Medical Student Diversity Pipeline Program in Radiology and Imaging Sciences

SCHOOL OF MEDICINE
RADIOLOGY AND IMAGING SCIENCES

CURRENT TOPICS IN MEDICINE | VOLUME 28, ISSUE 7, P922-929, JULY 01, 2021

Historically Black Schools of Medicine Radiology Residency Programs: Contributions and Lessons Learned

Andrea A. Birch, MD, FACR • Lucy B. Spalluto, MD, MPH • Tonuka Chatterjee, BS • ...
Marques L. Bradshaw, MD • Sandra A. Bates, MD • Stephanie E. Spottswood, MD, MSPH • Show all authors

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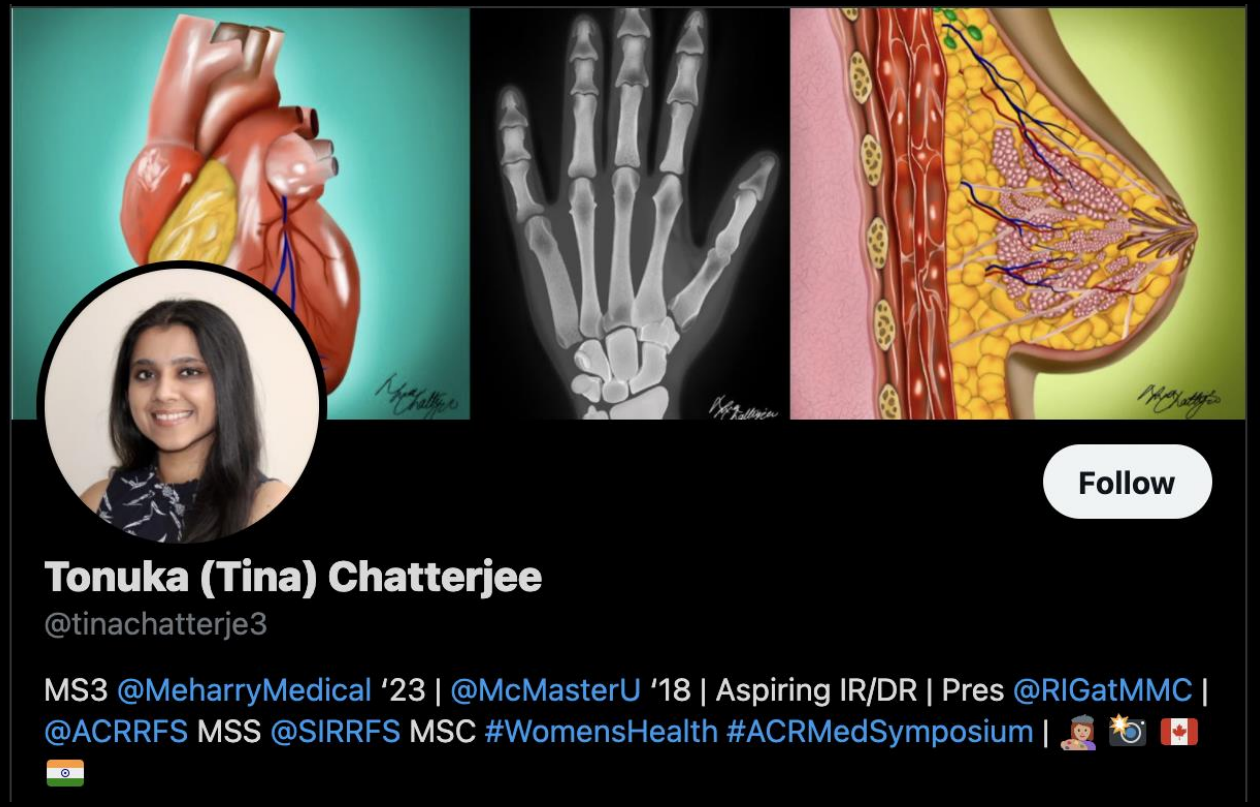
- Black radiologists are significantly underrepresented in the workforce (2%)
- HBSOM focus on providing care to underserved and under-resourced areas of the US
- All radiology residencies at HBSOM have closed (est. 1945-1972, all closed by 2004)
- Reasons for closure were multifactorial
- Loss of these residency programs contribute to Black radiologist underrepresentation
- ***Opportunity for other radiology residencies to step up, help fill the gap***

Tina Chatterjee, Meharry Medical College, now a radiology resident at Mount Auburn Hospital, Cambridge, MA

- Not decided about her medical career, father was a radiologist in India, currently an ultrasound technologist in Canada
- ACR PIER program 2020, Dr. Andrea Birch co-mentor – “the lightbulb turned on and burned brightly!”
- Co-leader and co-moderator, ACR Medical Student Symposium 2021 and 2022
- Publications: ACR Case in Point, ACR The Voice of Radiology Blog, Academic Radiology 2021, JACR 2022



Dr. Agarwal's presentation to Indiana Radiological Society in Fall 2021:

- "Currently, Meharry students have to rely on the single radiology teaching faculty at Meharry and on Vanderbilt University Dept. of Radiology. There are no radiology rotations.
- As such, we have lost one important part of the pipeline for female and URM individuals to enter radiology. Other radiology training institutions, such as IU, need to become more actively involved in exposing female and URiM medical students to radiology."

First Cohort 2022

Meharry Medical School
Rising MS2 Visiting Summer Research Program

- Collaboration
  - IMPRS Program – Co-directors:
  Dr. Atul Agarwal & Dr. Rupa Radhakrishnan
  - Dept. of Radiology – funding 1 student
  - Indiana Radiological Society – funding 1 student
  - Tennessee Radiological Society – NMA conference travel
- IU SOM Radiology IMPRS Program (IU Med Student Program for Research & Scholarship) – 10 weeks
  - Research mentors & summer project
  - Summer-long didactics/workshops about medical research
  - Poster presentation
- DEIJ Committee, Dept. Of Radiology
  - Campus housing & living stipend
  - Career exposure, shadowing radiologists/trainees
  - Volunteer opportunities: high school, middle school
  - Department social events
- NMA conference & oral presentation

Vanessa Okechuku

John Attia

2022 Research Mentors:

Dr. Nicholas Koontz

Dr. Mesha Martinez

Radiology shadowing & dept. social events

IU IMPRS Poster Presentation & NMA 2022 Radiology and Radiation Oncology Section

James Collins, MD Medical Student, Resident and Fellow Symposium, Third Prize

Disparities in the Treatment of Unruptured Intracranial Aneurysms: A County Hospital Experience

John Attia, Taylor Smith, Kelley Wormmeester PA, Mesha Martinez, MD, J.Nicolas Useche, MD, Juan Tejada, MD
Department of Neurointerventional Radiology
Sidney & Lois Eskenazi Hospital
Indiana University School of Medicine

ABSTRACT

There is an increasing prevalence of unruptured intracranial aneurysms (UIAs), due to increased radiologic imaging, which can cause life-threatening conditions such as aneurysmal subarachnoid hemorrhages. Studies have shown that minorities have limited access to non-invasive imaging screening and preventive care (1-3). We hypothesized that due to our diverse endovascular team and intentionality to equity in healthcare, there would be no difference in care between minorities and whites. A retrospective chart review was performed, and statistical analysis showed no difference in treatment of UIAs in Whites/Non-Hispanics versus the minority group. We conclude that a diverse physician team and intentionality, including providing adequate resources at hospitals that serve marginalized populations, can allow equity in healthcare.

INTRODUCTION

Studies suggest that minorities in the United States have limited access to non-invasive imaging screening. This has led to insufficient care, thereby increasing the risk of more life-threatening conditions such as aneurysmal subarachnoid hemorrhages(1-3). The growing impact of UIAs implies the need to provide the appropriate treatment to all patients. We hypothesized that due to our diverse endovascular team and intentionality to equity in healthcare, there would be no difference in care between minorities and whites undergoing treatment for UIAs at our institution.

MATERIALS & METHODS

We conducted a retrospective electronic medical record-based review of all patients with UIAs (n=144) between September 2010 and June 2022 treated at Sidney and Lois Eskenazi Hospital in Indianapolis, IN. Data regarding age at the time of treatment, gender, race, and insurance type were obtained. Statistical comparisons were performed using the X2 test for categorical variables, t-test for numerical variables, and the Fisher exact test in case of minor expected frequencies.

