



Brief Report

Implementation of a required 3rd-year medical student surgical pathology clinical experience



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A B S T R A C T

Few medical schools have required experience in surgical pathology during the clinical years. After introducing a pilot and preliminary surgical pathology clinical experience into the curriculum, we initiated a required 3rd-year medical student surgical pathology clinical experience that consisted of a one hour introductory lecture; one hour gross room, histology, and immunohistochemistry laboratory introduction; and one hour of one-on-one case sign-out preceptorship with a subspecialty surgical pathologist within the surgery and obstetrics/gynecology block. Concepts that were covered included specimen processing, intraoperative frozen section consultation, completing specimen requisitions, interpreting synoptic reports, and pTNM staging. Students evaluated the surgical pathologist from 1 to 5 (1 "poor/unhelpful," 2 "marginal," 3 "neutral," 4 "good," 5 "excellent/useful"). Ten multiple-choice questions (included as part of a perioperative services exam) and attendance were incorporated into students' perioperative services rotation grade. From 2014 to 2018, 757 students participated in the required 3rd-year surgical pathology clinical experience. Thirty academic subspecialty pathologists acted as preceptors with an average of nine sessions per preceptor per year. Evaluation data from 316 students from 2015 to 2018 showed a mean preceptor rating of 4.8/5 (range 4.0–5.0). Students scored an average of 81% on the surgical pathology portion of the exam (range 21–99% for each question). We successfully implemented a required medical student surgical pathology clinical experience. At the clerkship's conclusion, students demonstrated understanding of key concepts and rated their preceptorship experience highly.

Keywords: Surgical pathology, Clerkship, Rotation, Preceptor, Medical student

Most medical schools in the United States do not have required pathology experiences in the clinical years of medical school.^{1–5} Despite surgical pathology accounting for the largest source of revenue in 78% of pathology practices,⁶ there are few required clinical experiences in surgical pathology.² The College of Medicine at our institution, a United States allopathic medical school, planned to implement a new medical student curriculum in August of 2014. My goal was to create a required surgical pathology clinical clerkship experience within the new 3rd-year curriculum to create graduates familiar with basic principles in surgical pathology. The updated 3rd-year clerkship curriculum consisted of 3 core blocks, including surgery/obstetrics and gynecology, internal medicine/psychiatry/neurology, and family medicine/pediatrics. The surgery and obstetrics/gynecology 4 months block was targeted for the inclusion of the surgical pathology clerkship due to overlapping patient care themes (Fig. 1). A meeting was held with the director of the surgery and obstetrics/gynecology 4 months block, who was receptive to including surgical pathology within the new curriculum. Senior leadership with the pathology department, including the chair and anatomic pathology vice-chair, were very supportive of this initiative.

The experience aimed to create a better understanding of surgical pathology and impart baseline knowledge of key principles of surgical pathology among all graduating medical students. The surgical pathology clinical experience objectives were as follows: (1) state information

needed on the pathology requisition, (2) list steps and timing of specimen processing including accessioning, grossing, histology, immunohistochemistry, and case sign-out and intraoperative section analysis, (3) describe how to submit a surgical pathology specimen for routine processing, intraoperative consultation, and lymphoma work-up, and explain limitations of surgical pathology, (4) understand the role of a synoptic report, and (5) list the components of pTNM staging (Table 1). These objectives were designed to give medical students knowledge of surgical pathology processes and regulations applicable throughout the United States and as such, would be relevant in their future careers in medicine.⁷

A pilot program was conducted during the 2012–2013 academic year from September to November of 2012. Each session included 1 to 4 students and occurred on a Friday for three hours and 45 min. Students reported at 1 p.m. on their assigned Friday and were given an overview of the gross room laboratory for 30 min, histology laboratory for 30 min, and immunohistochemistry laboratory for 15 min by the gross room manager and histology/immunohistochemistry histotechnologist manager. Students were then split into two groups for the following 2.5 h, spending one hour and 15 min in each activity, switching at the halfway point. One group actively engaged with individual pathologists' assistants in intraoperative consultation and gross prosection, while the other group was paired with an attending surgical pathologist. The attending

