

School of Medicine Greenville

BACKGROUND

The University of South Carolina School of Medicine Greenville rolled out a refreshed curriculum to first-year students in the fall of 2023. This refresh moved the Hematology and Oncology course from early in the second-year to early in the first-year which provided an opportunity to deliver basic science content alongside pathology content. Refreshed courses incorporated active learning sessions with required student attendance. Therefore, new active learning sessions needed to be developed that engaged students and reinforced course content.

PURPOSE

 \succ To develop an engaging active learning session for the first-year Hematology and Oncology course that incorporates biochemistry, genetics and pathology content.

METHODS

A brief case report on Lynch syndrome was provided to students at the start of the required active learning session in the first-year Hematology and Oncology course. Students worked in groups to answer questions that assessed their understanding of biochemistry (mutation impact on protein function), genetics (inheritance pattern in pedigree) and pathology (grading and staging of tumor) content presented in the case report. Faculty reviewed the correct answers as a large group. Next, student groups were assigned to write one NBME-style question regarding the case that assessed biochemistry, genetics and/or pathology knowledge. The student groups wrote their questions and then submitted questions via Padlet so that all in attendance could see their work. Finally, faculty reviewed the submitted questions as a large group. Students were provided a QR code to share their opinion of the session via an online survey.

Active Learning Session Combining Biochemistry, Genetics and Pathology in a Hematology and Oncology Pre-clerkship Course

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- 1. Read the short case report if you have not done so already.
- 2. Briefly discuss the genetics and biochemistry of this case:
- a) What does the pedigree tell you about the inheritance of Lynch syndrome?
- b) Why is the mutation identified in the MLH1 gene significant?
- 3. Briefly discuss the pathology presented in this case: a) Discuss the type of tumors the proband had.
- b) Discuss the grading and staging of the malignancies in this family.
- . Write one NBME-style question regarding this case. Your question should assess genetics, biochem or pathology knowledge. ***We will review how to do this on the next slides***
- 2. Submit your question on the Padlet linked here: https://padlet.com/chosed/lynch-syndrome-casequestions-zszza3p1ugdttf69
- 3. Review the questions submitted by your classmates.

Figure 1: Slides with directions provided to the students for the in-class activity and the resulting student-authored questions submitted via Padlet.

RESULTS

The active learning session was well-received by students as their feedback on the survey revealed that the session added value to their learning of the content. The NBME-style questions written by the students demonstrated that they were able to link the biochemistry and genetics content to the pathology content and clinical information.

> Student comments:

CONCLUSIONS

Introduction of an active learning session in a Hematology and Oncology first-year course allowed students to apply their biochemistry, genetics and pathology knowledge to a clinical case. The group activity linked the basic science content to clinical content which may help first-year medical students retain more of their basic science knowledge.

Reference: Lu, Xiaohuan et al. "Identification and genetic counseling for a novel variant of MLH1 associated with lynch syndrome in colorectal cancer: a case report." Gastroenterology Report 11 (2023): goad049.

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A 47-year old male presented to the

room with abdominal distention, dis

hematochezia. Laboratory tests reve

decreased hemoglobin level, but all o

were within normal range. Abdomina

scan shows scattered nodules in bot

rectum, Biopsy revealed 6 adenomat

a tumor that was found to be adenoo Which of the following features are li

present in the cancerous specimen?

C. Lower nucleus to cytoplasm ratio

A 45-year-old man presents to the h

abdominal distention, abdominal disc

hematochezia. Additional workup rev

polyps in the epithelial lining of the c

laparoscopic colectomy reveals there

tissue invasion and no signs of meta:

his information, how would you class

A 47 year-old male presents to the e

department at 11:30 PM with compla

abdominal pain, bloating, and irregula

novements. Laboratory findings are

anemia (Hct. 108. ref. 130-175).CT im

obtained, revealing several small scat

along the colon. CT imaging is not in

spread to other organs. He is admitt

A. Uniform nuclei

E. Metaplasia

cancer?

