A Comprehensive Analysis of a Web-Based Dermatopathology Second Opinion Consultation Practice

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• ***Context.*—Sharing cases and seeking second opinion consultations is an important part of everyday pathology practice. Internet-based communications and upcoming digital slide technologies have the potential to decrease barriers and open access to the best expertise. We recently developed a dedicated Web-based process for communication with outside practices seeking second opinion consultations. The software allowed us to collect data about the current needs and use of a second opinion consultation practice, a topic that has not been addressed in research studies thus far.**

***Objective.*—To analyze the needs for and performance of a Web-based second opinion consultation practice in dermatopathology.**

***Design.*—We performed a retrospective analysis on paper and digital records.**

***Results.*—The average turn-around time from the time of biopsy to the time the report was issued was 7 days. Eighty-two percent of cases were reported the same day they were received. Biopsies of melanocytic lesions, inflammatory dermatoses, and squamous lesions comprised 82% of consultations. Among the remaining cases, soft tissue tumors, adnexal neoplasms, alopecia, and nonmelanoma nonsquamous lesions were the most common diagnoses. In 69% of cases, the outside report contained information about the diagnosis favored by the submitting pathologists. In 5%, there was a significant change in the diagnosis.**

***Conclusions.*—Web-based communication facilitates rapid turn-around time and reduces costs and barriers to second opinion consultation.**

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Sharing cases and seeking second opinion consultation from experts on difficult cases is an important part of everyday pathology practice. However, our extensive review of the literature revealed only a few studies analyzing second opinion consultation practices. Most of the studies focused on the importance of the retrospective mandatory review of specimens in the context of a patient referral to a tertiary medical center.[1–4] Studies analyzing prospective voluntary second opinion (expert) consultation practices are even less frequent and sketchy. Goldenberg et al[5] compared material submitted for a second opinion by different dermatopathologists, dermatologists, and pathologists. van Dijk et al[6] reported a major diagnostic discrepancy in 27% of cases of difficult melanocytic lesions submitted for consultation to a melanoma expert. A similar level (25%) of major discrepancies was reported for soft tissue tumors.[7] These studies illustrate the value of second opinion consultations in diagnosis of difficult cases but offer little understanding of the processes involved and needs for second opinion in the daily practice of community pathologists.

The field of pathology is on the cusp of realizing the power of the digital era. Internet-based communications and whole-slide scanning technologies are likely to have significant impact on the practice of pathology. Specifically, digital technologies offer promise to decrease the current logistical and cost barriers for sharing interesting and challenging cases among pathologists. These technologic breakthroughs may allow pathology organizations lacking in-house subspecialized expertise more cost-effective access to experts worldwide.

In anticipation of these trends, we recently developed a custom-designed, Web-based software and workflow for communication to support our consultation practice, www.DermatopathologyConsultations.com. Our process currently still relies on sending glass slides by couriers but is designed to anticipate future digital pathology capabilities.

In this article, we analyze quantitative information from our practice, which allows us to answer some interesting questions about the current needs and practices related to seeking second opinion consultative services in dermatopathology. Our data also allow us to make some speculations about the impact of digital pathology on practices and costs of sharing cases among pathologists.

METHODS

To better understand the limitations of the study and allow for a meaningful comparison with similar future

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studies, it is important to understand the unique nature of the practice analyzed as well as the workflow used before analyzing the data.

Practice Setting

The practice analyzed is devoted to providing dermatopathology consultations and head and neck, oral, and ophthalmic pathology consultations. It is organized and credentialed as a free-standing Clinical Laboratory Improvement Amendments of 1988–certified laboratory and is not formally affiliated with a large medical center or an institution. The practice does not provide in-house technical services, such as tissue processing, immunohistochemistry, immunofluorescence, or molecular studies. If needed, such services are performed at submitting institutions or at contracted laboratories. Outside pathology organizations range from individual pathologists seeking second opinion consultations on rare cases to large pathology groups or commercial laboratories with significant volumes of cases generating need for daily consultations. What differentiates this practice from other second opinion providers is that it seeks to develop long-term relationships with the clients encouraging them to enter contractual agreements. This allows them to send a predetermined number of cases per month for a flat fee. Such business arrangements may have an impact on the use of the services and on some of results of this study.

Workflow

The consultation process is supported by a custom-designed, Web-based software that allows the outside practices to securely submit online the patient and case information, track materials and shipments, and receive reports online. It creates a paperless system for communicating with submitting clinicians and their office staff, instantaneously alerting them through e-mail that a consultation report is ready. The key aspects of the workflow are explained in detail in Figure 1.

