INTRO

Telepathology can expand laboratory efficiency in a time of tightening budgets and simultaneous need to expand services. Telepathology was considered after the University of Wisconsin Hospital and Clinics (UWMC) formed a strategic partnership with the Watertown Regional Medical Center (WRMC) to extend specialty services to the rural communities in Wisconsin, Minnesota, and the northern part of Iowa. The desire was to expand pathology services to remote sites, particularly to the smaller hospitals in the region.

METHODS

Validation was performed through competency assessments of frozen section slides viewed on telepathology and by light microscopy. The competency assessments on each method were then compared for accuracy between the methods. Acceptable accuracy was determined to be 90% of cases receiving the correct diagnosis for both light microscopy and telepathology.

RESULTS

All pathologists had acceptable accuracy with both methods; microscopy and telepathology. There was no difference detected between telepathology diagnoses and microscopic diagnoses. The Cochran-Mantel-Haenszel (CMH) test (Table 1) found outstanding correlation between telepathology and direct microscopy with a value of $p<0.001$. The null hypothesis in this analysis was that there was no correlation between the two methods. The exceedingly low $p$-value gives extremely strong evidence against that null hypothesis.

CONCLUSIONS

In pathology/informatics, there are many products of variable utility. The product studied here has been effective in providing expanded capability and support. Given institutional support of the technology and network infrastructure required for transmission of images, telepathology is a viable tool to expand a pathology’s capability. RMT software allows for greater efficiency and streaming capabilities which require little training and minimal technical support following implementation.

No difference between diagnostic capability using telepathology and direct microscopy could be detected in our study. Similar studies in other institutions have also found dynamic real-time telepathology to be diagnostically equivalent to light microscopy. Therefore, telepathology can be judged as an effective and efficient method of extending pathology services to cover wide geographic areas.

Although there was some concern about system reliability, we found that there had been no technical issues since the time of our frozen section analysis. Each person involved in this implementation was asked to comment on an issue with the system they had noted since its first usage in March of 2012. There were two user errors noted. In the first case, the PA at the remote site had not started the image broadcast. In the second case, the faculty member at the university had not started the imaging client software. Technical staff from both UWHC and WRMC had detailed training on the system to address these issues. Four of these issues were fixed by rebooting the telepathology system at the remote site. The one technical issue was related to changes in the firewall at the WRMC without the awareness of the need for the firewall changes by the remote site.

These issues were all detected during system checks or during daily signout activities. Telepathology allows pathologists to evaluate specimens and make diagnoses in geographically disparate areas without the logistical complications of formal visits. Telepathology has been used by pathologists in the Veterans Health Administration system in this region for more than 15 years. Also, the UWMC cytopathology section has been using telepathology since 2009 to allow cytopathologists the ability to remotely evaluate fine needle aspirate specimens for adequacy. UWMC now seeks to use dynamic imaging telepathology for intraoperative frozen section consultation.

Because technical staffing was needed at the location of the remote site for preparation of the tissue, sectioning and staining of the slide, a pathology assistant (PA) was needed to scan the frozen section slide under the microscope at the remote location. The gross specimens that needed dissection.

While technical staff was needed at the remote site, the pathology assistant was not needed. The assistant was able to scan the images, which helped to simplify the process and allow for a minimal technical support following implementation.

A pathologist at the main laboratory is in contact with the PA at all points in the telepathology consultation (Fig. 1) process via phone: high-definitiongrossing cameras are used to allow the pathologist to input into the tissue dissection (Fig. 2). This allows for issues related to tissue sampling (in a large specimen) or tissue orientation to be discussed as these may be critical in margin assessment. The slide is then scanned manually by the PA via a full 1080p digital camera (Fig. 3). With a microphone, the pathologist to assure all aspects of the slide are examined.

As with all newly implemented laboratory methods, validation was necessary. Validation goals were to confirm to Clinical Laboratory Improvement Amendment Act of 1988 and College of American Pathologists regulations, to train staff, and to test technology.

TABLE 1. CMH Test to Compare Telepath with Direct Microscopy Controlling for Pathologists

<table>
<thead>
<tr>
<th>Pathologist</th>
<th>I +</th>
<th>I -</th>
<th>J +</th>
<th>J -</th>
<th>p-value</th>
<th>HA</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>9</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>0.001</td>
<td>.73</td>
<td>There is an excellent agreement.</td>
</tr>
</tbody>
</table>

There was a significant overall agreement in telepathology and direct microscopy.

FIGURE 2: Camera at Remote Site; Grossing Station

| TABLE 2. Overall Kappa coefficients and test of equal kappa coefficients

<table>
<thead>
<tr>
<th>Pathologist</th>
<th>Overall Kappa</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.73</td>
<td>There is an excellent agreement.</td>
</tr>
</tbody>
</table>

There is an outstanding correlation between telepathology and direct microscopy.

TABLE 3. McNemar’s test for each pathologist

<table>
<thead>
<tr>
<th>Pathologist</th>
<th>p-value from McNemar’s test</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0.001</td>
<td>Telepath and direct agree.</td>
</tr>
</tbody>
</table>

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REFERENCES


The authors would like to thank Bob Rhode for his assistance in developing and maintaining the computer system described above.