9), *Saimiri sciureus* (frugivore; n = 10), *Colobus* sp. (folivore; n = 9), *Chiropotes satanas* (granivore; n = 3), and *Pithecia pithecia* (granivore; n = 4) and to examine its relationship to diet. Using 3D Slicer, length, area, and circumference measurements were taken from the mandibular foramen.

Results: ANOVAs showed that folivores were significantly different in mandibular foramen area and circumference from all other dietary categories (all p-values < 0.05) but no other categories could be differentiated from one another. Gumnivores alone were significantly different from all other dietary categories in each measurement (all p-values < 0.05) with the smallest range and average values.

Conclusions: Folivories (leaf-eating) primates use their posterior dentition for much longer feeding and chewing periods than other dietary categories, with a need to feel minute differences between leaf types. These data support the hypothesis that *Colobus* sp. would need more nervous tissues in the posterior dentition to detect these minute differences for optimal nutritional foraging and tooth protection.

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ADAM family of metalloproteases

Brandy Ree PhD, Emilie Games, Septimiu Demeter, Steven Chen

The ADAM family of metalloproteases catalyze shedding, which is the proteolytic cleavage and subsequent release of cell surface factors. Misregulation of the sheddase role of ADAMs have been shown to promote disease. Interestingly, almost half of the individual ADAMs lack the consensus sequence for catalysis, and are thus catalytically inactive. We propose that the noncatalytic ADAMs may function to regulate the catalytic ADAMs through ,”Competitive mimicry”. As ADAMs are established integrin ligands and integrin expression influences ADAM-mediated shedding, molecular interactions such as integrin binding may localize a catalytically active ADAM to a substrate to facilitate shedding. If a noncatalytic ADAM exhibiting the same integrin binding specificity as a catalytically active ADAM counterpart is introduced, competition for integrin occupancy may occur resulting in altered shedding activity. This study investigates the intricate relationship between the non-catalytic ADAM7 and catalytically active ADAM28. Previous studies have illuminated the fact that ADAM7 and ADAM28 exhibit overlapping expression patterns, similar kinetics, and analogous active sites, suggesting that ADAM7 may regulate the sheddase activity of ADAM28. To investigate this intriguing connection, this project begins with the development and expression of specific DNA constructs. Site-directed mutagenesis was employed to generate a mutation known to “reawaken” ADAM7 (ADAM7Q/E), as well as a catalytically inactive form of ADAM28 (ADAM28E/A). Additionally, wild type ADAM7 and wild type ADAM23 were also put into expression vectors. These constructs were used for transfection of ADAM28 knockout MDAMB231 breast cancer cells. Four distinct cell lines were cultivated for experimentation: MDAMB231 wild-type, ADAM28 knockout MDAMB231 cells transfected with wild-type ADAM7, ADAM28 knockout MDAMB231 cells transfected with ADAM7Q337E, and ADAM28 knockout MDAMB231 cells transfected with wild-type ADAM23. To ascertain the expression of ADAM7, ADAM7Q337E and ADAM23, the cell surface proteins of the four separate cell lines were biotinylated using EZ-link Sulfo-NHS-LC-Biotin and visualized using Western blot and transfer techniques. The expression of ADAM28 knockout MDAMB231 cells transfected with wild-type ADAM7 and the expression ADAM28 knockout MDAMB231 cells transfected with wild-type ADAM23 was confirmed. The ADAM28 knockout MDAMB231 cells transfected with ADAM7Q337E did not show detectable expression at this time, highlighting a crucial area for further exploration.

Use of Progressive Simulation to Develop Clinical Judgment in an Undergraduate Nursing Obstetrics Course

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Purpose/Hypothesis: The purpose of this study was to examine if the use of progressive simulation in an obstetrics course can promote the development of clinical judgment in undergraduate nursing students.

Subjects: Thirty-four undergraduate nursing students in an obstetrical course completed the progressive simulation. All information was de-identified. There is a rising need to develop practice ready nurses that exhibit clinical judgment to promote better outcomes for clients in healthcare. There is a gap between students having knowledge and being practice ready. Nursing students lack exposure in clinical with high-risk obstetrical incidents and independent decision making. This progressive simulation allowed students to participate in a client's deterioration of a complicated shoulder dystocia birth and participate in an independent bedside shift change. The simulation allowed students to assume the role as a postpartum care team for the client experiencing postpartum hemorrhage.

Materials/Methods: Tanner's Clinical Judgment Model was the framework used. During the progressive simulation, instructors utilized the Lasater Clinical Judgment Rubric (LCJR) instructors to evaluate the clinical judgment. A formative pre- and post-test were administered to assess percentage of learning gain that occurred. Additionally, a self-evaluation tool was administered to students to evaluate their individual clinical judgment develop upon completion of the progressive simulation.

Results: This progressive simulation allowed students to participate in a client's deterioration in a complicated birth and recovery through simulated shift change. It increased students' knowledge of shoulder dystocia and postpartum hemorrhage by recognizing signs and symptoms and providing interventions. Instructors evaluated students' performance in each domain of the LCJR, which noticing, interpreting, responding, and reflecting.

Conclusion: Progressive simulation facilitated nursing students developing clinical judgment in an obstetrics course with this research study. It increased students' knowledge of shoulder dystocia and postpartum hemorrhage by recognizing signs and symptoms and providing interventions. However, continued research on the use of progressive simulation should be considered to evaluate the development of clinical judgment among prelicensure students throughout all healthcare specialties.

Clinical Relevance: Healthcare system needs practice ready nurses to be able to recognize cues, analyze data, take action and evaluate outcomes when caring for clients. Progressive simulation can be an innovative technique used in preparing prelicensure nurses to enter the workforce.

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Gadolinium-Based Contrast Agent-Induced Nephrogenic Systemic Fibrosis

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Purpose

Gadolinium-induced nephrogenic systemic fibrosis¹ (GINSF) is a gradual onset, multiorgan fibrosing condition induced by gadolinium-based contrast agents (GBCAs) utilized in magnetic resonance imaging (MRI). This condition is categorized by fibrosis of the skin and systemic organs, including liver, lungs, and kidneys. This systemic review examines the efficacy of various gadolinium-based contrast agents as they relate to nephrotoxicity.

Description

Gadolinium-based contrast agents consist of gadolinium, a heavy metal known for its toxicity, as well as chelating agents, such as ligands, which aid to mitigate toxic effects. GBCAs consist of different chelating agents, namely linear and macrocyclic in composition, with linear ligands forming weaker bonds thus dissociating more quickly and inducing systemic effects. Compared to macrocyclic chelating agents, these are considered higher risk contrast agents².

Patients with renal insufficiency, including Stage 4 and 5 renal diseases, are particularly at risk. According to the American College of Radiology, approximately 30% to 45% of the 40 million MRI procedures performed annually utilize GBCAs³.

GBCAs are categorized into three distinct groups: group I agents with the greatest incidence of GINSF, group II agents with a few, if any unconfounded cases of nephrogenic systemic fibrosis,⁴ group III agents for which data remains limited regarding nephrogenic systemic fibrosis,⁴ Gadavist, a gadobutrol derivative, is identified as a group II agent with the least number of nephrotoxic effects.