RESULTS

Variable (n(%))	Black/ Hispanic N=80	White/ Non-Hispanic N=63	P-Value
Woman	66 (82.5%)	47 (74.6%)	0.244
Age ≥65 years	12 (15%)	11 (17.4)	0.683
Insurance Type*			
Commercial/ Private^	20 (54.1)	14 (65.0%)	0.879
Medicare	8 (21.6)	7 (28.0%)	0.765**
Medicaid/ Uninsured	9 (24.3)	4 (16.0%)	0.533**

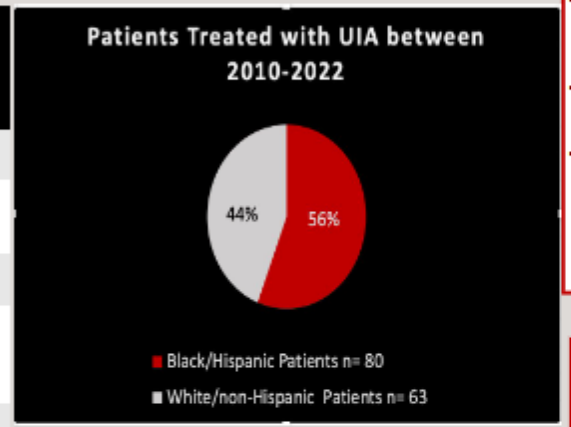
*n=62 available records

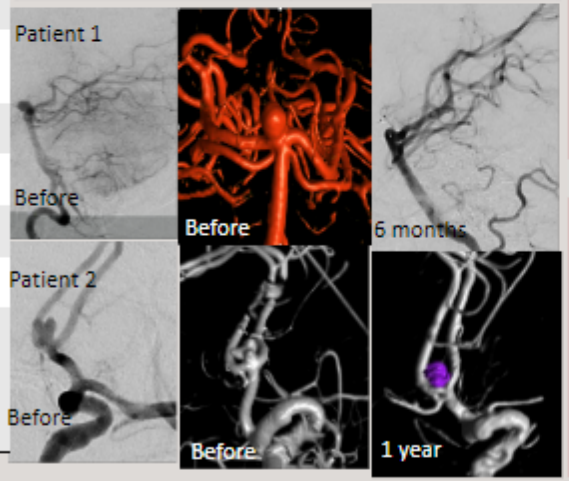
n=37 Black/ Hispanic with available insurance record

n= 25 White/non-Hispanic with available insurance record

** Fisher Exact test

^Commercial/private: MDWISE HIP, Aetna Medicare, Anthem Commercial, Commercial Generic, CareSource HIP, MHS Medicaid Indiana, University Health Plans Medicare, Managed Health Services HIP, AMHETTER, United Healthcare Commercial, United Medical Resources, [illegible] HIP,





DISCUSSION

- More minority patients were treated for UIAs at our institution than White/Non-Hispanics which is different from the national trend, although this was not statically significant.
- Even though it was more common that the minority population had Medicaid or was uninsured, this did not limit their access to care.
- This supports our hypothesis that diverse endovascular physician care teams and intentionality, including providing appropriate funding and resources to facilities typically used by marginalized populations, can mitigate minority patients' limited access to care of UIAs (4).

CONCLUSION

Building a diverse neuroendovascular physician team as well intentionality in providing equity in patient care, including providing appropriate funding and resources to facilities used by marginalized populations, can mitigate minority patients' limited access to appropriate intracranial aneurysmal care. However, additional research is needed to understand the root cause of such disparities and find more lines of action to correct them.

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Head and Neck Biopsy & MRI Diffusion-Weighted Imaging

Vanessa Okechuku[1,2], Cody Whitted[1], Nicholas Koontz[1,3,4]

[1]Indiana University School of Medicine, [2]Meharry Medical College, [3]Indiana University Department of Radiology & Imaging Sciences; [4]Otolarngology-Head & Neck Surgery

INDIANA CTSI Clinical and Translational Sciences Institute

IMPROVING HEALTH THROUGH RESEARCH. IndianaCTSI.org

Abstract

Definitive differentiation of benignity versus malignancy of head and neck tumors requires biopsy and histopathological assessment.[2] Despite appropriate localization of biopsy needles into tumors via computed tomography (CT)-guided biopsy technique, a minority of imaging-guided head and neck tumor biopsies prove non-diagnostic or hypocellular, leading to ambiguity of tissue diagnosis. In this study, we assess the role of quantitative DWI and DTI in the prediction of diagnostic yield of CT-guided fine needle aspiration (FNA) of head and neck tumors in hopes of guiding biopsy technique, predicting necessity of converting FNA to core needle biopsy, and predicting benefit of CT-guided biopsy versus open surgical biopsy.

Introduction

Human body - 60-70% water

MRI Diffusion Imaging
- Diffusion Weighted Imaging (DWI)
- Diffusion Tensor Imaging (DTI)

Region
- Head and Neck

Diffusion Weighted Imaging
- Measures the diffusivity of H_2O molecules within tissues
- The Good
  - Adjunct to conventional MRI
  - Prediction of benignity versus malignancy
  - May improve detection of residual or recurrent cancer
  - May identify response to chemotherapy and/or radiation therapy
  - May predict which patients will benefit from chemotherapy or radiation therapy
- The Bad
  - Sensitive to motion-induced phase errors[1]
  - Longer scanning time & decrease scanner stability
  - Overlapping ADC (apparent diffusion coefficient) values[1]

Aim

- Aim: To determine if DWI and/or DTI can be used as a predictor of diagnostic yield of CT-guided head & neck biopsies

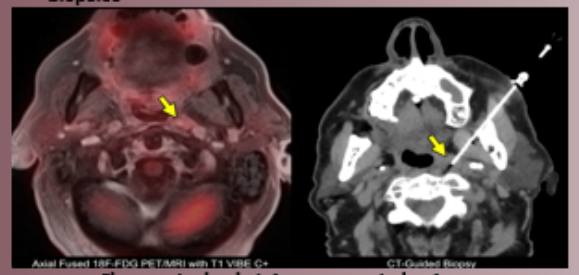

Figure 1: Lesion in left pterygopalatine fossa

Methodology

Data collection from the IU Health electronic medical record, radiology information system, and picture archiving and communication system
- Retrospective Study
- IRB approved
- CT-guided head & neck biopsy at IU Health from 2015-2022

Region of interest (ROI) analysis of MRI
- Mean ADC
- Mean ADC lesion-to-medulla ratio
- Statistical correlation
- Free-handed ROI of lesion & medulla sparing peripheral 1-2 mm

Inclusion Criteria
- Age 18 or older
- Pre-biopsy MRI with DWI and/or DTI
- CT-guided fine-needle aspiration and/or core needle biopsy of head & neck lesion

Exclusion Criteria
- Lack of DWI/DTI on pre-biopsy imaging

Case Example

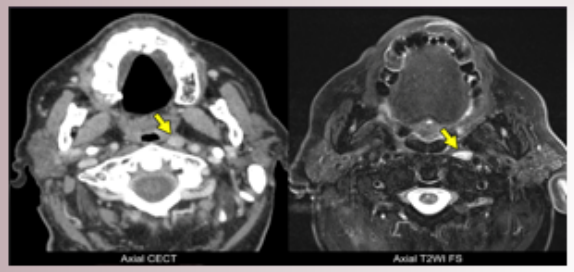

Figure 2: Lesion in left pterygopalatine fossa

Future Directions

Multivariate analysis, including quantitative DWI/DTI and FDG-PET/CT data to improve prediction of diagnostic yield of:
- CT-guided FNA
- Core needle biopsy of lesions

Data

Ongoing project:
- ROI analysis on all subjects (81 patients)
- Meeting with Department of Biostatistics for statistical analysis

Most malignant lesion
- Metastatic keratinized squamous cell carcinomas

Most common benign lesion
- Pleomorphic adenomas

Demographics	Patients
Age Range	18-90
Females	44
Males	37
FNA Only	41
Core biopsy Only	1
FNA and Core biopsy	39

Demographics	Patients
FNA Hypocellular & Non-Dx	6
Core Hypocellular & Non-Dx	2
FNA Hypocellular & Non-Malig.	7
Core Hypocellular & Non-Malig.	5