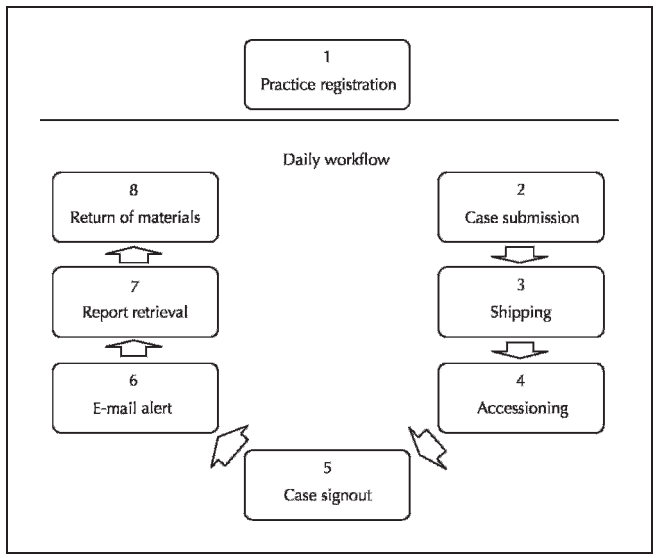

Figure 1. *DermatopathologyConsultations.com workflow. 1, Practice registration. To use the system each practice goes through a registration process. This involves giving the members of the outside practice (pathologists and support staff) secure passwords to the online system and assigning them appropriate roles. 2, Case submission. Practice staff securely submits case information and generates a mailing list containing case information and description of materials sent. 3, Shipping. Cases are shipped by a courier service. 4, Accessioning. When the slides are received in the consultant's office, the case information and materials received are verified and the case is given a consultation number. As the case data are already available in a digital format this process can take as little as a few minutes. 5, Case signout. The case can be reported by a consultant immediately after accessioning. 6, E-mail alert. Submitting pathologist and/or staff receives an e-mail notification that the case is ready for review. Autofaxing of reports is optional. 7, Report retrieval. Pathologist and/or staff logs in securely to the Consultations.com Web site to retrieve the report. Transcription can be done without need of typing. Pathologist can verify the accuracy of the report online. 8, Return of materials. All materials (slides, blocks) are returned to the outside practice.*

Data Analysis

For the purpose of the study, data from cases diagnosed during the 6-month period from February 10, 2009 through August 10, 2009 were reviewed. No patient-identifiable information was retrieved or included in the analysis. Only dermatopathology consultations were analyzed. Head and neck, oral, and ophthalmic pathology consultations were excluded. To provide more accurate assessment of turn-around time, cases submitted from institutions outside of the United States and cases submitted as part of a retrospective review or with incomplete data (usually lacking the date of the procedure) were also excluded.

The resulting data set included 1229 cases. The case information analyzed included diagnosis and data related to the turn-around time (date of the procedure, date the case was received, date the final report was issued, date the slides were returned). The information regarding whether or not additional studies were necessary before final consultation report was issued was also available. The paper records (including outside reports and cover letters) were examined to determine what diagnosis was considered by a submitting pathologist and if it agreed with the consultation diagnosis. Any information indicating that a second opinion was requested by a patient or a clinician performing the biopsy or was requested because of a contractual arrangement requiring a board-certified dermatopathologist to diagnose skin biopsies was also recorded. Consultant's diagnoses were used to establish the diagnostic category of a case, which included melanocytic lesion, squamous lesion, nonmelanoma skin cancer, inflammatory process, alopecia, soft tissue tumor, and atypical lymphoid infiltrate. All averages are shown as mean plus or minus standard deviation.

RESULTS

General Findings

A total of 1229 dermatopathology consultations qualified for the study. One hundred ninety-eight cases (16%) were from within our state and 1013 (82%) were from out of state, including 76 cases (6%) from the island of Hawaii.

Nine percent of cases contained information indicating that the review was requested by a submitting clinician, a patient, or an outside institution due to specific policies (ie, quality control review) or contracts requiring review of certain cases by an expert or a board-certified dermatopathologist. The remaining cases (91%) appeared to be originated by an outside pathologist.

The consultations were received in 357 separate courier shipments; thus, an average shipment contained 2.9 cases.