Summary of Use

GBCAs are given as injections to patients prior to receiving MRI scans. These contrasts enhance imaging of inflammation, internal organs, and vasculature. Group I GBCAs exhibit highest incidence of GINSF in patients with chronic kidney disease with a glomerular filtration rate (GFR) $<30\text{mL}/\text{min}/1.73\text{min}^5$, as well as patients with acute kidney disease. The risk appears to be lower for patients with moderate kidney disease, GFR $30\text{--}59\text{mL}/\text{min}/1.73\text{min}^5$, and the least for patients with mild kidney disease, GFR $60\text{--}89\text{mL}/\text{min}/1.73\text{min}^5$. Group II GBCAs significantly reduce risk across all stages of kidney disease, with an incidence rate of 0.0%, upper bound of 95% CI was 0.07%, compared to 0.10% in Group I GBCAs⁵.

Importance to Members

The importance in employing Gadavist in MRI usage lies in the significant risk mitigation of developing GINSF. This significantly improves nephrotoxic outcomes in patients with acute and chronic kidney disease.

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Relations of Tooth wear and Dental Sculpting in *Saimiri sciureus* and *Colobus guereza*

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Purpose: Tooth wear in primates represents a multifaceted phenomenon influenced by aging, environment, evolutionary advantages, and diet (Galbany et al., 2014). The interplay between tooth morphology, enamel microstructure, and dietary mechanics plays a pivotal role in shaping the occlusal surface morphology of teeth, leading many researchers to rely on new methods such as dental topography measures and variables. Recent work (i.e., Pampush et al., 2018; Ungar, 2018; Lucas, 2004) have proposed the „Äadaptive dental sculpting,Ä hypothesis which argues that teeth specifically adapted for high wear diets (e.g., folivores) would maintain or increase dental efficiency with increased wear but this hypothesis has not been tested in species with low wear diets (e.g., frugivores).

Materials/methods: This study examines the dental traits of *Saimiri sciureus* (frugivore, $n = 15$) and *Colobus guereza* (folivore, $n = 8$) to facilitate a comparative analysis between topographic variables and tooth wear in the first mandibular molar (M1) taken from 3D microCT scans. The R package MolaR was used to calculate Dirichlet,Ä Normal Energy (DNE; surface complexity), Relief Index (RFI; 3D surface area ratio to 2D area), Orientation Patch Count (OPCr; calculates the orientation of varying surfaces), Slope (average cusp height), and Area Relative Curvature (ARC; sharpness of cusps) of the occlusal surface of each tooth (Pampush et al., 2016).

Results: Mann Whitney-U tests showed significant differences in ARC ($p = 0.023$) and Slope ($p < 0.001$) with *C. guereza* showing higher ARC values (thus sharper teeth) and lower slopes (higher cusps). As wear increases, slope differences become non-significant ($p = 0.736$) at 20-29% wear between both species while slope continues to lower (indicating lower cusps for each species). ARC values become non-significantly different at 10-19% wear ($p = 0.927$) and continue to increase for both species.

Conclusions: These data support the adaptive dental sculpting hypothesis in different ways at earlier stages (0-19%) of wear (*S. sciureus* is increasing in sharpness with wear while *C. guereza* is maintaining sharpness with wear with both showing reduction in cusp height) but in the same way at later stages (20-29%) of wear (both species are maintaining sharpness and reducing cusp height). This preliminary data indicates more study is needed to establish differences in topographic variables in later stages of wear with species that eat high and low wear diets.

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Symptoms of Myocardial Infarction in Transgender and Gender Non-Conforming Patients: A Call to Action Literature Review

Darren Schoenike, MSB

Purpose and Description:

Heart disease is the leading cause of death in the US, claiming nearly 700,000 lives per year and over \$3 billion being poured into research each year to fight against it. From understanding risk factors and prevalence to developing treatment methods, the goal is to promote health and longevity in as many people as possible. Proper education on heart health can play a vital role in equipping patients with the knowledge necessary for them to play an active part in making healthy choices by means of preventative care (Adams, 2010).

With social prevalence of transgender and gender non-conforming individuals (TGN) rising, there has been increased accessibility to resources for TGN folks to medically transition. Medical transition can include using hormones such as testosterone or estrogen as hormone replacement therapy (HRT), but there is a paucity of research regarding long term use of HRT in the TGN population. Knowing the potential risk factors of HRT is important in making an informed decision about its use.

Data has shown that the prevalence of heart disease is higher in TGN individuals, but there is conflicting data as to whether the use of HRT or certain dosages are a potential cause (Veala, 2023). Data has also shown an increase in risk factors such as lipid panel levels in those who use testosterone HRT, whereas those using an estrogen HRT have an increase in cardiovascular disease (CVD) (Maraka et al., 2017). This is not surprising since similar results have been seen in postmenopausal cisgender women who use estrogen (Wierckx et al., 2013).

Summary of Use and Importance to Members:

Despite the increased prevalence of CVD in TGN individuals, there is little to no research looking at the warning signs of myocardial infarction in this population. Cisgender individuals can be educated about typical warning signs, chest pain traveling to the left arm in cisgender males versus more flu-like symptoms in cisgender females (American Heart Association, 2017). With the drastic effects HRT has on the body, it warrants the question: „ÄDoes HRT change the anticipated warning signs of a heart attack so that they will more closely align with the sex associated with that particular hormone?„Ä In this literature review, we wanted to determine if any research exists to answer this question. Since education plays a pivotal role in preventative medicine for heart health, then this is a question that needs to be investigated to better equip TGN individuals with the knowledge and warning signs that can potentially save their lives.

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Copper Deficiency Anemia and Neutropenia due to Zinc excess

Jasmine Shrestha, MD; Victoria Schrock, OMS IV; Asis Shrestha, MD; Runa Shrestha, MD

Introduction

Copper and zinc are crucial micronutrients for our body. Copper functions as an enzymatic cofactor in metabolic processes such as hemoglobin synthesis, iron oxidation, neurotransmitter, cellular respiration, antioxidant and in formation of pigments and connective tissue.[1] Zinc is involved in DNA expression, membrane stabilization and vitamin A metabolism.[2]

Case description

We present a case of an 84-year-old female with history of hypertension and asthma, who was referred to hematology clinic for evaluation of anemia and neutropenia. Her chief complaint was fatigue. Her recent cancer screening with mammogram and colonoscopy were normal. Her family history was relevant for leukemia in brother during his 80s. Laboratory investigation showed worsening macrocytic anemia (Hemoglobin 9.3 from 12.2g/dl in one year with MCV 98.5fl), worsening leukopenia (WBC 2.5 from $6.1 \times 10^3/\text{ul}$) and neutropenia (ANC 793 cells/uL). Her other anemia workup including bilirubin, vitamin B12, folate, iron panel, ferritin, haptoglobin, LDH were within normal limits. Vitamin D and celiac serology were normal. As basic anemia workup showed no obvious etiology, copper level was tested and resulted extremely low ($< 10 \text{ mcg/dl}$). On further investigation, she reported taking almost 9 to 10 tablets of zinc tablets per day (50 mg each) for the last two years since the COVID pandemic. She was advised to stop zinc supplement. The zinc level was 101 mcg/dl but was checked 10 days after discontinuing the supplement. She was started on copper gluconate 2mg daily. Repeat CBC in two months showed normalization of blood counts with resolution of symptoms. Copper level improved to 110 mcg/dl.