Conclusion

DWI/ DTI may have prediction value of diagnostic yield of CT-guided pathological procedures in head & neck region
- Ongoing research of 81 patients
- Useful imaging tool
  - Molecular activity and cellular functions[1]
- DTI/DWI has not achieved its fullest potential
  - Potential biomarker for diagnosis, prognosis, & follow-up

Acknowledgments & References

This project was funded, in part, with support from the Indiana Clinical and Translational Sciences Institute funded, in part by UL1TR002529 from the National Institutes of Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Health

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Second Cohort 2023

Incoming Visiting Meharry Scholars 2023

Latifah Henry, MS1

Mentor: Dr. Jerry Kovoor,
Interventional Radiology

Dasanae Davis, MS1

Mentor: Dr. Meichen Yu,
Imaging Sciences

WIR welcome for Meharry medical students May 23, 2023

Meharry Students 2023

Indiana Fever game June 11

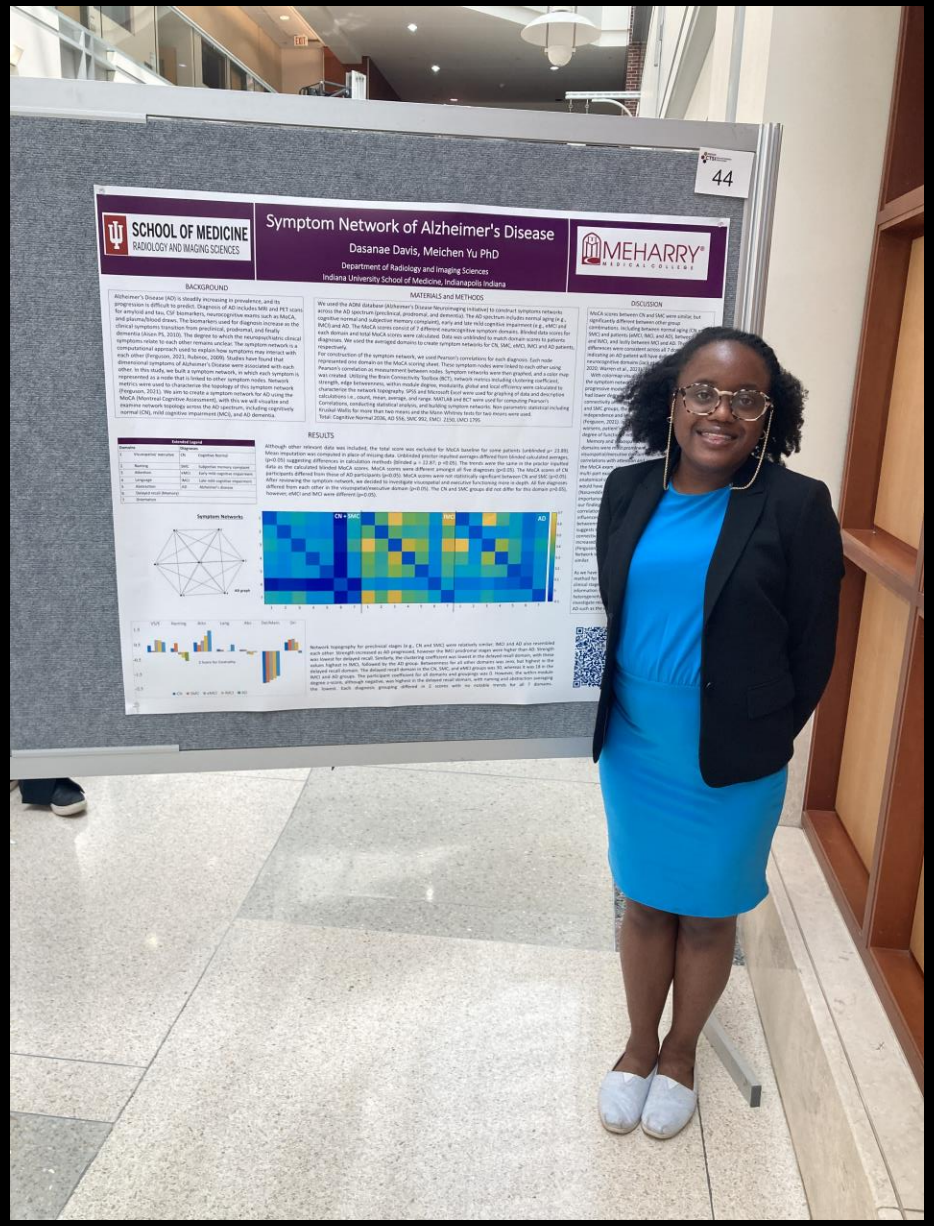
Volunteering with IU Health Rising Junior Internship students – Heylin and Geanika

Volunteering with WIR for Eureka! Girls Inc. Radiology Workshop

Dinner with IU Radiology SIG

Breast imaging biopsy workshop

IMPRS Poster Session July 27, 2023



Liquid Embolic Agent vs PVA Particles in Cases of Subdural Hematomas Post-Middle Meningeal Artery Embolization

Latifah Henry[1], Jean Mutambuze[2], Bradley N Bohnstedt[3], Jerry Kovoor[2]
[1]Meharry Medical College; [2]IUSOM, Department of Radiology and Imaging Sciences; [3]IUSOM, Department of Neurosurgery

Background

- Subdural Hematoma(SDH): intracranial hemorrhage between dura mater and arachnoid mater
- Pathophysiology: rupture of bridging veins
  - Trauma
  - Brain atrophy
  - Chronic anticoagulant or antiplatelet therapy
  - Spontaneous
- Epidemiology: Men > women(3:1); 50+ years
- Diagnosis: CT scan, Glasgow coma scale(GCS) score
- Complications: irreversible brain injury or death
  - Hematoma augmentation
  - Increased intracranial pressure(ICP)
  - Brain herniation
- Treatment: surgical hematoma evacuation
  - Burr hole craniostomy
  - Craniotomy
  - Middle meningeal artery(MMA) embolization

MMA embolization can serve as an adjunct or replacement to surgical drainage. Embolic material penetrates neovascular membranes and accelerates hematoma absorption rates

Objective

- Numerous embolic agents with few comparative studies
- Compare most used embolic agents in MMA embolization
  - Polyvinyl alcohol particles(PVA)
  - Liquid embolic agent(Onyx)
- Hypothesis: Onyx > PVA
  - Deep vascular penetration
  - Full occlusion
  - Permanent

Materials and Methods

- Retrospective
- January 2021- June 2023
- 18+ years
- SDH with MMA embolization using PVA or Onyx

Results

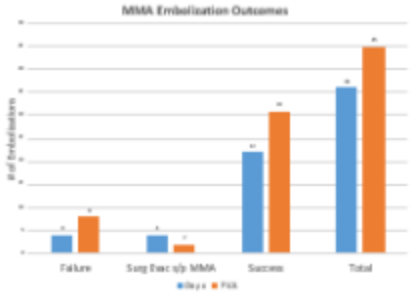


Fig. 1

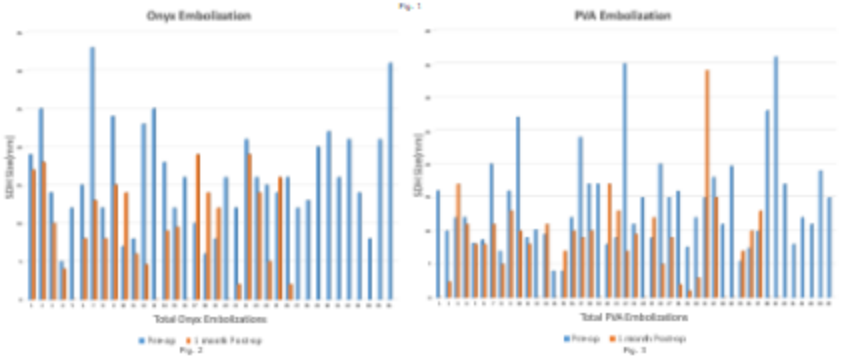


Fig. 2 Fig. 3

Conclusions

- Embolization failure(increased SDH size)
  - PVA: 20.5%(8/39)
  - Onyx: 15.4%(4/26)
  - P=.602
- Post-embolization evacuation
  - PVA: 25%(2/8)
  - Onyx: 100%(4/4)*
- SDH thickness reduction
  - Average: 6.5 mm
  - PVA: 46% average reduction
  - Onyx: 41% average reduction
  - P= .35

Discussion

- SDH is pathological and disproportionately affects elderly
- Mortality rate reportedly varies from 36-79%
  - Hematoma thickness
  - Degree of midline shift
  - Glasgow coma scale score
- SDH recurrence common with surgical evacuation
- MMA embolization occludes SDH blood supply
  - Aids resolution
  - Minimizes recurrence
  - Safe, cost effective, minimally invasive
- PVA and onyx equally effective embolic agents

Limitations

- Patient identification through ICD codes
  - Possible incorrect/incomplete ICD-coding
- Small sample size
  - Increased margin of error
  - Reduced confidence level
- Continued analysis needed
  - Analyze data from entire available cohort
  - Confirm no statistical difference between embolic agents

References

Acknowledgements

Special thanks to Leah Sieck, Anne Nguyen, and Kelly Wormeester for their mentorship and support with this project.

