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# Changing Trends in Dermatopathology Case Complexity

## A 9-Year Academic Center Experience

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• **Context.**—Pathology case volume and complexity impact clinical service burden, staffing, and reimbursement, particularly in an academic setting.

**Objective.**—To investigate dermatopathology case complexity by using indicators of challenging cases, which require increased clinical service effort.

**Design.**—A retrospective review was performed of dermatopathology cases during a 9-year period at a tertiary care academic center. A subset of cases was analyzed for which extractable data were available. Cases requiring the following metrics of complexity were identified: rush processing, consensus agreement, performance of immunohistochemistry, use of special histochemical stains, use of immunofluorescence, examination of additional tissue levels, review of a prior case, addition

of an explanatory note, presence of multiple specimen parts, and use of intradepartmental consultation.

**Results.**—A total of 8173 cases were reviewed. During the same 3-month period of the year, there was a statistically significant increase in use of rush processing/interpretation, consensus review, number of cases requiring immunostains, special stains, levels, and an explanatory note, and cases reviewed by other subspecialists in the department from 2010 to 2019.

**Conclusions.**—This study shows an increasing trend in dermatopathology case complexity, suggesting that overall clinical service efforts have increased. These findings may inform clinical service staffing and reimbursement.

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In addition to histopathologic diagnosis, the academic pathologist's role encompasses a broad range of activities including teaching, quality improvement, leadership or administrative tasks, tumor boards/clinical conferences, and research endeavors, among others.<sup>1,2</sup> Furthermore, recent technologic advances and the rise of precision medicine are expanding the role of the pathologist in health care.<sup>3</sup>

Pathologists' workload is impacted by specimen volume and case complexity. Pathologist-generated complex tissue-based data for cancer reporting, in particular, have expanded given the need for diagnostic and prognostic biomarkers. No accepted standards exist for the assessment of case complexity, a difficult-to-define metric in measuring a pathologist's daily efforts.<sup>1,4</sup> However, with the workforce crisis and expanding clinical needs, realistic calculations of the amount of work a pathologist performs should include the measurement of complexity and not only case volumes.

During the past decade, we and other academic providers have perceived an increase in case complexity and time spent on individual cases without necessarily an increase in case volume. With respect to dermatopathology, the number of inpatient medical dermatology cases requiring extended review of clinical records and images has been perceived to have surged at our institution. Although attempts to better quantify complexity have been undertaken, to our knowledge, no systematic investigations regarding changes in complexity over time have been previously reported in dermatopathology. We sought to investigate dermatopathology case complexity by using indicators of challenging cases, as these factors may influence clinical service staffing needs and reimbursement.

### METHODS

A retrospective chart review was performed on dermatopathology cases signed out at the Massachusetts General Hospital (Boston) during a 3-month period (April to June) in 2010 and in 2019 for which extractable data were available. Cases included were reported by pathologists whose practice was exclusively limited to dermatopathology. Four pathologists reported only dermatopathology cases during each period, and 3 of the 4 dermatopathologists remained constant during the study period.

A case was defined as all specimens received from a patient on a given day. Data were extracted from Sunquest CoPath pathology information system by using free-text search items to capture the reporting terminology used at this institution. Statistical analysis was performed by using Fisher exact test. A *P* value less than .05 was considered statistically significant. Rush cases consist predominantly of biopsies from inpatient medical dermatology patients and to a lesser extent, staged excisions performed by Mohs and

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other surgeons. Dermatopathology consensus conference occurs weekly and a standardized phraseology is included in the report of each case shown at this conference. Special stains included the following histochemical stains: periodic acid-Schiff, Fontana-Masson, iron, colloidal iron, Alcian blue, von Kossa, tissue Gram stain, Fite, and Grocott methenamine silver stain. The Massachusetts General Hospital Pathology Service is entirely subspecialized within its surgical pathology sign-out. Therefore, intradepartmental consultation was defined as a case shown to a pathologist of another subspecialty (eg, hematopathology or soft tissue pathology); this information is also reported in a standard fashion within the final diagnosis comments.