Discussion

Daily recommended intake of zinc is 8 mg/day for women, 11 mg/day for men and the tolerable upper intake level for adults is 40 mg/day.[3] Excessive zinc stimulates erythrocytes to produce intracellular heavy metal-binding protein called metallothionein. The metallothionein then binds to zinc and promotes its excretion. However, copper also has high affinity towards metallothionein and will be excreted in the process. Thus, excess zinc could lead to copper deficiency.[4] Anemia and neutropenia are common hematological abnormalities associated with copper deficiency. Typically, copper deficiency due to excessive zinc resolves with removal of zinc but may require copper supplementation in symptomatic patients.

Conclusion

Dietary supplements are quite common in the general population. Copper deficiency could

present with bicytopenia without neurological symptoms and should be considered as a part of anemia workup after basic workup is unrevealing. Excess zinc supplementation should be ruled out when copper deficiency is revealed.[5]

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Presumed Covid 19 Infection Unveiling an Advanced Lambda Light Chain Cardiac Amyloidosis

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Background and Purpose: Cardiac amyloidosis is a disease that occurs when a protein byproduct termed amyloid builds up within the heart, changing its morphological structure and overall function. Two subtypes of amyloid that have been found to frequent cardiac involvement include light chain (AL) and transthyretin (ATTR). The advanced presentation and events leading up to the patient's diagnosis of AL show us the importance of diagnosing cardiac amyloidosis in an early stage.

Case Description and Outcome: A 69-year-old female presented to the hospital for severe shortness of breath with exertion for the past year. She works as a respiratory therapist and her symptoms greatly impeded her work and daily activities. Aside from the shortness of breath, the patient had no other complaints. The patient recalls contracting a viral illness back in the fall/winter of 2019 before there was standardized COVID testing. After having this viral illness, the patient noted that her health rapidly deteriorated. She subsequently developed atrial fibrillation (A-fib) with a concomitant stroke shortly afterward. During her current hospitalization he was diagnosed with diastolic heart failure with a preserved ejection fraction (HFrEF) of about 45-50%. The echocardiogram also showed an enlarged heart with severe concentric LV hypertrophy with ventricular dysfunction. ECG showed a normal sinus rhythm with low voltage QRS and left atrial enlargement. Cardiac MRI also confirmed the diagnosis of severe left ventricular hypertrophy. With these findings, tests were taken to determine the possible causes of her heart failure, focusing on cardiac amyloidosis. The tests included serum electrophoresis (SPEP), urine electrophoresis (UPEP), serum-free light chain (SFLC), and 99mTechnetium-Pyrophosphate (PYP). SFLC showed an elevated free lambda light chain, directing the diagnosis toward primary cardiac amyloidosis due to the deposition of light chains. Cardiac biopsy showed mild myocyte hypertrophy, scant interstitial fibrosis, and interstitial and arteriolar deposition of Congo red-positive material. Lambda light chain deposits were seen along with amyloid features on electron microscopy. These findings were consistent with AL lambda-type amyloidosis. Treatment was initiated to improve the patient's symptoms and overall outcome with spironolactone, bumetanide, and metoprolol.

Discussion: It is vital to diagnose AL amyloidosis early because untreated patients with heart involvement have the most rapid disease progression. Late diagnosis results in approximately 30% of patients presenting with advanced, irreversible organ involvement and dying in a few months despite modern treatments. By gaining information about the different cardiac amyloidosis types, physicians can better recognize the clinical signs and catch the disease early. This will help physicians develop multidimensional treatment plans and provide better patient education to those currently suffering from either AL amyloidosis or ATTR.

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Title: Cayo Santiago *Macaca mulatta* Hard Palate Morphology in adults

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Purpose: Many works have established a greater variability in structures for males in comparison to females (Schultz, 1926). Despite the little significance given to the structure, the hard palate is important for the separation of the oral and nasal cavities and an integral part of the skull that evinces a high degree of modularity (Andrews et al., 2020). Previous work on *Saimiri sciureus* and hard palate length shows that males have a longer palate and a longer intercanine, interpremolar, and intermolar length in comparison to females (Lima et al., 2012). Further, previous work on macaques (King & Schneiderman, 1993) has established significant differences in palatal length between sexes, with greater midfacial prognathism in adult males than in females. This may be due to the fact that female growth ceases with the advent of adulthood, while male growth continues leading to longer palate length but similar palate width in a study conducted with orangutans (Hens, 2005). However, little research has addressed differences in depth of the hard palate using traditional linear measurements and shape differences using geometric morphometrics (GM).

Materials/Methods: The purpose of this work is to assess shape differences in male and female hard palates within the Cayo Santiago *Macaca mulatta* using 3D models of 15 male and 15 female adults (ages 8-19 years). Using 3D Slicer, 28 3D landmarks were placed, and 23 depth and linear length measurements were taken across the hard-palate.

Results: Paired t-tests showed significant differences (p -values all > 0.05) between the curved (depth) and straight linear inter-tooth measurements. Further t-tests using size-adjusted variables showed significant differences between males and females between first incisor ($p = 0.005$ [straight], $p = 0.001$ [curved]), second incisor ($p = 0.022$ [straight], $p = 0.004$ [curved]) and length of the maxillary hard palate ($p = 0.005$ [straight], $p = 0.014$ [curved]). Following a GPA, PCA axes for 3D shape showed males have overall larger palates although females showed larger anterior palatal aspects. An ANOVA showed a significant relationship in the regression of shape on size ($p = 0.001$), although there were no significant differences between males and females when size was accounted for using a regression of the shape residuals on centroid size ($p = 0.956$).

Conclusion: All together, these results indicate that females have wider anterior maxillary hard palates (likely due to smaller canine size) while males have overall longer palates, leading to greater midfacial prognathism.

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Pharmacology Retention and Evolving Memory Palaces: How the Method of Loci can be Modified for Medical Students' Pharmacology Learning

Jawad Syed, OMS-III; Nathaniel Zhu, OMS-III; Naunihal Zaveri, MS, PhD

Purpose:

We hypothesize that Evolving Palaces create a better representation of concepts, enhance retention and retrieval, and allow for greater personalization to memorize pharmacology concepts in medical school compared to existing static memory palaces commonly utilized by medical students through commercially available platforms.

Description:

The method of loci (MoL), also known as memory palace, memory journey, or mental walk is often used for memory training and retention. This method has been applied by medical students to recall, transfer, and apply knowledge leading to better performance on class assessments, board exams, and in clinical rotations. In this study, we explore the potential uses of Evolving Palaces, a term we coined to mean a visual mnemonic that can be consistently updated and organized as new information is presented.