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Symptom Network of Alzheimer's Disease

Dasanae Davis, Meichen Yu PhD

Department of Radiology and Imaging Sciences
Indiana University School of Medicine, Indianapolis Indiana

BACKGROUND

Alzheimer's Disease (AD) is steadily increasing in prevalence, and its progression is difficult to predict. Diagnosis of AD includes MRI and PET scans for amyloid and tau, CSF biomarkers, neurocognitive exams such as MoCA, and plasma/blood draws. The biomarkers used for diagnosis increase as the clinical symptoms transition from preclinical, prodromal, and finally dementia (Aisen PS, 2010). The degree to which the neuropsychiatric clinical symptoms relate to each other remains unclear. The symptom network is a computational approach used to explain how symptoms may interact with each other (Ferguson, 2021; Rubinoc, 2009). Studies have found that dimensional symptoms of Alzheimer's Disease were associated with each other. In this study, we built a symptom network, in which each symptom is represented as a node that is linked to other symptom nodes. Network metrics were used to characterize the topology of this symptom network (Ferguson, 2021). We aim to create a symptom network for AD using the MoCA (Montreal Cognitive Assessment), with this we will visualize and examine network topology across the AD spectrum, including cognitively normal (CN), mild cognitive impairment (MCI), and AD dementia.

MATERIALS and METHODS

We used the ADNI database (Alzheimer's Disease Neuroimaging Initiative) to construct symptoms networks across the AD spectrum (preclinical, prodromal, and dementia). The AD spectrum includes normal aging (e.g., cognitive normal and subjective memory complaint), early and late mild cognitive impairment (e.g., eMCI and lMCI) and AD. The MoCA scores consist of 7 different neurocognitive symptom domains. Blinded data scores for each domain and total MoCA scores were calculated. Data was unblinded to match domain scores to patients diagnoses. We used the averaged domains to create symptom networks for CN, SMC, eMCI, lMCI and AD patients, respectively.

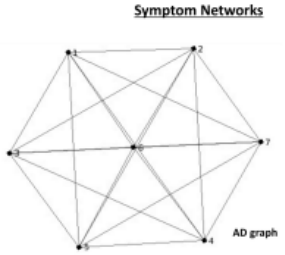
For construction of the symptom network, we used Pearson's correlations for each diagnosis. Each node represented one domain on the MoCA scoring sheet. These symptom nodes were linked to each other using Pearson's correlation as measurement between nodes. Symptom networks were then graphed, and a color map was created. Utilizing the Brain Connectivity Toolbox (BCT), network metrics including clustering coefficient, strength, edge betweenness, within module degree, modularity, global and local efficiency were calculated to characterize the network topography. SPSS and Microsoft Excel were used for graphing of data and description calculations i.e., count, mean, average, and range. MATLAB and BCT were used for computing Pearson's Correlations, conducting statistical analysis, and building symptom networks. Non-parametric statistical including Kruskal-Wallis for more than two means and the Mann Whitney tests for two means were used.

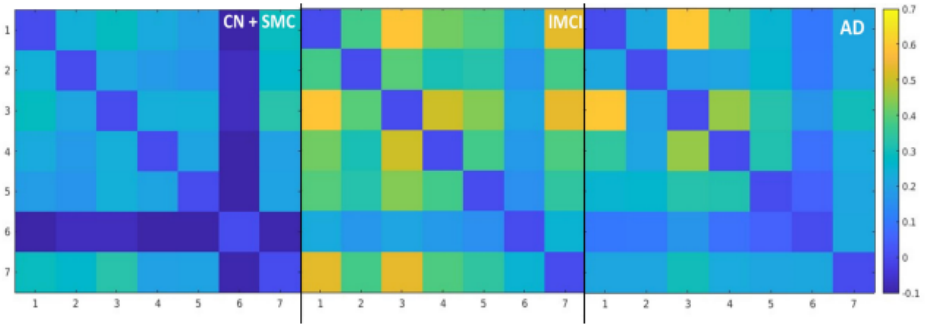
Total: Cognitive Normal 2036, AD 556, SMC 992, EMCI 2150, LMCI 1795

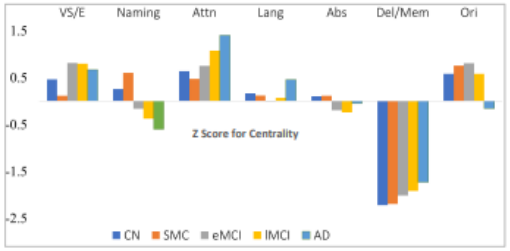
RESULTS

Extended Legend			
Domains		**Diagnoses**	
1	Visuospatial/ executive	CN	Cognitive Normal
2	Naming	SMC	Subjective memory complaint
3	Attention	eMCI	Early mild cognitive impairment
4	Language	lMCI	Late mild cognitive impairment
5	Abstraction	AD	Alzheimer's disease
6	Delayed recall (Memory)		
7	Orientation		

Although other relevant data was included, the total score was excluded for MoCA baseline for some patients (unblinded μ= 23.89). Mean imputation was computed in place of missing data. Unblinded proctor-inputted averages differed from blinded calculated averages, ($p<0.05$) suggesting differences in calculation methods (blinded μ = 22.87; $p<0.05$). The trends were the same in the proctor inputted data as the calculated blinded MoCA scores. MoCA scores were different amongst all five diagnoses ($p<0.05$). The MoCA scores of CN participants differed from those of AD participants ($p<0.05$). MoCA scores were not statistically significant between CN and SMC ($p>0.05$). After reviewing the symptom network, we decided to investigate visuospatial and executive functioning more in-depth. All five diagnoses differed from each other in the visuospatial/executive domain ($p<0.05$). The CN and SMC groups did not differ for this domain $p>0.05$), however, eMCI and lMCI were different ($p<0.05$).







Network topography for preclinical stages (e.g., CN and SMC) were relatively similar; lMCI and AD also resembled each other. Strength increased as AD progressed, however the lMCI prodromal stages were higher than AD. Strength was lowest for delayed recall. Similarly, the clustering coefficient was lowest in the delayed recall domain, with these values highest in lMCI, followed by the AD group. Betweenness for all other domains was zero, but highest in the delayed recall domain. The delayed recall domain in the CN, SMC, and eMCI groups was 30, whereas it was 18 in the lMCI and AD groups. The participant coefficient for all domains and groupings was 0. However, the within-module degree z-score, although negative, was highest in the delayed recall domain, with naming and abstraction averaging the lowest. Each diagnosis grouping differed in Z scores with no notable trends for all 7 domains.

DISCUSSION

MoCA scores between CN and SMC were similar, but significantly different between other group combinations. Including between normal aging (CN and SMC) and patients (eMCI, lMCI, and AD), between eMCI and lMCI, and lastly between MCI and AD. These differences were consistent across all 7 domains, indicating an AD patient will have deficits in multiple neurocognitive domains (Jack et al., 2018; Jessen et al., 2020; Warren et al., 2023).