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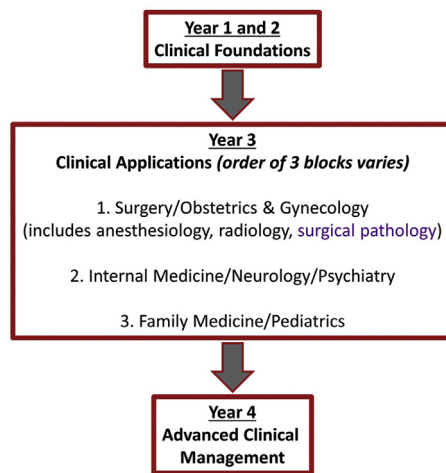


Fig. 1. The Ohio State University College of Medicine curriculum. Surgical pathology is placed in the 3rd year within the surgery/obstetrics and gynecology block.

surgical pathologist preceptor facilitated one-on-one sessions with the students. Students chose a surgical pathology subspecialty for the experience based on daily availability, utilizing our subspecialty sign-out model. Subspecialty options included breast, gynecologic, otolaryngic, thoracic, and urologic pathology. By using a multiheaded microscope typically within the attending surgical pathologist's office, active clinical cases were viewed and diagnosed while instructing the student throughout the completion of the cases, similar to the interaction with a pathology resident. Preceptors were required to include clinical cases with hematoxylin and eosin (H&E) slides, an immunohistochemical stain, a synoptic report, and pTNM staging to meet curriculum objectives.

At the conclusion of the pilot program, students completed an anonymous evaluation given by the College of Medicine. Students were asked to rate the overall experience using a Likert scale (1 = "Not useful at all," 2 = "A little bit useful," 3 = "Moderately useful," 4 = "Very useful," 5 = "Extremely useful") and a series of short answer questions ("What was the most helpful thing about the afternoon in pathology?" "Was there anything you did not learn on your afternoon in pathology that you had hoped to?" "What could be improved for next year?"). Students were evaluated via a multiple choice quiz of 10 questions worth 1% of their surgery grade and a narrative clinical performance evaluation. A total of 21 students and 4 attending surgical pathologists participated in the pilot program across 8 Friday sessions. Of the 21 students, 18 submitted an evaluation at the end of the experience with a mean rating of 4.0 ("Very useful"). Students responded to the short answer questions with a variety of answers, including, "I enjoyed seeing the process from start to finish and gaining a better understanding of what the process entails," "More clinical correlations," and "I think it was great that we had this afternoon to be exposed to this field, and I think the time devoted was about right to get a quick exposure and understanding of the field."

Due to positive student responses from the pilot program, the pathology department was asked to begin the required surgical pathology

Table 1
Surgical pathology clinical experience objectives.

1. State information needed on the pathology requisition
2. List steps and timing of specimen processing, including accessioning, grossing, histology, immunohistochemistry; case sign-out; and intraoperative consultation
3. Describe how to submit a surgical pathology specimen for routine processing, intraoperative consultation, and lymphoma work up and explain the limitations of surgical pathology
4. Understand the role of a synoptic report
5. List the components of pTNM staging

clerkship experience for all students for the 2013–2014 academic year, rather than wait one year for the initiation of the new College of Medicine curriculum as was the original plan. For accommodating approximately 200 students, the experience was modified to include a one hour introductory lecture at the beginning of the block to 60 students and a two hour surgical pathology clerkship experience similar to the pilot with the following modifications. First, the surgical pathology clerkship experience occurred on Tuesdays from 2 pm. to 4 pm. Second, students engaged with the pathologists' assistant gross room manager in the gross room laboratory for 30 min, the histotechnologist manager in the histology and immunohistochemistry laboratories for 30 min, and the surgical pathologist for one hour. Finally, subspecialty options for the students to choose from increased to include dermatologic, gastrointestinal, neurologic, ophthalmic, and orthopedic pathology in addition to breast, gynecologic, otolaryngic, thoracic, and urologic pathology. A total of 18 surgical pathologists served as preceptors for 245 students during the 2013–2014 academic year. The mean number of sessions per preceptor was 14 (range 3–22), with a 4.9% student no-show rate for the year. Students failed to attend their surgical pathology preceptor session for several reasons, including academic failure, leave of absence, excused absences uncommunicated to the pathology department, or unexcused absences.