Summary of Use:

Based on literature studies, we utilized the 5 visualization steps in the MoL for creating our own Evolving Palaces. PowerPoint presentation (PPT) was our organization tool to compile multiple visual memory palaces, since PPT allows for unlimited superimposition of images and gives freedom to reorganize and update slides. Images are chosen based on a strong personal association to a word or concept.

We explored two main approaches to improving the effectiveness of Evolving Palaces. The first approach is to build it from the ground up by choosing and compiling visual symbols for details about a drug class. The second approach is to use existing static memory palaces from third parties and modify them by adding more symbols as needed for the benefit of saving time at the cost of reduced personalization. For both approaches, when new information is presented later, visual backdrops and symbols can be added to expand the canvas and keep information current.

Importance to Members:

There are limitations to platforms available through third-party resources. They are not comprehensive enough to cover all topics in medical school classes, board exams, and clinical rotations, and they do not cover much of the material in standardized question banks. The dilemma is solved by our Evolving Palace, which incorporates new information from resources in real time. Personalization is a powerful factor in memory retention. Static memory palace services use generic symbols that are not personalized memory hooks for the student. With Evolving Palaces, students utilize their own symbols by drawing from a lifetime of imagery that is personally meaningful such as real-life objects, cartoon characters, historical figures, and more. While both static and Evolving Palaces have strengths and limitations, static palaces do not require much imagination from the learner, whereas Evolving Palaces require imagination and effort to make it personalized. This makes the Evolving Palace an infinitely expandable and updatable living visual mnemonic that grows more useful and comprehensive over time.

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Masticatory function in primate teeth based on tooth wear and topography

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Purpose: An extensive body of research exists on dietary effects of tooth wear in primates and how wear changes the masticatory capabilities of the tooth (e.g., Martin et al., 2003). Traditional primate diets (e.g., folivore, frugivore, etc.) are categorized by which foods are consumed in the highest abundance. Food choice is also dependent on the ecosystem availability and season (Hoshino et al., 2021; Martins et al., 2023). There is evidence that species who have adapted to high wear diets (i.e., folivores) increase the masticatory function of teeth as more wear accrues. Recent research has used topographic measurements, like the sharpness or relief, to indicate that tough/stiff diets drive adaptations for sharper teeth, higher tooth relief, and lower cusp slope (Berthaume et al., 2020).

Methods/Materials: The R package MolaR was used to calculate Dirichlet, Normal Energy (DNE; surface complexity), Relief Index (RFI; 3D surface area ratio to 2D area), Orientation Patch Count (OPCr; calculates the orientation of varying surfaces), Slope (average cusp height), and Area Relative Curvature (ARC; sharpness of cusps) of the occlusal surface of each tooth (Pampush et al., 2016). This study uses microCT scans of the first mandibular molar (M1) in *Papio anubis* (n = 8), *Macaca fascicularis* (n = 6), *Nasalis larvatus* (n = 7), *Trachypithecus cristatus* (n = 6), *Chiropotes satanas* (n = 3), and *Pithecia pithecia* (n = 3) to assess variation in wear and topographic values.

Results: Mann-Whitney U tests showed no significant differences ($p > 0.05$) between the right and left side of each individual and no significant differences ($p > 0.05$) in sex when sides were combined. Kuskal-Wallis tests showed that when there is 0-9.9% wear on teeth, there are no significant differences in any topographic values across all species ($p > 0.05$). However, as teeth wear (between 10-19% wear index), RFI ($p = 0.011$) and slope ($p = 0.011$) show significant differences between frugivores and folivores. As wear increases past 20% of the occlusal surface, there are again no significant differences between topographic values.

Conclusions: This indicates that while wear does increase the masticatory function of the surface of the tooth with some wear, higher rates of wear will decrease the masticatory function. These preliminary data show that more research is needed on understanding how wear affects the topographic surface of a tooth between diets and primary species.

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Optical Coherence Tomography of Tumor Spheroids Identifies Candidates for Drug Repurposing in Ovarian Cancer

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Hypothesis: This study proposes that swept-source optical coherence tomography (SS-OCT) can effectively monitor dynamic changes in multicellular tumor spheroids (MCTs) when exposed to three specific drug inhibitors (2-Methoxyestradiol, AZD1208, and R-Ketorolac). The overarching aim is to assess the efficacy of these inhibitors in treating high-grade serous ovarian carcinoma.

Subjects: The research employs OVCAR4 cells as a representative model of high-grade serous carcinoma. These cells are cultured and used to create MCTs, serving as vital three-dimensional models for evaluating inhibitor effectiveness.

Materials/Methods:

Cell Culture: OVCAR4 cells are maintained in RPMI 1640 medium, supplemented with FBS, penicillin, and streptomycin.

Spheroid Formation and Inhibitor Treatment: Cells are seeded in non-adherent plates, and inhibitors are administered on the 5th day.

SS-OCT Imaging: A custom SS-OCT system captures 2D and 3D MCT images, utilizing a 1300 nm wavelength and 200 kHz scanning frequency.

Scanning Protocol: A custom motion stage ensures sterility during imaging, covering a 3 mm \times 3 mm field with a 5 μ m \times 5 μ m resolution.

Histological Staining: On the 11th day, spheroids undergo Hematoxylin and Eosin (H&E) staining.

Operetta Imaging: On the 11th day, spheroids are imaged using brightfield and far-red fluorescence to evaluate the number of dead cells for post-inhibitor treatment.

Image Analysis: Necrotic tissue detection and tissue uniformity distribution are assessed.

Results: Concentrations of 10 and 25 μ M of 2-ME, AZD1208, and R-keto significantly inhibit ovarian MCT growth. These inhibitors don't induce substantial necrosis within MCTs, maintaining a dynamic equilibrium in the necrotic tissue-to-spheroid ratio. Higher 2-ME and AZD1208 concentrations notably affect high uniformity tissue volume.

Conclusions: This study underscores the reliability and effectiveness of SS-OCT as a means of monitoring the therapeutic impact of inhibitors on high-grade serous ovarian carcinoma. Specifically, the inhibitors 2-ME and AZD1208 exhibit substantial promise as targeted therapies. Importantly, SS-OCT surpasses traditional diameter-based methods, offering superior accuracy in the assessment of volume changes within MCTs.

Clinical Relevance: The clinical relevance of this study lies in the potential application of SS-OCT and MCTs as a rapid platform for screening drug repurposing in the treatment of ovarian cancer, addressing the challenge of recurrent high-grade serous ovarian carcinoma. The

translational potential of SS-OCT technology in oncology research and clinical applications signifies a significant stride towards enhancing the precision and efficiency of drug screening processes, ultimately benefiting patients who confront limited treatment options.