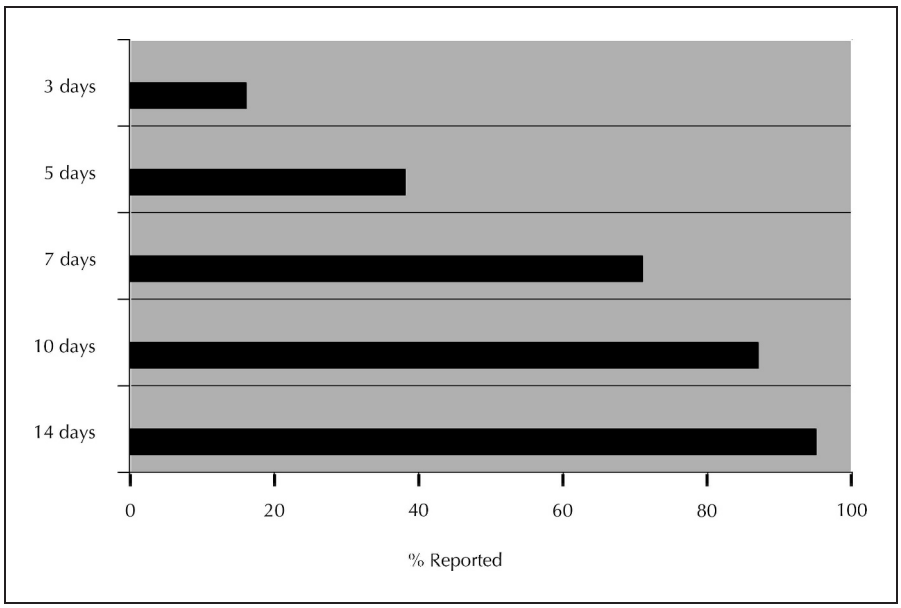

Figure 2. *Turn-around time from the date of the procedure to the date of the report issued by a consultant.*

In 136 cases (11%) more than 1 specimen was submitted for consultation. An average case consisted of 3.4 ± 3 slides.

Turn-Around Time Information

The average overall turn-around time from the date of the procedure to the time the diagnosis was rendered by a consultant was 7 ± 5.1 days. Two hundred six cases (16%) were reported within 3 days, 471 (38%) within 4 days, 878 (71%) within 7 days, 1075 (87%) within 10 days, and 1164 (95%) within 14 days from the date of the procedure (Figure 2).

Our data do not provide the assessment of the total turn-around time from the time of consultant diagnosis to the time the final report is issued by the referring pathologists. Eighty-two percent of cases were signed out the same day they were received. This number was increased to 88% if the cases requiring additional studies ordered by a consultant (80 cases, 6.2%) were excluded from the analysis. Ninety percent of cases were finalized within the first 2 days of receipt. This number was increased to 95% if cases requiring additional studies were excluded.

The slides were kept in our laboratory for an average of 7.4 days before being shipped back to the referring practice.

Diagnostic Categories

Diagnostic categories of specimens submitted are summarized in the Table. The most common type of specimen submitted was a biopsy of a melanocytic lesion (37%), followed by an inflammatory process (other than alopecia) (27%) and squamous proliferation (18%). These 3 most frequent types of specimens comprised 82% of all the specimens. The consultation request concerned a biopsy of a soft tissue tumor or an adnexal neoplasm in about 4%, alopecia in 1.5%, and an atypical lymphoid infiltrate in less than 1% of cases. The diagnosis of a nonsquamous nonmelanoma skin cancer was rendered in 17 cases (1.5%). The cases were submitted with a clearly stated favored preliminary outside diagnosis in 69% of cases. A major discrepancy between a preliminary diagnosis suggested by an outside pathologist and a consultant's diagnosis was noted in 41 (5%) of these cases. It is important to emphasize that the suggested diagnoses do not represent the final diagnosis rendered by the outside pathologist. A specific question was posed to a consultant in 140 cases.

COMMENT

Second opinion consultations on difficult cases are an important part of pathology practice. It is reasonable to expect that, because of increasing subspecialization of pathologists and demands by the patients, clinicians, and insurers that their specimens are interpreted by fellowship-trained physicians, the need for sharing cases outside of institutional boundaries will only become more prevalent in the future. The traditional paper-based process of seeking an outside consultation has been quite cumbersome, time consuming, and costly. Communication between the submitting physician and a consultant required dictating a cover letter, collecting billing information, packaging slides, and mailing. On the receiving end, the effort required accessioning, slide review, dictation of the diagnosis and a letter, printing, and mailing or faxing

Diagnostic Categories of Submitted Species

Category	No. (%)
Melanocytic lesion	452 (37)
Inflammatory lesion (other than alopecia)	331 (27)
Squamous proliferation	221 (18)
Soft tissue tumor	54 (4)
Adnexal neoplasm	47 (4)
Alopecia	29 (2)
Nonsquamous, nonmelanoma skin cancer	17 (1.5)
Atypical lymphoid infiltrate	9 (<1)
Miscellaneous	85 (7)

reports. In addition to time and cost, multiple steps increased the risk of clerical error and delays.