The College of Medicine implemented the new curriculum for the 2014–2015 academic year. The required surgical pathology experience was incorporated into the new perioperative services rotation, which consisted of anesthesiology, radiology, and surgical pathology and was still within the surgery and obstetrics/gynecology block. The surgical pathology clerkship time slot was moved to Wednesdays from 2 pm to 4 pm. In the 2015–2016 academic year, the gastrointestinal surgical pathology fellow participated as an additional preceptor. After the experience, students completed a written evaluation. Students ranked their experience with the surgical pathologist on a scale of 1–5 and provided overall positive and negative feedback. At the end of each academic year, surgical pathology preceptors received an individual summary teaching evaluation, which was included in each faculty member's departmental annual review. Data from these evaluations have been compiled from 3 academic years (2015–2016, 2016–2017, and 2017–2018). Students were evaluated via 9–10 multiple choice questions included in the perioperative services rotation exam (12% of the perioperative services rotation grade) and attendance (5% of perioperative services rotation grade). In total, the surgical pathology experience accounted for 17% of the student's perioperative services rotation grade. The perioperative services rotation grade (designated as honors, letter of commendation, satisfactory, or unsatisfactory) was included in the Medical Student Performance Evaluation (MSPE) letter for application to residency, alongside all other 3rd-year rotation grades (Fig. 2).

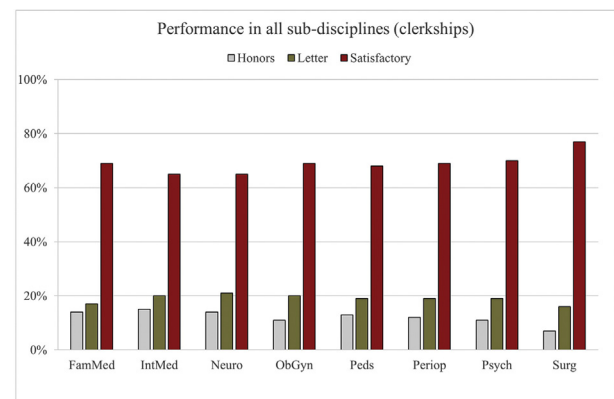


Fig. 2. Sample medical student performance evaluation (MSPE). The MSPE is sent to all residency programs to which a student applies. The surgical pathology experience is included in the perioperative services rotation, which receives a clerkship grade that is represented alongside all other required 3rd-year medical student clerkships.

A total of 27 surgical pathology attending physicians and 3 gastrointestinal surgical pathology fellows, ranging from 20 to 23 preceptors in a given year, partook in the surgical pathology experience for the 4 academic years from 2014 to 2018, precepting a total of 757 students. The mean number of sessions per preceptor each year was 9 (range 1–15). The student absence rate has been variable, ranging from 0.5 to 4.8%, with a modest improvement more recently (Table 2). Data from the evaluations were collected from the 2015–2016, 2016–2017, and 2017–2018 academic years. Among the 547 students, 315 submitted evaluations. On average, students rated their one hour sessions with the surgical pathologist as 4.8 out of 5.0 (range 3.0–5.0), with individual preceptor yearly average ratings ranging from 4.0 to 5.0 (Table 2). Qualitative feedback is shown in Table 3. Exam data was collected from 2014 to 2018. In total, 711 students took the exam over the 4 year period with an average score of 81.3% on the surgical pathology portion of the exam. Sample exam questions are shown in Table 4. The average percentage correct for each surgical pathology question ranged from 20.7 to 98.7%.

The most significant resource that the clerkship experience required was preceptor time and participation. For each class of approximately 200 students per year, we enlisted 20–23 academic subspecialty surgical pathologists in our department to act as preceptors. Each preceptor contributed less than one hour per month (nine hours on average each year) to the clerkship. The faculty mentors who participated were provided with student feedback as a part of their department's annual review. Student evaluations, which have been almost uniformly positive, were also incorporated into promotion and tenure dossiers. Most of the faculty in our department has a limited role in the education of medical students, and thus, this experience provides a beneficial opportunity for faculty to demonstrate involvement and excellence in medical education. Additional resources required to run the clerkship included laboratory staff (i.e. the gross room manager, histotechnologists, and pathologists' assistants), who were required to give instructional sessions in the laboratory for one hour each week, and the time of the surgical pathology rotation director, with assistance from the pathology education coordinator, who organized student and faculty scheduling and communicated with the College of Medicine. For departments with fewer surgical pathologists at the site, strategies could be utilized to still accommodate a large number of medical students. For example, each attending can precept multiple students at the same time, particularly if there is access to a multiheaded microscope or if there is a camera mounted on a microscope, which can display images in real time. Fellows and residents can also be utilized as preceptors.