Reference:

This study is predicated upon the referenced publication [1], in which one of the co-authors, Sam Ton, possesses full access rights:

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Modified Ride-on Cars for Early Power Mobility: A Technical Report

Allison Young, PT, DPT, Kaylee Byars, SPT, Dakota Martin, SPT, Brandon Oates, SPT, Demiana Farag, SPT, Adam Gunn, PT, DPT

Background: Cerebral palsy with hemiparalysis is a neurological disorder characterized by impaired motor function on one side of the body due to brain damage, often occurring before or during birth (Mutch et al., 1992). This condition affects muscle control, coordination, and posture, impacting daily activities. Children with hemiplegic cerebral palsy may experience spasticity or weakness on one side, affecting their ability to ambulate or manipulate objects. Early intervention therapy services are essential for managing symptoms and enhancing mobility, independence, and improving overall quality of life (Ostensjø et al., 2005).

Children with mobility limitations have decreased opportunities to explore their environments and participate with family members and peers (Huang & Galloway, 2012). While assistive devices and technology exist for this population, options are limited to allow children the opportunity to interact with their environment in the same capacity that typically developing children experience. The purpose of this report is to provide instruction and guidance on modifications for a popular ride-on car for children with mobility limitations.

Modifications: The OEM utilized 2x SPDT (single-pole double throw) momentary switches that were replaced by 1x dual-axis potentiometer joystick for user control. Converting to the analog joystick required the addition of PWM (Pulse Width Modulated) input/output control via an Adafruit Trinket™ microcontroller, 2x REV Robotics SPARKmini™ 6-12v motor controllers, and basic Arduino programming. All custom wiring connections were soldered and covered in heat shrink tubing for conductance. Other custom modifications included the fabrication of an adjustable joystick positioning bracket to adapt for progressive therapeutic needs.

Clinical applications: Using a modified ride-on car for a child with cerebral palsy can have positive clinical implications for early mobility development. These individualized and adapted cars provide opportunities for improved spatial awareness, motor skills, and social interaction (Uchiyama et al., 2008). Engaging in independent movement enhances the child's sense of autonomy and self-confidence. Participating in activities with peers such as using ride-on cars stimulates cognitive and perceptual abilities as they navigate their environment (Ostensjø et al., 2005). The modified ride-on car encourages postural and muscle engagement, potentially aiding in muscle tone development. This intervention supports overall motor function, coordination, and social integration, supporting the child's physical and emotional well-being.

Management of Type I Diabetes in An Elite Endurance Athlete

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Background:

Type 1 diabetes mellitus (T1DM) is a chronic metabolic disorder that affects the body's ability to produce insulin, leading to hyperglycemia (Haller et al., 2005). Endurance exercise poses unique challenges for athletes with T1DM, requiring careful management of blood glucose levels to prevent exercise-induced complications (Riddell et al., 2020). Strategies to manage blood glucose levels during exercise include administering exogenous insulin, nutritional macronutrient intake, and continuous blood-glucose monitoring devices. While research is emerging to support these athletes and management of T1DM, little remains known about dietary patterns, nutritional strategies, and glycemic response to endurance exercise in elite endurance athletes.

Case description:

The athlete is a 33-year-old male with T1DM who had previously completed a 100-mile gravel bike ride and a weekly training regime leading up to a 2022 race. The route of the remote 100-mile race spanned two states with rugged highlands and challenging terrain. The athlete consumed 3.5 bottles of Science & Sport Beta Fuel throughout the race and tracked his consumption. He competed on a Viathon G1 gravel bike with running 42 mm bokken double cross tires. Power was measured with a Stages single-sided power meter. Distance, heart rate, temperature, power, and cadence were tracked using a Garmin Edge 520 head unit. Blood glucose was measured via the participant's personal Dexcom G6 with insulin delivered via tandem pump.

Outcomes:

The athlete consumed varying carbohydrate amounts at different time intervals, with blood glucose responses corresponding to specific race zones. Notably, in zones 1-4, blood sugar declined progressively, with associated changes in heart rate and power output. Zone 5 featured a carbohydrate intake leading to a peak in blood glucose, followed by a subsequent peak later in the race. In zone 6, a decline in blood glucose occurred.

Discussion:

Endurance athletes are at an increased risk of dehydration (Goulet, 2012), combined with hyperglycemia. This could lead to decreased performance as indicated by the athlete's reduced power output throughout the duration of the race. This athlete also demonstrated an increase in blood glucose levels, likely due to the continued consumption of carbohydrates and decreased sensitivity to insulin because of the decreased power output. The findings of this case study highlight the intricate relationship between carbohydrate intake, blood glucose dynamics, and physiological parameters during endurance racing. and the need for better guidelines for athletes with Type 1 Diabetes. Specifically, further research is needed on endurance exercise nutrition for optimal performance as well as hydration guidelines.

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A Quest to Uncover Underlying Etiology in a Pregnant Patient Presenting with Stroke like Symptoms

Maha Zafar, MD, Mohankumar Doraiswami, MD

Background/Purpose: Moyamoya disease (MMD) is a rare disease of unknown etiology characterized by occlusion or narrowing of arteries of circle of Willis particularly middle cerebral and internal carotid artery along with the formation of collateral bypass vessels. Moyamoya syndrome (MMS) is moyamoya vasculopathy associated with other autoimmune, infectious, or genetic disorders. MMD and MMS are common in genetically predisposed pregnant females due to vascular dilation caused by estrogen and progesterone. Symptoms range from mild transient ischemic attack to catastrophic hemorrhage, stroke, seizure, coma or even death. We present a unique case of stroke in a pregnant female that led to the diagnosis of Moyamoya disease with history of hypertension but no genetic predisposition.

Case Description & Outcome: A 34-year-old, 8-week pregnant female presented with complaints of aphasia, intermittent episodes of blurred vision, numbness, and tingling sensation of right side of her face. Denied any headache, nausea, dysphagia, or weakness. Past medical history was significant for hypertension, hyperlipidemia, and anxiety disorder. Denied history of smoking, alcohol, or drug usage. Examination revealed decreased sensation on the right cheek and mild facial droop. HbA1c, lipid panel and urine drug screen were normal. Brain MRI revealed an acute infarct in the right frontal and parietal cortex. MR angiography of head and neck revealed complete occlusion of left middle cerebral artery with filling of collateral distal branches. The clinical presentation was highly suspicious for Moyamoya disease. Further hypercoagulable, autoimmune, and infectious workup including factor V Leiden, Antithrombin 3, protein C and S, lupus anticoagulant, anti-beta2 glycoprotein antibody, ANA, ANCA, SSA, SSB, hepatitis, HIV, syphilis, SPEP and ACE testing were negative for Moyamoya syndrome. The patient was then diagnosed with moyamoya disease, started on low dose aspirin, and referred to neurosurgery for bypass post-delivery.

Discussion: The annual incidence of cerebrovascular disease is higher in pregnancy and around 30 per 100,000 females. A thorough physical examination with investigation of etiology of CVD in pregnancy is vital for the diagnosis. Early discussion regarding mode of delivery is another challenging aspect for MMD patients and obstetricians. Cesarean section with blood pressure control has been associated with good outcomes for MMD.

Conclusion: We emphasize the need for further workup including hypercoagulability, autoimmune and infection to decrease morbidity and mortality associated with MMD in patients with limited risk factors presenting with neurological symptoms during pregnancy.

