Results

Table 1. Summary of Kendall's W coefficient of concordance, Cohen's kappa coefficient k, and p-values of various FISH cancer panels

<table>
<thead>
<tr>
<th>Cancer Panel</th>
<th># cases</th>
<th># probes</th>
<th>signal intensity</th>
<th>background</th>
<th>scoring results</th>
<th>Kendall's W, p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM</td>
<td>5</td>
<td>7</td>
<td>k = .76, p &lt; .001</td>
<td>k = .40, p = .019</td>
<td>k = 1, p &lt; .001</td>
<td>W = .84, p &lt; .001</td>
</tr>
<tr>
<td>MDS</td>
<td>5</td>
<td>4</td>
<td>k = .89, p &lt; .001</td>
<td>k = .22, p = .019</td>
<td>k = 1, p &lt; .001</td>
<td>W = .93, p &lt; .001</td>
</tr>
<tr>
<td>ALL</td>
<td>3</td>
<td>6</td>
<td>k = .31, p &lt; .001</td>
<td>k = .06, p = .019</td>
<td>k = 1, p &lt; .001</td>
<td>W = .90, p &lt; .001</td>
</tr>
<tr>
<td>CLL</td>
<td>5</td>
<td>6</td>
<td>k = .73, p &lt; .001</td>
<td>k = .52, p = .004</td>
<td>k = 1, p &lt; .001</td>
<td>W = .90, p &lt; .001</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>5</td>
<td>2</td>
<td>k = .1, p = .001</td>
<td>k = .01, p = .001</td>
<td>k = 1, p &lt; .001</td>
<td>W = .90, p &lt; .001</td>
</tr>
</tbody>
</table>

Note. MM - multiple myeloma, MDS - myelodysplastic syndrome, ALL - acute lymphoblastic leukemia, CLL - chronic lymphocytic leukemia. # cases: total cases, # probes: number of probes in the FISH panel.

Graphical representation of cost and time analysis

Figure 1. Duration of the protocols to process one batch of slides in one run.

Figure 2. Cost of reagents calculated based on the volumes necessary to run the protocols per one week.

Figure 3. Cost of manual labor calculated based on the mean hourly rate of cytogenetic technologist multiplied by the approximated time necessary to process one batch of 10 to 50 slides.

Figure 4. Cost of manual labor calculated based on the mean hourly rate of cytogenetic technologist multiplied by the approximated time necessary to process batch of 10 to 50 slides.

Conclusions

The results of our study demonstrate the significant time and cost savings of automation of FISH slide processing for a high throughput cytogenetic laboratory.

Goal of the Study

- Evaluate the performance of the VP 2000 Processor
- Assess quality of the slides by comparing with the manual method
- Calculate labor and reagent cost
- Develop optimal operational protocol

Methods

- Two sets of slides were prepared to hybridize FISH probes for the following cancer disorders: multiple myeloma, acute lymphoblastic leukemia, chronic lymphocytic leukemia, myelodysplastic syndrome, and lymphoma.
- One set was processed using manual protocol, another using VP 2000 protocol.
- Slides were examined microscopically and compared for signal intensity (diminished, moderate, or bright), background (present or not), and concordance of scoring results (normal or abnormal).
- Kendall's W coefficient of concordance, Cohen's k coefficient, and p-values were calculated using IBM SPSS Statistics software.
- Reagent cost necessary per week was calculated and compared to that of the manual method.
- Manual labor cost and time analysis for both methods were compared.
- The time duration of protocols for both methods were compared.

Discussion

- The cost of reagents required for a VP 2000 protocol was greater than that for manual method due to size of the basins of the instrument: 150 mL, 250 mL and 500 mL used to process the batch of 8, 20 and 50 slides, respectively. For the manual protocol 50 mL Coplin jars that fit 10 slides were used.
- Hands-on time was significantly less for a VP 2000 Processor, as it is a truly walk-away instrument. The technologist manipulates the slides only once, when loading the slide holder.
- Calculations of Kendall's W coefficient of concordance indicate strong agreement between the manual and automated methods.
- Calculations of Cohen's kappa k for the background noise showed slight to moderate agreement due to subjective nature of the task. Cohen's kappa for signal intensity was at moderate to near perfect, and scoring results were at perfect agreement.
- The total run time was shorter for a VP 2000 Processor, since the new modified and shortened protocol, based on the manual method, was established empirically prior to the study.

Examples of FISH Images

Figure 7. A and B. DAPI-stained and inverted interphase and metaphase human bone marrow cells. Locus specific dual color break apart probe labeled with orange and green. Chromosome 11 (ML L gene segment on a long arm q23 band). C. Amplified HER-2/neu (labeled with an orange) paraffin embedded breast tissue. Centromere of chromosome 17 is labeled with a green color.