During the implementation of the experience, the largest barriers to success that arose were unexpected student and faculty absences. We addressed the issue of preceptor absences by sending the faculty schedule via email a few weeks in advance with email reminders 3 days prior to, as well as on the day of the faculty member's participation. Additionally, after implementing a system to give the faculty direct feedback and comments from students, the largely positive evaluations from the students provided positive reinforcement and motivation for improved faculty engagement. Both of these strategies have helped to decrease the preceptor absence rate. Student absences were largely due to poor

Table 2
Surgical pathology clinical experience 2014–2018.

	2014–2015	2015–2016	2016–2017	2017–2018	Total
Number of preceptors	20	20	20	23	27
Number of students	210	179	189	179	757
Percentage of no shows	4.8%	0.6%	0.5%	3.9%	2.5%
Mean evaluation rating	NA	4.8	4.8	4.9	4.8

Table 3

Student evaluation responses from surgical pathology clinical experience 2015–2018.

"Helped show me key findings in recent cases and explained importance of report-where clinicians should read."
"Great to learn about how to thoroughly read pathology reports and how to correctly submit specimens. Thanks!"
"He showed me a number of slides and explained the importance of pathology reports and how we as future clinicians can better serve our patients by giving and understanding the correct diagnosis."
"Having a slide to look at normal and abnormal pathological specimen, as well as an experienced pathologist available to walk through the histology greatly expedites the learning process. I felt I learned a lot in that one hour, almost more so than during my first two years of medical school."
"Very helpful! It's good to finally learn what happens after specimens leave the OR."
"I feel I'll be more comfortable as a clinician interacting with pathologists/reports as a result."
"This was a fascinating opportunity to see the hard work that surgical pathologists put into making an accurate diagnosis. I firmly believe that it will help me work as part of a more effective team with my colleagues in the future. Thank you!"
"Helpful to know what pathologists need to know about the specimen. Good session."

communication between the College of Medicine and the pathology department (i.e. failure of the College of Medicine to update the coordinator regarding excused absences or the status of students no longer in medical school) and students not remembering their assigned session. This issue was addressed by requesting improved communication with the College of Medicine and implementing a strict policy to no longer allow make-up sessions, which was emphasized to students during orientation and by the College of Medicine. These strategies modestly improved the student absence rate, although the issue has not been completely resolved, with the most recent student absence rate at 4%.

Essential to the success of the program was support from senior leadership in the department (chair and anatomic vice chair of pathology). Leaders can appreciate the many potential benefits of this new rotation experience, such as increased visibility of the department across the medical center, increased medical student direct contact teaching hours, which could result in College of Medicine remuneration, opportunities to showcase medical student teaching in promotion and tenure documents, creation of future colleagues with a better understanding of pathology, and improved recruitment into pathology.

Table 4

Sample exam questions.

1. You are performing a nephrectomy on a 36-year-old female. Intraoperatively, you notice a lesion in the abdomen for which you would like an intraoperative consultation. The best way to submit a specimen from the OR for intraoperative frozen section is which of the following?
a) In glutaraldehyde (0.1%)
b) In formalin (6.5%)
c) In RPMI (0.3%)
d) In saline (0.3%)
e) Dry or on a Telfa pad moistened with saline (89.7%)
2. A cirrhotic liver is surgically removed from a 59-year-old female. The specimen is submitted to pathology and is described, sectioned, and selected portions submitted for histologic examination. This process is which of the following?
a) Intraoperative consultation (2.0%)
b) Histologic analysis (11.8%)
c) Immunohistochemistry (0.3%)
d) Grossing (68.9%)
e) Accessioning (17.0%)
3. A 35-year-old male with hematuria and a history of metastatic testicular germ cell tumor is currently undergoing a bladder biopsy. Which of the following is required to note on the pathology specimen requisition?
a) Current oral medications (1.0%)
b) History of chemotherapy/radiation (95.9%)
c) Mental status (0.1%)
d) Family history (0.8%)
e) Surgical history (2.1%)

Correct answers bolded and percentage of student responses noted by each response.