With colormap visualization and network metrics of the symptom networks we were able to confirm the progressive model of AD. The prodromal and AD stages had lower degrees of functional segregation and more connectivity amongst the seven domains. In contrast CN and SMC groups, the domains exhibit more independence and less overall connectivity functionally (Ferguson, 2021). Indicating as disease progression worsens, patient's clinical symptoms exhibit a higher degree of functional interaction.

Memory and visuospatial/executive functioning domains were most prominent. The visuospatial/executive domain had the strongest correlations with attention and orientation. As tested by the MoCA exam, visuospatial/executive functioning is a multi-part exam, testing functions located in multiple anatomical sites. It would be expected that this pathway would have multiple interactions with other domains (Nasareddine, 2017). Ferguson (2021) emphasizes the importance of memory as a central node reaffirmed by our findings. Memory, transitioned from a strong anti-correlation to a weak correlation. This suggests memory influences the other six domains. Further, the high betweenness scores and low participation coefficients suggests this node plays a significant role in the connectivity of the symptom network. As memory increased in relevance so did severity of diagnosis AD (Ferguson, 2021; Rubinoc, 2009; Warren et al., 2023). Network topography for all non-memory domains were similar.

As we have shown, the symptom network is a useful method for tracking the progression of AD through five clinical stages. Future studies will include demographic information in the network model, elimination of heterogeneity data, and use multivariate analysis to investigate relationships between multiple domains of AD such as the visuospatial, attention, and orientation.

ACKNOWLEDGMENTS & REFERENCES

Third Cohort 2024

2024 Meharry Summer Research Interns with the IU Radiology IMPRS program

Kofi Boahene, MS 1

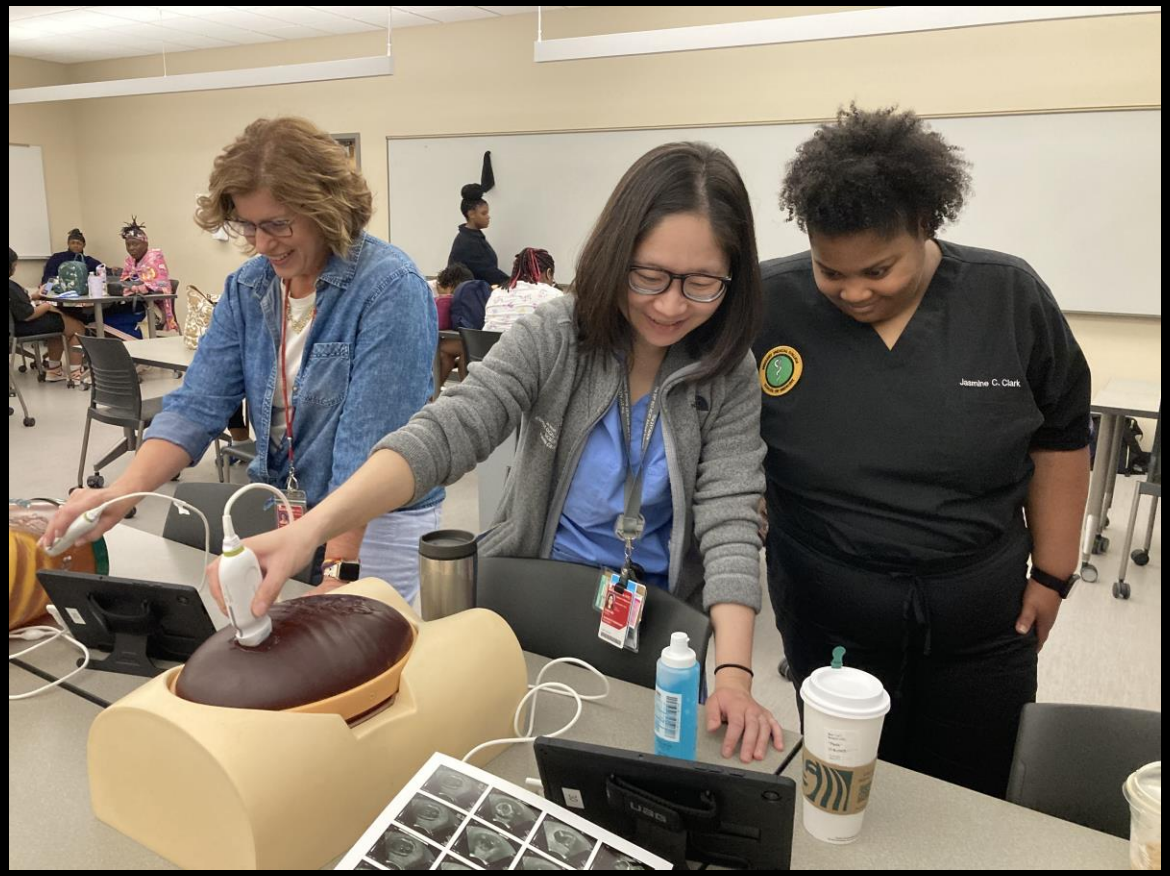
Research mentor Dr. Meichen Yu

Jasmine Clark, MS 1

Research mentor Dr. Vivek Halappa


Welcome lunch for IU and Meharry IMPRS Students

Jasmine Clark, volunteering for our IU WIR Dr. Lauren Ladd, lead organizer, for Girls Inc. Radiology Workshop

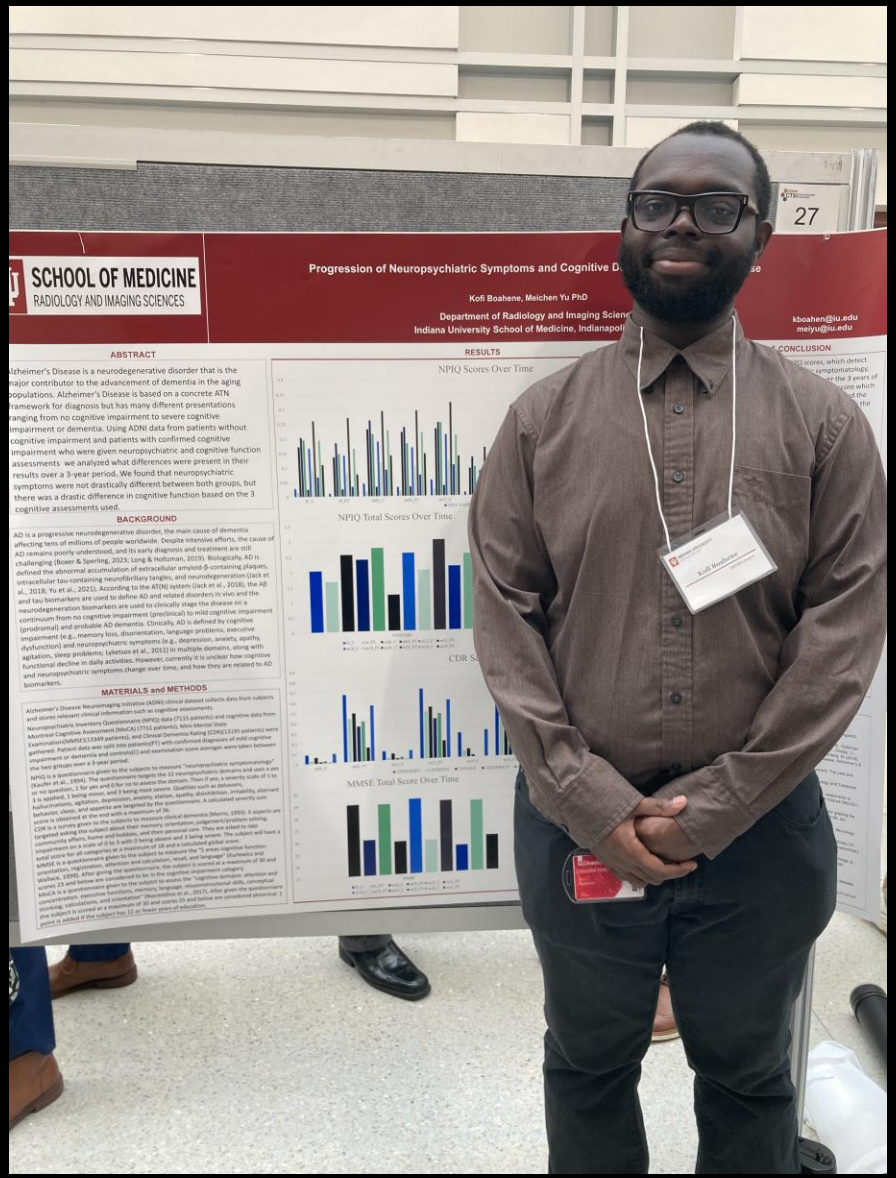


WIR volunteering for Girls Inc. Eureka! 2024 Career Talks: Jasmine Clark talks about Medical School