There are very few published reports analyzing second opinion consultations practices. Most published reports addressed quality control aspects of mandatory retrospective outside slide review in the context of patient referrals to academic centers.[1–4] These studies overwhelmingly showed the value of the secondary review, which was able to correct diagnostic errors in a significant subset of original diagnoses. For instance, in dermatopathology, a mandatory review of primary biopsies before Moh surgery disclosed an erroneous primary diagnosis in 2.2% of cases.[2] Voluntary second opinion (expert) consultations on difficult melanocytic lesions[6] and soft tissue tumors[7] resulted in significantly changed diagnosis in 27% and 25% of cases, respectively. Another recent study compared the materials sent for second opinion consultation to an expert dermatopathologist by general pathologists, dermatologists, and dermatopathologists and concluded that pathologists and dermatologists submit similar types of cases.[5] Our extensive literature search did not reveal studies comprehensively analyzing important logistical aspects of prospective voluntary second opinion consultative practices. Such analysis was the primary objective of the current study.

Within the 6-month study period, we received 1229 second opinion dermatopathology consultations. Most cases (84%) were from out of state. All the cases were sent as voluntary consultations prospectively by submitting pathologists. However, our analysis indicated that not all of them represented true ''second opinion consultations.'' In 9% of cases, we found in our records information indicating that a consultation was requested by a clinician performing the procedure or that a case was referred because of outside institutional policies or contracts demanded that a skin biopsy be reviewed by a board-certified dermatopathologist. We suspect that the percentage of cases referred because of considerations other than just seeking a second opinion on a challenging case may be higher than reported as we based our data only on the information recorded in our records. Only 69% of cases were submitted with an outside pathologist's diagnosis. These data might be interpreted as suggestive that in up to approximately one-third of cases the consult provided primary diagnosis. This number may overestimate the use of the consultants as providers of the primary diagnosis. However, given low costs and logistical barriers to outside practices of our Web-based service, it is possible that for some practices it may be less expensive to use an outside consultant than to hire an in-house dermatopathologist or a locum-tenant. It is also impossible to determine how many of the cases were sent because of ''medicolegal'' considerations to obtain a second opinion on a potentially equivocal case, even though a submitting pathologist had little doubt about a diagnosis.

Eleven percent of cases contained multiple specimens and an average shipment contained 2.9 separate cases. Actually, only 112 shipments contained a single case. The somewhat unexpectedly high number of multiple daily consultations from a single practice may be because most of our consultation clients opt for flat fee contracts, which allow them to send a predetermined number of cases per month on a prepaid subscription basis. Such arrangement significantly reduces the cost of sending an additional case.

As most cases sent out for a second opinion are already delayed, the turn-around time is a very important aspect of the second opinion consultation practice. Therefore, our Web-based process was optimized to allow fast reporting and we were able monitor different metrics related to turn-around time. The overall turn-around time from the date of the procedure to the date of the report issued by a consultant averaged 7 days. Seventy-one percent of cases were reported within 1 week. Our data indicate that it is possible to achieve a 3-day turn-around in some cases (16%) and a 5-day turn-around time in many (38%). Many factors will influence the turn-around time of a diagnostic process involving an outside consultant. These include the logistical factors such as time before a decision to seek a second opinion is reached by an outside pathologist, time necessary to gather materials and documentation, time of shipping, internal turn-around at the consulting practice, and so forth. Obviously, the type and difficulty of a case and need for additional special studies are also important. The data regarding the turn-around time of other second opinion practices have not been published so comparisons cannot be made. However, our data indicate that our Web-based communication process facilitates in-house turn-around time. Eighty-two percent and 90% of cases were finalized the same day or within the first 2 days since receipt of a case, respectively. In 6.2% of cases, consultants asked for additional special studies. If these cases were excluded, the same day or second day turn-around was achieved in 88% and 95% of cases, respectively. This set of percentages may be a more accurate indication of in-house turn-around time. We do not retain the glass slides. They are automatically returned to the submitting practices. On average, the slides were kept in our office for 7.4 days before being sent back.