## RESULTS

Extractable data were available for 4738 cases in April through June 2010 and 3435 cases in April through June 2019. The Table summarizes the complexity metrics extracted for 3-month intervals at the 2 time points. There was a statistically significant ( $P < .05$ ) increase in the number of rush cases (7 of 4738 [0.15%] versus 68 of 3435 [2.0%]), cases shown at consensus conference (128 of 4738 [2.7%] versus 188 of 3435 [5.5%]), cases requiring the use and interpretation of immunohistochemistry (209 of 4738 [4.4%] versus 485 of 3435 [14%]), cases using special stains (253 of 4738 [5.3%] versus 297 of 3435 [8.6%]), cases with additional examined levels (491 of 4738 [10.4%] versus 430 of 3435 [12.5%]), cases with an explanatory note (1240 of 4738 [26.2%] versus 1249 of 3435 [36.4%]), and cases necessitating intradepartmental consultation (5 of 4738 [0.10%] versus 35 of 3435 [1.0%]) during this 9-year period. No change in the use of direct immunofluorescence or the number of case parts was noted. Review of prior cases was used somewhat less than in the past. In 2010, the cumulative sign-out experience of the dermatopathologists at this institution was 32 years and in 2019 was 59 years.

## DISCUSSION

Complexity is a challenging metric to define and may encompass such tasks as the performance and interpretation of ancillary tests, consulting with other pathologists, or reviewing the medical history (either in discussion with the clinician or via the patient's chart).<sup>1</sup> Authors have divided complexity into cognitive, requiring the amalgamation of clinical information and additional studies, and procedural.<sup>5</sup> Traditional metrics focus on the latter type of complexity, such as number of slides or current procedural terminology (CPT) code, but do not take into account, for example, the intricacies of clinicopathologic correlation for interpreting a single slide from the biopsy of a hospitalized medical dermatology patient with a rash.<sup>5</sup> Other point-based methods of quantifying workload, such as the Royal College of Pathologists' system, also do not include points for interpretation of immunostains, intradepartmental consultation, or need for clinical chart review, for example, and may not be as applicable to dermatopathology.<sup>6</sup> In contrast, more recently developed approaches to quantifying case difficulty, such as the Automatable Activity- Based Approach to Complexity Unit Scoring, do take into account the need for additional histochemical or immunohistochemical stains, levels, notes/addenda, or synoptic reports for cancer.<sup>1</sup>

This study attempts to measure aspects of dermatopathology case complexity. The term *complexity* in this study is used to indicate not only inherent diagnostic difficulty of a given histopathologic specimen (such as a challenging case like a Spitzoid neoplasm, in need of consultation), but also

Compiled Dermatopathology Case Metrics From April 1 to June 30																							
Year	Total No.	Consensus Review		Rush Processing		Immunostains		Special Stains		Direct Immunofluorescence		Additional Levels		Review of Prior Biopsy		Explanatory Note		Two Parts		Three or More Parts		Intradepartmental Consultation	
		No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
2010	4738	128	(2.7)	7	(0.15)	209	(4.4)	253	(5.3)	40	(0.84)	491	(10.4)	15	(0.32) <sup>a</sup>	1240	(26.2)	634	(13.4)	260	(5.5)	5	(0.10%) <sup>a</sup>
2019	3435	188	(5.5) <sup>a</sup>	68	(2.0) <sup>a</sup>	485	(14) <sup>a</sup>	297	(8.6) <sup>a</sup>	18	(0.52)	430	(12.5) <sup>a</sup>	2	(0.06)	1249	(36.4) <sup>a</sup>	464	(13.5)	205	(6.0)	35	(1.0%) <sup>a</sup>

<sup>a</sup> Indicates statistical significance,  $P$  value  $< .05$ .

the necessary time and interpretative effort required on the part of the pathologist to perform tasks such as the interpretation and reporting of ancillary studies like PD-L1 and BRAFV600E immunostains, when these are required for prognostic or treatment, rather than diagnostic, reasons.<sup>7</sup>

We show that clinical dermatopathology service effort requirements have increased within the same 3-month period from 2010 to 2019. The number of cases requiring rush diagnosis (and therefore direct communication with the clinician), consensus review, intradepartmental consultation, an explanatory note, and the performance of immunohistochemical stains, histochemical stains, and additional levels increased significantly. During the past 9 years, the percentage of cases with corresponding immunofluorescence studies and multiple parts (eg, 2 or more than 3 specimens per case) remained relatively constant. Taken together, we find a trend toward increasing case complexity in dermatopathology.