Dinner out with our IU Black Radiology Interest Group resident- mentors

Brunch with IU Radiology Student Interest Group, with Ethel Okonjo, DEIJ Chair of IU Rad SIG

Poster Presentations 2024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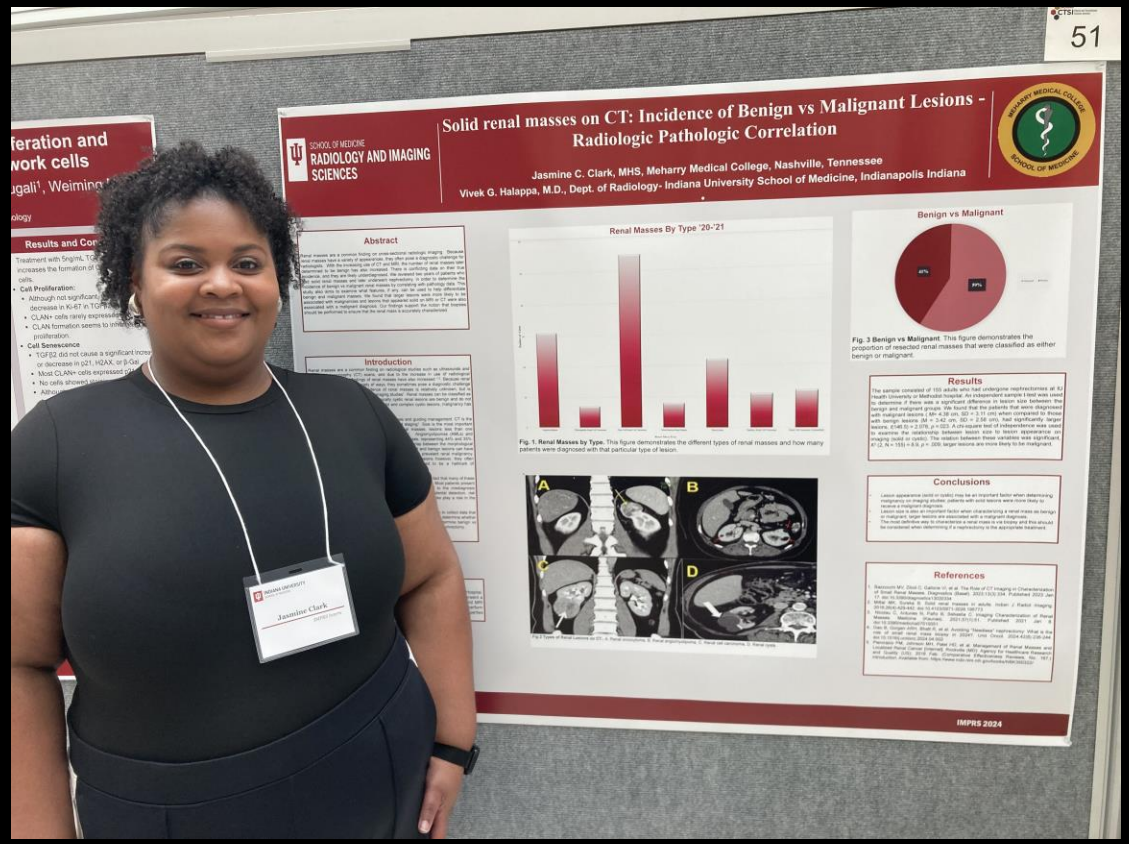
SCHOOL OF MEDICINE
RADIOLOGY AND IMAGING SCIENCES
Progression of Neuropsychiatric Symptoms and Cognitive D
Kofi Boahene, Meichen Yu PhD
Department of Radiology and Imaging Scienc
Indiana University School of Medicine, Indianapoli
kboahen@iu.edu
meiyu@iu.edu
ABSTRACT
BACKGROUND
MATERIALS and METHODS
RESULTS
NPIQ Scores Over Time
NPIQ Total Scores Over Time
MMSE Total Score Over Time
CONCLUSION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Solid renal masses on CT: Incidence of Benign vs Malignant Lesions - Radiologic Pathologic Correlation
SCHOOL OF MEDICINE
RADIOLOGY AND IMAGING SCIENCES
Jasmine C. Clark, MHS, Meharry Medical College, Nashville, Tennessee
Vivek G. Halappa, M.D., Dept. of Radiology- Indiana University School of Medicine, Indianapolis Indiana
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IMPRS 2024

Progression of Neuropsychiatric Symptoms and Cognitive Decline in Alzheimer's Disease

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kboahene24@mmc.edu
meiyu@iu.edu

Kofi Boahene[1], Meichen Yu[2]

[1]School of Medicine, Meharry Medical College, [2]Department of Radiology and Imaging Sciences
Indiana University School of Medicine, Indianapolis, Indiana

ABSTRACT

Alzheimer's Disease is a neurodegenerative disorder that is the major contributor to the advancement of dementia in the aging populations. Alzheimer's Disease is based on a concrete ATN framework for diagnosis but has many different presentations ranging from no cognitive impairment to severe cognitive impairment or dementia. Using ADNI data from patients without cognitive impairment and patients with confirmed cognitive impairment who were given neuropsychiatric and cognitive function assessments we analyzed what differences were present in their results over a 3-year period. We found that neuropsychiatric symptoms were not drastically different between both groups, but there was a drastic difference in cognitive function based on the 3 cognitive assessments used.

BACKGROUND

AD is a progressive neurodegenerative disorder, the main cause of dementia affecting tens of millions of people worldwide. Despite intensive efforts, the cause of AD remains poorly understood, and its early diagnosis and treatment are still challenging (Boxer & Sperling, 2023; Long & Holtzman, 2019). Biologically, AD is defined the abnormal accumulation of extracellular amyloid-β-containing plaques, intracellular tau-containing neurofibrillary tangles, and neurodegeneration (Jack et al., 2018; Yu et al., 2021). According to the AT(N) system (Jack et al., 2018), the Aβ and tau biomarkers are used to define AD and related disorders in vivo and the neurodegeneration biomarkers are used to clinically stage the disease on a continuum from no cognitive impairment (preclinical) to mild cognitive impairment (prodromal) and probable AD dementia. Clinically, AD is defined by cognitive impairment (e.g., memory loss, disorientation, language problems, executive dysfunction) and neuropsychiatric symptoms (e.g., depression, anxiety, apathy, agitation, sleep problems; Lyketsos et al., 2011) in multiple domains, along with functional decline in daily activities. However, currently it is unclear how cognitive and neuropsychiatric symptoms change over time, and how they are related to AD biomarkers.

MATERIALS and METHODS

Alzheimer's Disease Neuroimaging Initiative (ADNI) clinical dataset collects data from subjects and stores relevant clinical information such as cognitive assessments.

Neuropsychiatric Inventory Questionnaire (NPIQ) data (7115 patients) and cognitive data from Montreal Cognitive Assessment (MoCA) (7711 patients), Mini-Mental State Examination(MMSE)(13349 patients), and Clinical Dementia Rating (CDR)(13195 patients) were gathered. Patient data was split into patients(PT) with confirmed diagnoses of mild cognitive impairment or dementia and controls(C) and examination score averages were taken between the two groups over a 3-year period.

