Contemporary Mohs Micrographic Surgery histologic preparation methods, laboratory assistive personnel training, and practice setting – A survey study

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Introduction

The success of Mohs micrographic surgery (MMS) largely depends not only on the performance of the Mohs surgeon, but also on the integrated functioning of the other members of the MMS team. Specifically, the Mohs histotechnologist (MH) plays a critical role in facilitating specimen preparation and the production of microscopic slides. Requisite steps include tissue inking, flattening, freezing, sectioning and staining. Meticulous performance of each of these enables accurate interpretation of the peripheral and deep tissue margins by the surgeon. Specific MH responsibilities and roles vary across practices. To better understand practice variation, we directly surveyed American Society of Mohs Histotechnology (ASMH) members to assess MH educational training, work setting, and degree of involvement in various tissue and slide preparation activities.

Materials & Methods

Approval was obtained from the Loyola University Medical Center Institutional Review Board for all data collection and analyses. A 16-question survey was created using Survey Monkey®, which was electronically sent to all members of the ASMH. Membership in ASMH is open to individuals who are employed by a member of the American College of Mohs Surgery (ACMS) or are performing Mohs histotechnology services under the supervision of an ACMS member. This survey elicited information about training background and their laboratory's histologic processing techniques. All retrieved data were anonymous. Pearson chi-square and Fisher's exact tests were used for categorical comparisons. Non-parametric Wilcoxon rank sum test was used to assess for differences in place of employment

Information elicited in the survey of Mohs Histotechnologists
Highest level of education
Certification status
Type of Mohs laboratory training
Method used for specimin orientation
Role in specific processing steps
Cryostat type
Tissue section thickness
Stain use
Quality control strategy
Place of employment

Results

121, or 30% of queried histotechnologists, responded to the survey.

Education

The majority of MHs had completed an associate or technical degree as their highest level of training (49%). Of the remainder, 27% had attained a bachelor's degree, 12% a high school diploma or equivalent, 7% a graduate degree, and 5% some other level of training.

Job-Specific Training & Practice Setting

Most MHs had not achieved certification through the American Society for Clinical Pathology (60%). Training in MMS laboratory techniques was obtained through on-the-job instruction from other experienced MHs (67%), instruction from the collaborating Mohs surgeon (53%), formal course/certificate programs (31%), and other unspecified modalities (11%). Regarding practice setting, 62% of MHs worked in private offices, 32% in academic medical centers, and 6% at other sites.

	Mohs surgeon	MH	Clinical assistant
Illustration of Mohs layer map	75%	34%	6%
Inking of margin	48%	55%	4%
Tissue flattening techniques	26%	77%	6%
Sectioning of bulky specimens	33%	69%	5%

Laboratory Practices

In most laboratories, hand-drawn images were utilized to map and orient specimens (69%). Other practices utilized preprinted diagrams or anatomic site maps (36%), or digital photographs (22%). Tissue processing was largely performed by MHs, while illustration of the Mohs layer map was primarily performed by the surgeon. At a majority of labs, MHs were responsible for inking the tissue margin, tissue flattening, and sectioning of specimens. In practice, most MHs cut specimen sections of between 5-6 microns (49%), while others produced sections of 7-9 micron (33%), 4 microns (10%), or other breadths (8%). The most commonly employed stains for specimen preparation were hematoxylin and eosin (H and E) (94%). Only 14% of the surveyed laboratories utilized toluidine blue staining. Routine slide preparation was mainly mechanized with automatic stainers (73%). Total staining time was found to be significantly longer at academic medical centers versus private offices (7 vs. 5 minutes, $p = .01$), but no other statistically significant correlations were detected between the practice settings. The majority of laboratories did not use immunohistochemical staining (73%), but among those that did, the most commonly used antibody was Melan-A/melanoma antigen recognized by T-cells (MART-1). Surveyed MHs reported that stains and reagents are replaced in a range of frequencies: daily or weekly (77%), once every 2 weeks (13%), or monthly (10%). While practices utilized two main methods of quality assurance, including review of the first slide of the day (48%) or comparison to an established quality control slide (38%), a smaller proportion of respondents indicated that quality control was managed by other methods by the Mohs surgeon (8%) or other modalities (6%).

Discussion

Being cognizant of current norms in training may be helpful for practices that are hiring new MH personnel. The majority of MHs cite an associates or technical degree as the highest level of education attained and did not obtain certification through the American Society for Clinical Pathology (ASCP). This is not surprising and not particularly concerning, since while ASCP certification provides formal education on fixation, embedding/microtomy, processing, staining, and also requires clinical laboratory experience, it does not necessarily provide any training in the specific functioning of a Mohs laboratory, nor extensive training in frozen section preparation, both of which are the specialized skills of specific relevance for the MH.[6] As previously noted by Chen and colleagues, we found most practices train MHs on the job. In contradistinction to Chen, we found that 53% of surgeons also provided direct instruction to MHs compared to 30% in this previous survey.[2] This may represent a shift towards a more interdisciplinary approach to education.

In terms of specific duties, many of our findings were consistent with those previously reported in the literature. Silapunt et al found that 66.5% (compared with 75% in this study) of Mohs surgeons personally prepared the tissue map. In both surveys, the most commonly used mapping technique was a hand drawn image (69% in both).[4] MHs frequently inked the margins, flattened tissue, and sectioned specimens.

In line with the findings of Chen, we observed that most laboratories used the first slide of the day for quality control purposes and changed reagents and stains on a daily or weekly basis.[2] Hematoxylin and eosin tissue staining also continues to be th preferred stain for MMS, likely because it reproducibly enhances architectural and cellular morphology of tissue sections.[4,5] On the other hand, immunohistochemical staining was less commonly utilized across all practices. While we found that only 23% of laboratories employed this technique, our figure was nearly double the rate of utilization reported by Robinson in 2001.[3] Though immunohistochemical staining can increase the processing time and complexity of MMS, it can provide valuable additional data when processing rare or aggressive skin neoplasms.[1] Our study showed that routine staining is performed as an automated process 73% of the time compared to the finding of only 51% in 2001. This suggests that more laboratories have transitioned away from manual systems.[3] Our survey also found significantly shorter reported staining times in private offices as compared to academic medical centers. Variability may be due to factors not examined in this study.

This study provides a comprehensive outline of the current training, tissue mapping, and tissue processing/staining techniques employed in MMS practices across the country. Understanding MH personnel and laboratory trends over time may be helpful for adopting best practices.

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