Group 7

A. Adenoma

B. Adenocarcinoma

C. Angiosarcoma

D. Fibrosarcoma

E. Hemangioma

B. Changes in tissue polarity

D. Similarity to other tissues

chosed + 13 + 5mo * Frozen

Lynch Syndrome Case Questions

A 50-year-old man goes in to his PCP complaining Please add your group question to this of abdominal distention, discomfort, and Padlet by using the "+" at the bottom right hematochezia. He is referred for a colonoscopy and of the screen. numerous polyps are discovered and removed. He is determined to have Lynch Syndrome. Anonymous 5 What mutation is the likely cause of this cancer? A 42-year-old male presents to his primary care provide A. A mutation in a proto-oncogene for DNA B. A mutation in a tumor suppressor gene for DNA mismatch repair. bloodwork showed a low hemoglobin (10.2 g/dL) and a C. A mutation in a proto-oncogene for nucleotide genetic workup showed an abnormality of chromosome excision repair. D. A mutation in APC tumor suppressor gene. Which gene is most likely affected and what is this gene's primary function? A.) p53; proto-oncogene Anonymous 5n B.) p53; tumor-suppressor gene C.) Ras; proto-oncogene D.) Ras: tumor-suppressor gene Anonymous 5n E.) MLH1; proto-oncogene F.) MLH1; tumor-suppressor gene Anonymous 5 47 year old male presents with abdominal chezia. 6 polyps in the cold A 45-year-old woman with a family history of using colonoscopy and the colorectal cancer presents for genetic counseling athological biopsy revealed adenoma with low due to concerns about hereditary cancer risk. He grade and partial high-grade intraepithelial brother was recently diagnosed with colorectal eoplasm. The patient's mother was diagnosed cancer at the age of 47, and their mother was with sigmoid colon cancer (pT3N1M0) at 55 yo and diagnosed with sigmoid colon cancer at 55. The the patient's aunt was diagnosed with ascendin/ interested in understanding her risk an olon cancer (pT2N0M0) at 58 yo. The patient wa the potential genetic basis for her family's history referred for genetic evaluation, and Genetic testing is recommended, and a pathogenic munohistochemistry (IHC) testing revealed the germline variant in the MLH1 gene is identified. oss of MLH1 expression. Loss of this gene is will Further analysis reveals a novel heterozygous mpact which of the following DNA repair variant, c.482delC (p.Thr161ArgfsTer6). What is the mechanisms? likely impact of this variant on the MLH1 protein, and how might it contribute to the family's colorectal cancer predisposition? a) Base excision repair b) Nucleotide excision repair a) The variant introduces a missense mutation c) Mismatch repai leading to abnormal MLH1 protein folding and

~78% of students completing end-of-session survey rated the session as having good, very good or excellent value in participation and in format.

"the journal club was an amazing real-life application" "It was perfectly balanced with the practice questions, applying knowledge to outside research"

PZISMA HEALTH SM

		Q
nergency nfort and ed a er values nhanced CT the colon and s polyps and cinoma. ly to be	 A 47-year-old male is admitted to the hospital and treated for abdominal dissension, discomfort, and hematochezia. He complains of experiencing significant night sweats, unexplained weight loss, and fever. Six polyps are identified via colonoscopy, and pathological biopsy reveals adenoma with low-grad and partial high-grade intraepithelial neoplasm. After genetic testing is completed, the patient is diagnosed with Lynch Syndrome. Which of the following processes is most likely defective in this patient. A. Homologous end joining B. Mismatch repair C. Non-homologous end joining D. Nucleotide base excision repair 	A 47-year-old man with a history of abdominal discomfort and hematochezia was diagnosed with a novel germline variant in the MLH1 gene. This variant was also identified in the patient's family who had a history of colon cancer. The patient underwent laparoscopic subtotal colectomy, and analysis revealed moderately differentiated adenocarcinoma with partial mucinous adenocarcinoma. The family members are advised to undergo regular surveillance for cancers related to mismatch repair deficiency. Which of the following mechanisms of action is most accurate regarding mismatch repair and the identified variant's role in tumorigenesis?
ital with fort, and s dense n. The no direct sis. Given this type of	A 47-year-old man is admitted to the hospital with complaints of abdominal distension, discomfort, and hematochezia. A contrast-enhanced CT scan reveals segmental proximal intestinal wall thickening in the sigmoidal colon and scattered dense nodules in the colon and rectum. The patient was diagnosed with	 gene 2. Gain of function mutation in tumor suppressor gene 3. Loss of function mutation in a proto-oncogene gene 4. Loss of function mutation in tumor suppressor gene 5. Both a gain of function and loss of function mutation in a proto-oncogene
rgency s of powel	 Inclusion a synarome due to the presence of multiple polyps during a routine screening colonoscopy, is now concerned about the possibility of colorectal cancer. What is the cause of these pathological findings? A) APC gene mutation B) KRAS gene mutation C) BRAF gene mutation D) DNA mismatch repair (MMR) gene mutation E) SMAD4 gene mutation 	Lynch syndrome question 47 year-old man presents to the hospital with abdominal distention, discomfort, and hematochezia. He is sent for further testing, and has a colonoscopy. The biopsy reveals numerous polys indicating adenocarcinoma. He explains to the doctor that his mother and aunt also have adenocarcinoma of the colon. Genetic testing reveals a novel mutation in a mismatch repair. The doctor informs the patient that his mother and aunt
nificant for ing is red nodules ative of to hospital	A 47-year-old man diagnosed with Lynch Syndrome is found to have six polyps in his colon having undergone a colonoscopy. A biopsy of the mass shows adenocarcinoma with evidence of	are at risk for other cancers and should be screens. Which of the following cancers do they have the highest likelihood of developing? A. endometrial B. stomach