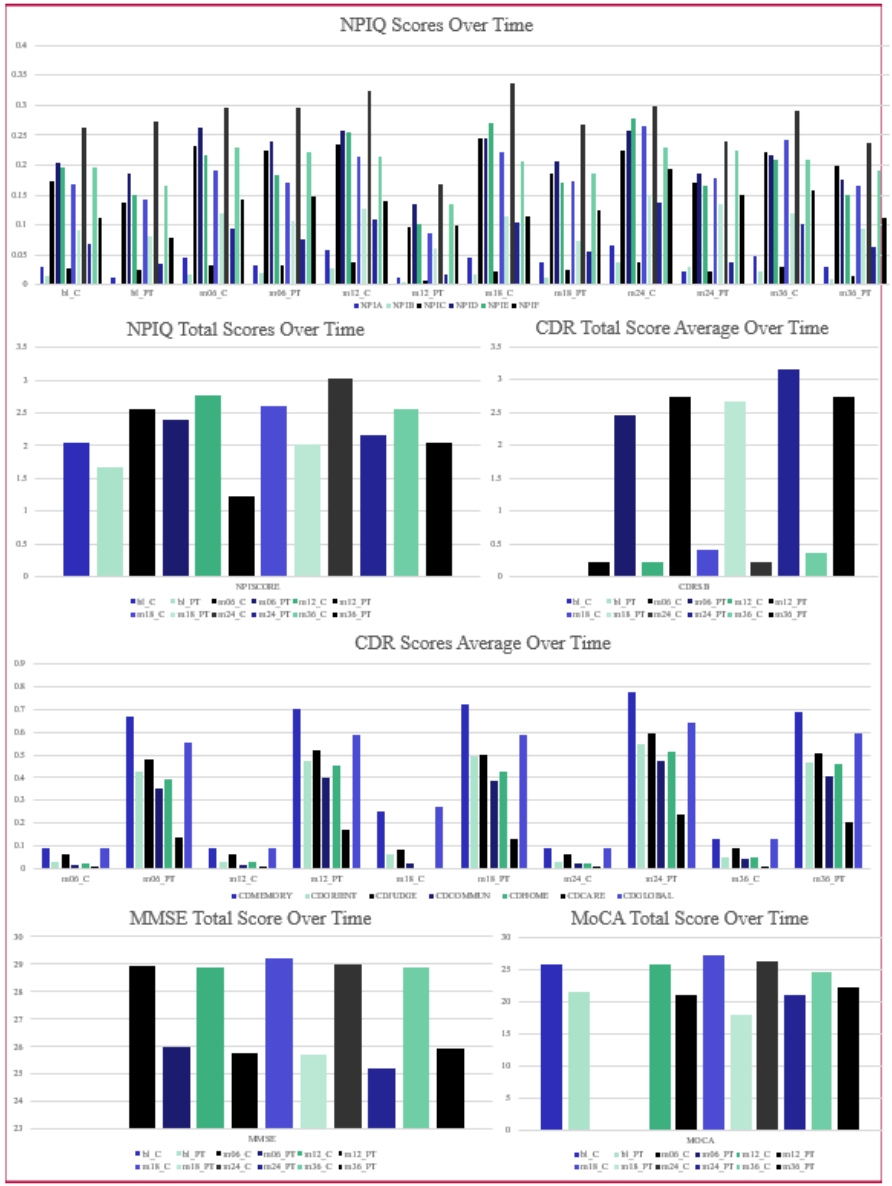
NPIQ is a questionnaire given to the subjects to measure "neuropsychiatric symptomatology" (Kaufer et al., 1994). The questionnaire targets the 12 neuropsychiatric domains and uses a yes or no question, 1 for yes and 0 for no to assess the domain. Then if yes, a severity scale of 1 to 3 is applied, 1 being minor, and 3 being most severe. Qualities such as delusions, hallucinations, agitation, depression, anxiety, elation, apathy, disinhibition, irritability, aberrant behavior, sleep, and appetite are targeted by the questionnaire. A calculated severity sum score is obtained at the end with a maximum of 36.

CDR is a survey given to the subjects to measure clinical dementia (Morris, 1993). 6 aspects are targeted asking the subject about their memory, orientation, judgement/problem solving, community affairs, home and hobbies, and their personal care. They are asked to rate impairment on a scale of 0 to 3 with 0 being absent and 3 being severe. The subject will have a total score for all categories at a maximum of 18 and a calculated global score.

MMSE is a questionnaire given to the subject to measure the "5 areas cognitive function: orientation, registration, attention and calculation, recall, and language" (Kurlowicz and Wallace, 1999). After giving the questionnaire, the subject is scored at a maximum of 30 and scores 23 and below are considered to be in the cognitive impairment category.

MoCA is a questionnaire given to the subject to assess the "cognitive domains: attention and concentration. executive functions, memory, language, visuconstructional skills, conceptual thinking, calculations, and orientation" (Nasreddine et al., 2017). After given the questionnaire the subject is scored at a maximum of 30 and scores 25 and below are considered abnormal. 1 point is added if the subject has 12 or fewer years of education.

RESULTS



DISCUSSION & CONCLUSION

When looking at the individual NIPQ scores, which detect presence or absence of neuropsychiatric symptomatology, the average scores do have small variance over the 3 years of assessment. However, when looking at the total score which measures average severity the patient population and the control population average severities differed based on the time they were measured. If we move to the cognitive function domains, we see a larger difference in the scores between the patient population and the control population. In the CDR individual score data, controls were more likely to have an absence or questionable impairment while the on average the patients were near questionable impairment, in some cases close to mild impairment. Considering the total scores, patients scored significantly higher on average than the controls. In the MMSE data, the controls scored near 29 at each time of measurement while the patients scored in the 25-26 range which is still above the 23-score cutoff for cognitive impairment. Lastly, for MoCA data, the controls on average scored near or below 26, the MoCA cut off for abnormal cognitive function. The patients performed far worse at some time points scoring on average 18 and some time points scoring on average 22.

Based on the NPIQ data we have gathered the results for the neuropsychiatric symptomatology did not show any drastic differences between the patients and control groups. On the other hand, data gathered using cognitive domain assessments did show differences between the control and patient groups at every time point measured. Particularly, MoCA scores had patients scoring well below the cutoff for normal cognitive function. However, there were some limitations to the data that was collected. Since the data is pooled from multiple centers there were data transfer errors that may have been in place. It was noted that some subject data was either; incomplete, missing, keyed-in incorrectly. For future studies more clean data may provide different results and inclusion of other measuring metrics such as neuroimaging data could prove useful as a next step.

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Solid renal masses on CT: Incidence of Benign vs Malignant Lesions - Radiologic Pathologic Correlation

Jasmine C. Clark[1], Vivek G. Halappa[2],
[1]School of Medicine, Meharry Medical College , [2] Department of Radiology, School of Medicine, Indiana University, Indianapolis, IN

Abstract

Renal masses are a common finding on cross-sectional radiologic imaging. Because renal masses have a variety of appearances, they often pose a diagnostic challenge for radiologists. With the increasing use of CT and MRI, the number of renal masses later determined to be benign has also increased. There is conflicting data on their true incidence, and they are likely underdiagnosed. We reviewed two years of patients who had solid renal masses and later underwent nephrectomy, in order to determine the incidence of benign vs malignant renal masses by correlating with pathology data. This study also aims to examine what features, if any, can be used to help differentiate benign and malignant masses. We found that larger lesions were more likely to be associated with malignancies and lesions that appeared solid on MRI or CT were also associated with a malignant diagnosis. Our findings support the notion that biopsies should be performed to ensure that the renal mass is accurately characterized.

Introduction

Renal masses are a common finding on radiological studies such as ultrasounds and computed tomography (CT) scans, and due to the increase in use of radiological studies, the incidental findings of renal masses have also increased [1,2]. Because renal masses can present in a variety of ways, they sometimes pose a diagnostic challenge for radiologists [1]. The true incidence of renal masses is relatively unknown, but is increasing due to increased use of imaging studies[1]. Renal masses can be classified as cystic, solid, and complex cystic [2]. Typically cystic renal lesions are benign and do not warrant further workup; however, with solid and complex cystic lesions, malignancy has to be ruled out[2].

Imaging is crucial for characterizing renal masses and guiding management. CT is the most commonly used modality for diagnosis and staging[1]. Size is the most important indicator of benign histology in small solid renal masses; lesions less than one centimeter have a may prevalence of up to 40%[1]. Angiomyolipomas (AMLs) and oncocytomas are the most common benign solid masses, representing 44% and 35%, respectively[1]. Studies have shown that there is an overlap between the morphological features of benign and malignant lesions; both malignant and benign lesions can have sharp borders[1]. Renal cell carcinoma (RCC) is the most prevalent renal malignancy. RCCs have many morphological similarities to benign lesions however, they often present a perifumoral pseudocapsule, which is considered to be a hallmark of malignancy[1].