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Noncirrhotic hyperammonemia in a patient with Clostridium difficile infection

Maha Zafar, MD, Reshly Mary Rajan, Monali Patil, MD

Background

Hyperammonemia has a well-known association with liver cirrhosis but there are some noncirrhotic etiologies of elevated blood ammonia levels including acute kidney injury, Urease positive organism bacteremia, urea cycle enzyme deficiency, seizures, starvation, total parenteral nutrition, valproic acid and carbamazepine use. We present a rare case of hyperammonemia in a noncirrhotic patient associated with uncommon etiology of clostridium difficile (CD).

Case Description

A 66-year-old male, with no prior history of alcohol use or liver disease, presented to hospital with worsening shortness of breath and altered mental status. Patient was noted to have elevated ammonia levels of 1590, hyponatremia 128 and Creatinine of 1.06. Urine drug screen, acetaminophen, ethanol, B12, folate, TSH, liver enzyme levels and CT head were negative. He later developed new onset tonic-clonic seizures. CT abdomen pelvis revealed incompetent ileocecal valve and suspicious colon mass leading to large bowel obstruction. GI pathogen panel, which was performed for persistent leukocytosis and ileus, showed CD. Patient was started on antibiotics for CD colitis and aspiration pneumonia. To prevent intracranial hypertension, emergent hemodialysis was performed leading to resolution of ammonia levels. After unsuccessful nasogastric decompression, explorative laparotomy with diversion colostomy was performed. Sigmoid mass with vesicular fistula noted. MRI brain showed anoxic brain injury secondary to status epilepticus. Considering patient's poor prognosis, palliative care was consulted, and patient was placed on comfort measures.

Discussion

The prevalence of C. difficile infection amongst the liver cirrhosis population was 134.93 per 100.000 vs 19.06 per 100.000 in non-cirrhotic patients. There are several documented cases of non-cirrhotic hyperammonemia. However, to our knowledge, CDI has not been identified as a cause of hyperammonemia. CD, a gram-negative anaerobe, is capable of producing ammonia using glutamate dehydrogenase. Clinical manifestations of hyperammonemia include nausea, vomiting, confusion, agitation, ataxia, and seizures. The patient discussed in this report presented with seizure and altered mental status secondary to hyperammonemia. Presently, the mainstay of hyperammonemia treatment is lactulose, regardless of the etiology. Treatment with lactulose in a patient with unidentified CDI can lead to worsening diarrhea and microperforation. We suggest that emergency dialysis should be considered as the primary treatment for non-cirrhotic, C-difficile associated hyperammonemia patients.

Conclusion

Extreme hyperammonemia requires rapid intervention due to increased risk of life-threatening neurological dysfunction. Therefore, early identification of CDI associated hyperammonemia and emergent hemodialysis is crucial for better patient outcomes.

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— RESEARCH INSTITUTE —
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UNDERGRADUATE STUDENT ABSTRACTS

Delivery Methods of Probiotics: Capsules, Gummies, and Liquids and the Impact of Delivery Methods on Growth Rates

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Probiotics are widely used across the United States and are classified as microorganisms that are alive and have benefits on health. The National Center for Complementary and Integrative Health describes what Probiotics might do to help our bodies. Probiotics might help our bodies maintain a healthy community of microorganisms, produce substances that have desirable effects, influence our body's immune response, along with an array of many other impacts. There are two types of bacteria that are common among probiotics: Lactobacillus and Bifidobacterium. The probiotics in this experiment contain one or the other and sometimes both of the most common bacteria. Since the 1900s, the idea of probiotics has changed, and we now have a better understanding of them. Since the original idea arose, manufacturers have come up with several delivery methods in order to disperse probiotics to people interested in taking supplements to benefit their gut biome. The delivery methods we are discussing include capsules, liquid, and gummies. There seems to be a significant knowledge gap on the testing of probiotics, especially for different delivery methods. We are experimentally determining the impact of delivery methods on growth rates of bacteria in the probiotic supplements. Will one delivery method of probiotics, like capsules (commonly used), have a higher growth of bacteria than the other methods and will these results of growth be statistically significant? How will this affect the community of people that use probiotics? It is important to the health of our communities to determine which delivery method of probiotics will work the best. The most common delivery method of bacteria, which is capsules will grow the best when referring to amount of bacteria because it is the least invasive way to deliver probiotics and it is cheaper for companies to produce. The transferring of materials to agar plates will be done while using a laminar flow to prevent contamination. We will proceed with aseptic techniques learned during our hands-on labs at the University of Arkansas at Fort Smith. Contamination could damage our experiment and skew our results. Determining growth rates will be measured with a flow cytometer in the lab to get accurate measurements.

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Microbial testing of soda fountains in Fort Smith, Arkansas area for presence of *Escherichia coli* and other coliforms

Jillian Cochran; Paul Gambill; Logan Perez

Purpose/Hypothesis: Our project examined fountain drink dispensers as well as ice dispensers from a variety of employee-operated and self-serve locations for the presence of coliforms and *E. coli* contamination. Samples were collected from approximately 8 locations in the Fort Smith, Arkansas area, split between restaurants and convenience stores. This experiment aimed to identify the presence of contamination in commercial establishments which could pose a threat to the health of customers by exposure to coliforms and *E. coli*.

Subjects: We plan to study 10-12 establishments in the Fort Smith, Arkansas area, either restaurants or convenience stores. Each participant of this study is notified of their test results, and results published are anonymous.

Materials/Methods: Roth Biosciences ECC medium R-Cards were used in this experiment to test for the presence of *E. coli* and coliforms. Initially, sterile swabs were placed in the nozzle of the soda fountain, and then put back into sterile tubes filled with 1mL PBS buffer. PBS buffer was introduced to the R-CARD according to manufacturer recommendation, and the cards were incubated at 35,ÑÉ for 24h. This process was repeated with ice chutes at the same locations.

Results: Data is still being collected at this time, so results or analysis cannot be shared at this time.

Conclusions: Conclusions cannot be drawn at this time due to data still being collected in this study.

Clinical Relevance: The presence of coliforms of fecal origin is a sanitation concern for those that use public soda fountains. Ideally, cleaning methods should prevent the proliferation of such bacteria, but sometimes such tasks do not get done at all or properly. It is paramount that businesses uphold stringent sanitation requirements to deter infection in their customers.

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Supplemental probiotics

Samantha Gates, PTA, Lana Putman, Nayda Barbry, James Brandli, faculty advisor

Supplemental probiotics are a multibillion-dollar industry. Numerous studies have shown that specific bacteria when introduced to the gut biome increase efficiency of bodily functions. However there are very few papers that validate the delivery system of said bacteria and the efficacy of more expensive products. In the study 3 different capsules at different market values with the same bacteria will be tested over a period of weeks to show if they will grow, and at what count. The design of the study will be plating each capsule on a separate plate in a clean environment and putting them at optimal growth parameters for 1 week to measure growth rate and amount. Data will be collected weekly using a flow cytometer for growth rate and identification of bacteria will be done via microscope.