By familiarizing future physicians with surgical pathology, we hoped to address and improve several issues relevant to pathologists. One problem that pathologists are commonly presented with is a deficiency of relevant clinical information on pathology requisition forms. A study by Nakhleh et al. revealed deficiencies in identification or accessioning in 6% of accessioned cases, with the most common deficiency (40%) identified as “no clinical history or diagnosis present on the requisition slip”.⁸ In order to address this issue, we educated students on the proper methods of submitting requisitions and specimens for analysis through several modalities, including an introductory lecture, hands-on lab didactics with the discussion of specimen/requisition submission, and one-on-one interaction with an attending pathologist. The second issue in pathology addressed was the overutilization of intraoperative frozen section consultation. A few reports from large academic medical centers revealed 5–12% of intraoperative frozen section consultations did not influence patient care and were considered inappropriate.^{9,10} Through our clinical experience, students learned the indications and limitations of frozen section interpretation and how to correctly submit specimens. Students were tested on these two key practice gaps through written examination, with 94% of students correctly answering questions on these topics and an overall exam question average of 81%. Scores from these questions and attendance contributed 17% of the perioperative service rotation grade (also including anesthesiology and radiology), which was reported alongside other required 3rd-year rotations in the MSPE, a critical part of the residency application. In addition to having quantitative data on students’ understanding, it is our belief that formally scoring a student’s performance imparts a uniform and higher expectation than a formative experience without such an assessment.

We aimed to improve communication between pathologists and future physicians via facilitating one-on-one interactions between students and surgical pathologists. Published studies have shown that there are disparities in interpretation between pathologists and clinicians regarding terms communicating diagnostic uncertainty in pathology reports.^{11,12} Through one-on-one interaction of the student with the surgical pathologist, students learned how to read and interpret a synoptic report and observed as the pathologist created reports in real time and explained the content to the student. Furthermore, direct interactions with a surgical pathologist early in medical training may help future clinicians feel more comfortable interacting with and utilizing pathologists as part of the healthcare team throughout their careers.

The focus of the clinical experience we created was not to increase recruitment into pathology (although that may be an unintended effect) but to impart a basic understanding of surgical pathology in all of our medical students to utilize in whichever field they pursue. Some may view increasing student exposure to pathology as a method to address the issue of decreased recruitment of medical students into the field of pathology, which is perceived to be due to the relatively recent lack of a dedicated pathology course in the preclinical years. Previously, medical schools usually required clinical experience in family medicine, internal medicine, obstetrics and gynecology, pediatrics, psychiatry, and surgery. However, the National Resident Matching Program (NRMP) data demonstrates the increasing competitiveness of other specialties that were not previously required rotations or dedicated courses.^{13–16} For example, fields such as physical medicine and rehabilitation and dermatology were not classically required clinical rotations or dedicated courses within the preclinical years in medical school, and thus, students typically have limited exposure. Despite this limited exposure, NRMP data has shown increasing competitiveness of these specialties through metrics such as increasing Step 1 and 2 scores, a growing applicant pool, and an increasing number of research experiences per applicant.^{13–16} Additionally, McCloskey et al. showed that participating in a separate pathology course did not increase pathology as a residency choice but

experiences within the final two clinical years, including clinical experience in pathology did.¹⁷

In conclusion, we have successfully created and implemented a required clinical experience in surgical pathology for all of our 3rd-year medical students. We believe exposure to surgical pathology during the clinical years is vital to creating more well-rounded physicians with a basic knowledge of the application of surgical pathology to patient care. The experience we have created was well-received by students (mean 4.8/5) and faculty in our department of pathology and did not require excessive redistribution of student time or departmental resources. We encourage other medical schools to implement similar required experiences for their medical students to educate future physicians about surgical pathology and address key practice gaps.

Declaration of competing interest

The Authors declare that there is no conflict of interest.

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