The true incidence of renal masses is widely unknown due to the fact that many of these lesions are found incidentally on abdominal radiographic studies. Most patients present asymptomatically or with vague symptoms and this may lead to the misdiagnosis or underdiagnosis of renal masses. Along with increased incidental detection, risk factors such as tobacco usage, obesity, and hypertension may also play a role in the increase in renal mass findings [1,3].

In reviewing the current literature on renal masses in adults, we aim to collect data that will offer insight into the true incidence of renal masses.. We also aim determine whether there is a need to do image guided biopsy for renal lesions to determine benign vs malignant etiologies before proceeding with invasive procedures like nephrectomy.

Methods

By reviewing medical records at IU Health University Hospital and Methodist Hospital, we identified 155 patients who were diagnosed with a renal mass and underwent a nephrectomy from January 2020 to December 2021. Data including CT and MRI imaging, radiology reports, past medical history pertinent for decision to perform nephrectomy, surgical and pathology reports, diagnosis, mass size and properties were reviewed and analyzed.

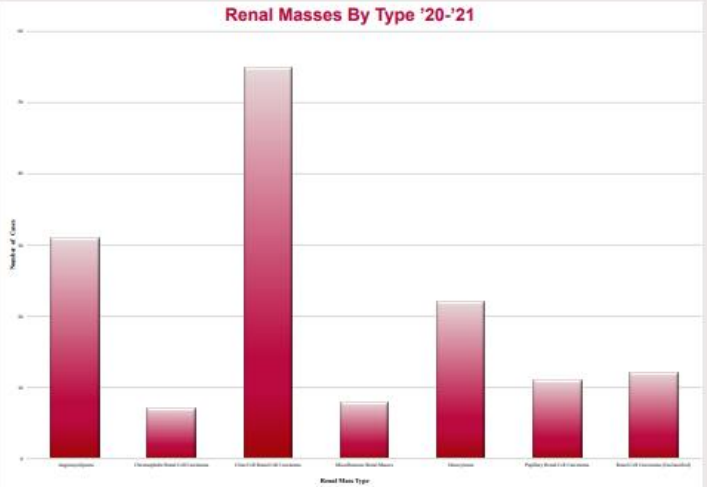

Fig. 1. Renal Masses by Type. This figure demonstrates the different types of renal masses and how many patients were diagnosed with that particular type of lesion.

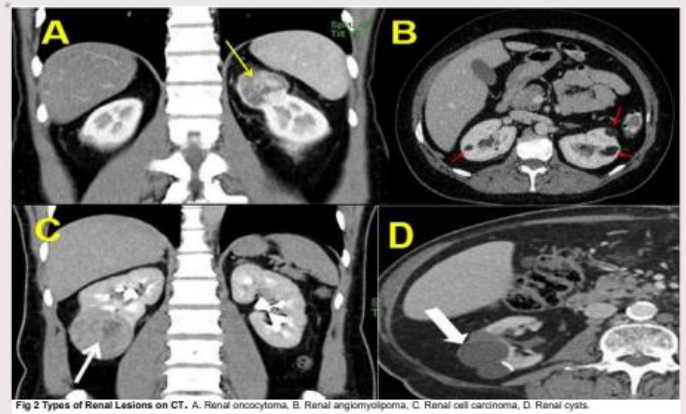

Fig 2 Types of Renal Lesions on CT. A. Renal oncocytoma, B. Renal angiomyolipoma, C. Renal cell carcinoma, D. Renal cysts.

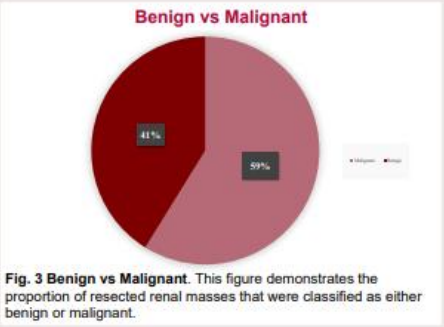

Fig. 3 Benign vs Malignant. This figure demonstrates the proportion of resected renal masses that were classified as either benign or malignant.

Results

The sample consisted of 155 adults who had undergone nephrectomies at IU Health University or Methodist hospital. An independent sample t-test was used to determine if there was a significant difference in lesion size between the benign and malignant groups. We found that the patients that were diagnosed with malignant lesions (M= 4.38 cm, SD = 3.11 cm) when compared to those with benign lesions (M = 3.42 cm, SD = 2.58 cm), had significantly larger lesions, $t(146.5) = 2.078$, $p = .023$. A chi-square test of independence was used to examine the relationship between lesion size to lesion appearance on imaging (solid or cystic). The relation between these variables was significant, X^2 (2, N = 155) = 8.9, $p = .009$; larger lesions are more likely to be malignant.

Conclusions

- Lesion appearance (solid or cystic) may be an important factor when determining malignancy on imaging studies; patients with solid lesions were more likely to receive a malignant diagnosis.
- Lesion size is also an important factor when characterizing a renal mass as benign or malignant; larger lesions are associated with a malignant diagnosis.
- The most definitive way to characterize a renal mass is via biopsy and this should be considered when determining if a nephrectomy is the appropriate treatment.

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Late May	Program begins

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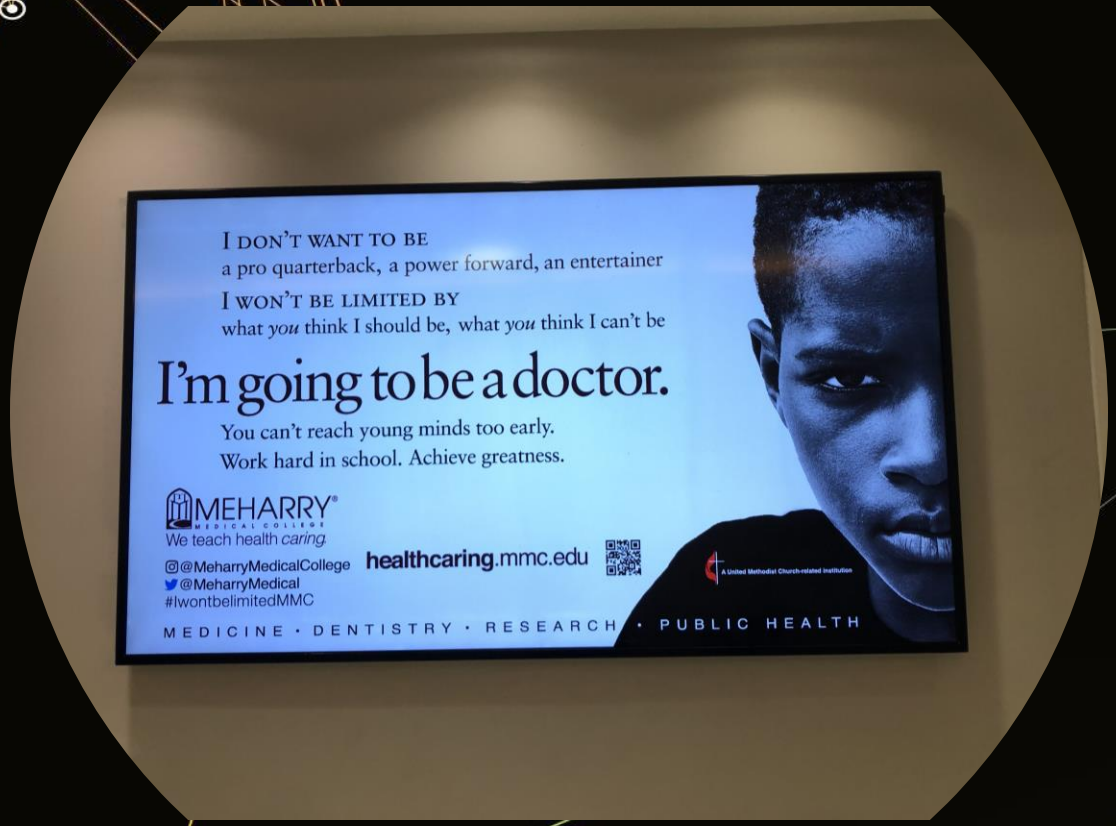

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