Szeto-Schiller (SS)-31 protects against doxorubicin induced hiPSC-cardiomyocytes senescence

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Doxorubicin (DOX) is a chemotherapeutic medicine used for the treatment of many types of cancer; however, the use of conventional DOX in clinical practice has been limited because of side effects, notably cardiotoxicity. There is no effective treatment yet for the DOX-induced cardiomyocyte injury. The peptide Szeto-Schiller (SS)-31 (H-D-Arg-Dmt-Lys-Phe-NH₂, elamipretide) targets mitochondria and reduces the reactive oxygen species (ROS) production. Our preliminary data showed that SS-31 attenuates 50 nM DOX induced cardiomyoblast H9C2 cell senescence. To be more translational, in this study, we further evaluated whether SS-31 attenuates the DOX human induced pluripotent stem cell differentiated cardiomyocytes (hiPSC-CMs) senescence. We differentiated the hiPSCs to cardiomyocytes by RBA protocol and the cells started beating at ~ day 8. Then the hiPSC-CMs were treated with 50 μ M DOX for 3 hours and cultured for 24 hours. The SS-31 were added with DOX treatment and after removing the DOX. We tested the senescence markers p16 and p21. We found that DOX treatment increased the expression of p16 and p21, while 1 μ M SS-31 decreased it in a 24-hour regimen. This data suggested that SS-31 protects the DOX induced senescence in the hiPSC-CMs. We will further test TNF α , IL-6, IL-1 β senescence markers.

Purpose/Hypothesis: Doxorubicin (DOX) is a chemotherapeutic medicine used for the treatment of many types of cancer; however, the use of conventional DOX in clinical practice has been limited because of side effects, notably cardiotoxicity[1-3]. Unfortunately, there is no effective treatment for the DOX-induced cardiomyocyte injury. The peptide Szeto-Schiller (SS)-31 (H-D-Arg-Dmt-Lys-Phe-NH₂, elamipretide) targets mitochondria and ameliorates high - dosed doxorubicin,Äinduced cardiotoxicity. Our preliminary data showed that SS-31 attenuates low concentration (50 nM) DOX induced cardiomyoblast H9C2 cell senescence. To be more translationally, in this study, we further evaluated whether SS-31 attenuates the DOX induced senescence in human induced pluripotent stem cell differentiated cardiomyocytes (hiPSC-CMs). We used two senescence markers, p16 and p21, to test the cell senescence in cardiomyocytes.

Material/Methods: Human induced pluripotent stem cells (hiPSCs) were differentiated into cardiomyocytes (hiPSC-CMs) using the RBA protocol, demonstrating functional maturity as evidenced by spontaneous beating around day 8 of differentiation. Subsequently, the hiPSC-CMs were exposed to a 3-hour treatment with 50 μ M doxorubicin (DOX), a chemotherapy drug known for inducing DNA damage and cellular stress. Alongside DOX treatment, SS-31 was introduced, and after the removal of DOX, the cells were cultured for an additional 24 hours.

Result: The results revealed that SS-31 administration led to a reduction in the expression of the

senescence marker p21 in response to DOX treatment. Additionally, a similar decrease was observed in the expression of the senescence marker p16, further emphasizing the potential mitigating effect of SS-31 on DOX-induced cellular senescence in hiPSC-CMs. These findings suggest that SS-31 may play a crucial role in attenuating the adverse effects of DOX on senescence markers, indicating its potential therapeutic significance in preserving the cellular health and functionality of hiPSC-CMs under conditions of DOX-induced stress.

Conclusion: The expression of senescent markers p16 and p21 were increased in hiPSC-CMs exposed to a 24-hours DOX regimen. The increasing of p16 and p21 by DOX were decreased in the presence of SS31. This study demonstrated that SS31 has a protective effect on DOX induced cardiomyocyte senescence.

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Over-the-counter probiotics

Lana Putman, Samantha Gates, Nayda Barbry, and James Brandli - Professor

Bacteria is important for the human digestive system. When bacteria have been depleted by prescription medications such as antibiotics there is a call for over-the-counter probiotics to reintroduce bacteria into the digestive system. Since probiotics are often the first thought to replenish bacteria, there is a high market for over-the-counter probiotics. However, the effectiveness of over-the-counter probiotics has not been studied in depth. In this study, probiotic growth rates were tested across three different price ranges to experimentally determine if more expensive brands grow more effectively than less expensive options. To determine growth rates of the bacteria from the probiotic brands, a flow cytometer was used to quantify the number of bacteria in the probiotic products. Proper techniques have been followed to ensure there is no contamination from the outside environment.



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HIGH SCHOOL STUDENT
PROJECTS

Parkinson's Disease

Alena Blackburn; Mackenzy Knubley; McKenzie Scoggins

Parkinson's disease is an ongoing neurodegenerative and progressive disorder that is named after Dr. James Parkinson who first detailed the disease. Parkinson's is a fairly prevalent disease in the U.S. with nearly 90,000 people diagnosed each year. A person with Parkinson's Disease (PD) would have trouble making voluntary and intentional movements. Due to this, a question that might arise would be, What is the difference in brain function between individuals with PD and individuals without? The purpose of this study is to bring awareness to a disease that, despite not being rare, is not commonly addressed. To address the proposed question, we did a literature search using Google and PubMed utilizing the terms Parkinsons, brain function, symptoms, diagnosis, and prevalence. For our literature search, it was found that PD is caused by the deterioration of nerve cells in the substantia nigra that usually produce a chemical called dopamine. This part of the brain helps control movement in the body. Unlike most people, individuals with PD do not have normal brain function which directly correlates to their decision making skills. Having Parkinson's increases risk of contracting illnesses and said illnesses being more severe. Due to the loss of cells that produce dopamine, those who have PD, cannot efficiently send messages from the brain to the body. In conclusion, the difference in brain activity between someone with and without PD is that the brain is not able to send messages to the body as effectively. Therefore, PD can result in involuntary movements, seizures, and cognitive malfunction that the average person does not experience. Unfortunately, Parkinson's currently has no cure because doctors have not been able to slow down the loss of brain cells in patients, although there are treatments available to reduce symptoms. While being a common disease, PD is not addressed as necessary as needed to provide awareness for patients and designing a cure.