Consensus review of pathology cases may reduce diagnostic discrepancies and be beneficial to patient care.<sup>8</sup> Despite the increase in the collective years of experience of sign-out pathologists (3 of 4 pathologists having an additional 9 years each of experience), the number of cases shown at consensus conference, and for which intradepartmental consultation was obtained, increased during the study interval. The growing number of cases requiring consensus or intradepartmental review is notable and may reflect an increase in case complexity as well as demand for quality assurance activities in the current practice environment.

We found a statistically significant increase in the number of cases with immunohistochemical staining performed in our study. This is, again, despite both the increasing experience among the reporting dermatopathologists and decrease in the number of cases with performance of up-front immunohistochemical staining (eg, melanoma sentinel lymph node specimens) due to rapidly changing guidelines for staging and treatment of patients with melanoma. As the knowledge of cancer biology expands, ancillary studies are increasingly used to both appropriately classify and provide prognostic and potentially treatment-relevant information regarding, for example, melanocytic neoplasms.<sup>9,10</sup> Additionally, the availability of duplex immunostains (eg, dual Mart-1/Ki-67) and the use of chromogens in colors such as red and green may be postulated to have increased the use of immunostains by dermatopathologists during the study timeframe.<sup>11</sup> Finally, an increasingly litigious work environment may affect behavioral patterns regarding the ordering of immunostains or other specialized tests.<sup>12</sup>

Concordant with our hypothesis, one of the most notably increased complexity metrics during the study period was the percentage of rush cases. At our institution in 2019 nearly three-quarters of our rush biopsies were taken from medical dermatology inpatients; the remainder were staged excisions. These inflammatory skin disorder biopsies on sick patients require increased clinicopathologic correlation, review of the electronic medical record, direct communication with clinicians, and at times literature review; 18% (12 of 68) of these also required processing or interpretation over the weekend. These cases often require the largest amount of time per slide in our practice and raise questions regarding the potential for reimbursement to account for time spent in specific scenarios within the practice of pathology. The use of staged excision with delayed reconstruction (eg, for lentigo maligna melanoma of the

head and neck) has become increasingly popular, rounding out the pool of cases requiring rush processing and interpretation.

Other factors contributing to complexity in dermatopathology include the recognition and discovery of new diagnostic entities, emerging infectious diseases and medication-related adverse events, and new or revised classification schema that use ancillary tests.<sup>13–16</sup>

Our study is limited by the single-institution large academic tertiary care center setting and may not be generalizable to other practice settings. Based on our natural language search, some factors in the pathology report were not readily extractable; this includes whether or not a case was *received* as an external or internal (intradepartmental) consultation case. This is especially relevant given the emergence of large health care networks anchored by a central academic hospital whose dermatopathology division provides expert consultation services on the most difficult cases. These cases are often more diagnostically challenging and may add to the complexity of an academic subspecialty practice, but are excluded from most methodologies for evaluating pathologist workload.<sup>5</sup> We suspect that, in addition to these challenging external consults, we are increasingly consulted by other services from within our institution, including soft tissue, gynecologic (particularly vulva), head and neck, and hematopathology, but are also unfortunately unable to quantify these consults with our current pathology information system. Individual pathologists' thresholds for ordering stains and showing cases may fluctuate and were not measured directly, although 75% of the pathologists remained the same during the study period, eliminating some variability in this regard.

Assessment of case complexity is essential for the appropriate appraisal of pathology workload burden. The increase in rush medical biopsies, use of immunostains, and consultation with other pathologists (consensus conference or intradepartmental review) all require significant time efforts and may affect case turnaround time.<sup>17</sup> Academic pathologists must balance service needs with satisfying the needs of the educational and research missions (for which 20% protected time is granted at our institution). Thus, clinical workload affects overall physician productivity and ultimately impacts academic advancement.

Our investigation highlights a trend toward increasing case complexity in dermatopathology within the same 3-month period from 2010 to 2019. Case volume and complexity collectively impact clinical service effort and may influence pathologist productivity, staffing needs, and reimbursement. We advocate for incorporating indicators of case complexity in the assessment of pathologist workload, particularly in the academic medical center setting.

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