Review of rendered diagnoses showed that 82% of consultations concerned 3 diagnostic categories including melanocytic lesions (37%), inflammatory skin conditions (27%), and squamous lesions (18%), followed by soft tissue tumors (4%), adnexal neoplasms (4%), and, less frequently, alopecia and nonsquamous nonmelanoma skin cancer and atypical lymphoid infiltrate. Frequency of consultations on melanocytic lesions is not surprising. They are among the most challenging diagnoses in dermatopathology and the most common subject of medicolegal litigation.[8,9] The correct interpretation of inflammatory skin conditions often requires subspecialty expertise. Our findings are similar to those reported by Goldenberg et al.[5] In their practice, 25% to 50% of voluntary consultations concerned melanocytic lesions and 9% to 27% concerned inflammatory conditions. The exact percentages depended upon subspecialty training of the submitting physicians. Board-certified dermatopathologists tended to submit more melanocytic lesions and fewer inflammatory lesions. We cannot make a direct comparison with this study as the board certification of the submitting physicians was not recorded. Intuitively, it is likely that a mix of cases submitted for consultation will depend on the area of expertise and reputation of the consultants. Our consultants published and lectured extensively in the areas of melanocytic lesions, adnexal neoplasms, inflammatory dermatoses, and alopecia. Somewhat surprising is the high number of squamous lesions. However, histologic differential diagnosis between squamous cell carcinoma and actinic keratosis is among the most difficult in dermatopathology and

biopsies of squamous lesions are very common. It is reasonable to speculate that economical and logistical factors may also affect the type of cases sent for consultations. Higher costs of seeking a consultation is likely to result in referral of only a few diagnostically critical cases. If, as in our model, submitting a case does not require significant secretarial resources once a practice is registered on the Web site and carries low cost to the referring pathologist, it is likely that more cases will be submitted. This, in our opinion, explains the relatively large number of squamous lesions, which although diagnostically very challenging usually do not represent critical diagnoses because the consequences of incorrect diagnosis, especially overdiagnosing malignancy, are relatively minor.

Presumed diagnosis was indicated in the outside report in 69% of cases. It agreed with the final interpretation by a consultant in 95% of cases. In 5% of cases there was a major discrepancy between the suggested outside and consultant's diagnosis. However, it is important to emphasize that the presumed diagnoses on cases submitted for a prospective review are most likely rendered with less consideration and may be different from the final diagnosis if it was to be rendered without consultation. Therefore, the number of misdiagnoses prevented by seeking a second opinion is most likely less than 5% and may be at par with the 2.2% rate of major diagnostic discrepancy during mandatory review of primary diagnosis in patients referred for Moh surgery.[2]

Our study provides to the best of our knowledge the first comprehensive overview of a second opinion consultation practice in dermatopathology. Unfortunately, due to lack of comparison with similar traditional paper-based practices it is difficult to assess to what extent the unique aspects of the practice model, especially the use of the Web-based platform for communication with the referring practices and business model encouraging outside practices to buy a flat rate subscription for access to consultation services, affects the use of the service and other metrics reported in this study.

Importantly, our workflow and software supporting the practice was designed as a intermediate solution in anticipation of a wider adoption of digital forms of communication and digital slide technologies, which are likely to change and most likely to facilitate different forms of case sharing between pathologists. The critical aspects of future developments that would have significant impact on logistical efficiencies and cost of second opinion consultations are (1) the ability of consultants and outside pathology information systems to communicate directly with each other, thus precluding the need for manual data entry and (2) the availability of virtual slide technologies, which would obviate the need for shipping glass slides between institutions. Addressing the first issue appears to be a daunting (costly) task given the complexities of different information systems and demands for access security and data protection. Our system circumvents some of these limitations by having both the outside pathologists and the consultants use a stand-alone dedicated information system. It is also not clear at present to what extent the availability of digital slide technologies would facilitate the process. This issue has to be looked at from both the logistical/cost and the professional aspects. Certainly, digital slides may offer consultants instantaneous access to images. This could reduce the turn-around time. However, our data illustrate that, assuming all the communication issues associated with sharing digital slides between institutions are resolved, the overall turn-around time could only be improved by approximately 1 day, which represents about one-seventh of the turn-around from the time of biopsy to the time of the consultant's report. Such marginal improvement would have to be justified by the human, hardware, and software costs of digital slide technologies. We are not in a position to estimate these costs. However, the costs of shipping glass slides overnight can be estimated. Assuming an average cost of $26 per shipment, the average shipping cost of sending a case (2.9 cases per shipment) was about $8.90 per case. As an average case contained 3.4 slides, the estimated potential cost savings of eliminating the need for shipping slides would be about $2.80 per slide.

In summary, our study provides a comprehensive overview of a Web-based second opinion consultation practice of dermatopathology. It shows that Web-based communication can facilitate timely and cost-effective access to expert consultations.

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