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Affiliation between Obesity and Diabetic Retinopathy

Rajaa Kaddoura; Alina Alam; Aamina Siddiqui

The main goal for our group's research is looking at ways to group and connect different information we find out about how obesity impacts different eye diseases. To go further with our research, our group gathered information from multiple, credible websites to put together in 1 research paper. We have found that obesity has an impact on many different eye diseases like diabetic retinopathy, glaucoma, and age-related macular degeneration. However, our main focus will be on diabetic retinopathy, an eye condition affecting the blood vessels in the retina which can cause vision loss and blindness in people who have diabetes, and its correlation with obesity. Diabetic retinopathy is the leading cause of blindness in working-age adults, caused by high blood sugar. Blood sugar is the main sugar that is found in the blood, it comes from the food that is consumed. The regular levels of blood sugar are 65-100 mg/dL. Anything above 126 mg/dL is considered diabetic. If the level is between 100-125 mg/dL, that would be considered prediabetes. The retrobulbar artery is the artery that supplies blood to the eye and the orbit. The glucose in the blood is transported from this artery to the eye. Obesity is defined as abnormal or excessive fat accumulation that presents a risk to health, an increase in body fat, and promotes adipose tissue dysfunction and abnormal fat mass physical forces, resulting in adverse metabolic, biomechanical, and psychosocial health consequences. In the case of our study, we will be measuring obesity through body composition. Body composition is the ratio of lean tissue to fat tissue. Our definition of obesity is identified by a greater than 32% normal body fat percentage in women, as compared to one greater than 25% in men. Our research will be conducted through a meta-analysis of previous, pertinent studies that have illustrated promising findings to support the associations found between diabetic retinopathy and obesity. Obesity is a major risk factor for prediabetes and type 2 diabetes because it causes both insulin resistance and β -cell dysfunction, where insulin secretion is impaired. So, by an increased risk of diabetes through obesity, there is also an increased risk of diabetic retinopathy. There are also many secondary health characteristics that affect vision through obesity. An example of this could be High LDL cholesterol, low HDL cholesterol, or high levels of triglycerides (dyslipidemia).

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Nicotine Fumes Effect on Skin

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Background & Purpose

Teenagers in the US heavily smoke nicotine-containing vapes, however, the impact of second-hand smoking on skin health is under-researched. Skin is more exposed to second-hand smoke than internal organs and respiratory systems, and awareness should be raised about its importance.

Case Description

The research will review academic journals to investigate correlations between nicotine fumes and skin health, utilizing sources that may help connect the dots. Cigarette smoking increases aging-related symptoms, including skin issues, and can induce premature skin aging, affecting biophysical parameters like dermis thickness, density, and nasolabial folds (Yazdanparast et al.). Tobacco smoke, containing its harmful chemicals, can cause premature aging and skin cancer. Nicotine in cigarettes not only causes premature aging but also premature wound healing. A study using EpiDermTM, a 3D model of the human epidermis and cultured human keratinocytes, found that dermal contact with nicotine may impair wound healing, increase susceptibility to skin infections due to a decrease in immune response, and cause oxidative stress in skin cells (Pittalwala). The harmful effects of nicotine can be traced to another biological study. Analyzed in a study by Misery, nicotine mimics acetylcholine effects on the skin, causing ambivalent effects on keratinocyte homeostasis, skin aging, wound healing, and other dermatological diseases. Studying these therapeutic effects is crucial for understanding cause and pathogenesis, and developing future treatments (Misery). E-cigarettes and vaping are equally harmful, with vaping being more potent as one puff of a vape is equivalent to smoking ten cigarettes.

Outcomes

Already, vaping is extremely dangerous but is the damaging effect on the skin the same as smoking a cigarette? A study suggested that e-cigarettes are just as dangerous, if not more, than smoking for bystanders who are exposed to vaping chemicals, such as nicotine fumes, second-hand. This study was carried out in emission chambers and ventilated rooms focusing on the respiratory system, however, it is still implied that it is dangerous because e-cigarettes are stronger than normal cigarettes (Palmisani). E-cigarette liquids are typically composed of propylene glycol, glycerol, or both, plus nicotine and flavoring chemicals. Over 2% of solvent molecules in vaped e-cigarette aerosol samples have converted to formaldehyde-releasing agents, reaching concentrations higher than nicotine (Jensen).

Discussion

Vaping exposure to stronger chemicals can significantly impact the health of others, particularly teenagers and students, as nicotine fumes from e-cigarettes can be harmful to skin health and

disrupt daily routines.

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Combination of immune checkpoint inhibition and photodynamic therapy in melanoma: a literature review

Michael Nguyen, Ngoc Tran, Nhu Nguyen

Immunotherapy and photodynamic therapy (PDT) have emerged as promising therapeutic strategies for cancer treatment. More specifically, immunotherapy predominantly refers to immune checkpoint inhibition by therapies targeting cytotoxic T lymphocyte-associated protein 4 (CTLA4) and programmed death protein 1 (PD-1). This therapy has proven particularly effective in melanoma, but unfortunately not all patients respond. Conversely, PDT focuses on targeted cancer cells by introducing a light-sensitive drug called a photosensitizer (PS) and utilizing laser light with a specific wavelength to stimulate the photosensitizer. This stimulation leads to the production of cytotoxic reactive oxygen species (ROS), such as singlet molecular oxygen, hydroxyl radicals, and superoxide anions, which exert phototoxicity. In addition, PDT has been shown to induce the release of damage-associated molecular patterns (DAMPs) that mobilize the immune system. As such, we hypothesized that combination therapy using immune checkpoint inhibition and PDT may be particularly effective. Here we explore the level of evidence surrounding this topic in the literature. To evaluate this, we conducted a literature search using the National Library of Medicine's PubMed database of peer-reviewed literature. Using the search terms ,Immunotherapy AND photodynamic therapy AND melanoma, 85 results were generated. These search results were evaluated further for applicability to the research question. Collectively, our results indicate promise for immunotherapy and PDT combination in melanoma, and suggest further evaluation is warranted.

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KIDNEY STONES: An Analysis of the Influence of Potassium Citrate as Treatment

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Purpose

In recent years, researchers have been looking into various ways to treat calcium kidney stones. One of the ways is the use of potassium citrate as it is shown to lower the risk of stone development in patients with recurrent calcium stones or lower urinary citrate (Sharma et al., 57). Many other researchers have come to similar conclusions concerning the use of potassium citrate as a treatment for kidney stones. However, there are still many factors that have not been tested, including lack of clarity in the cause of kidney stones (Sharma et al., 60).

Description

Every year in the United States, over 200,000 cases of kidney stones, or nephrolithiasis, are reported. In the more severe cases, stones block the path of urine, causing kidney swelling and ureter spasms (Kidney stones). Currently there is no definitive cause for kidney stones, however build up of calcium, oxalate, and uric acid increases a person susceptibility to kidney stones (Kidney stones). There are many types of kidney stones, but the most prominent is calcium stones caused by high levels of calcium oxalate.

Summary of Use

In terms of prevention, similarities may be derived between nephrolithiasis prevention and the experimental procedures involving K-cit. As Ca is often the base of kidney stone formation with patients, the increased excretion of urinary causes more susceptibility of such patients forming a growth of CaOx and/or CaP crystals which directly lead to the formation of kidney stones (Krieger et al.). Essentially, the citrate therapy currently implemented in society with patients who are susceptible to kidney stones are projected to be benefited by the procedure as it is ultimately expected for urine calcium concentration to be lowered and urinary citrate to be raised.

Importance to Members

Kidneys serve to filter waste and extra water, which is then turned into urine. The urine is then moved to the bladder through the two thin tubes called ureters. Nephrons, which consist of the glomerulus and a tubule, filter everything out. The glomerulus filters the blood with the tubule returning substances to the blood while removing waste (Kidneys). Together the millions of nephrons filter the blood, helping to maintain balance within the body. However, kidney stones can interfere with these functions, which calls in question the effectiveness of potassium citrate as a source of treatment.

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