Comparison of Automated Versus Manual Tumour % Determination in Colorectal Cancer

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Introduction

- Modern molecular pathology testing is performed on formalin fixed paraffin embedded tissue sections and requires macrodissection of well annotated tissue to enrich tumour content for DNA extractions.
- Traditionally such annotation has been performed manually at a microscope by trained and competent individual molecular diagnosticians (Bankhead et al., 2018).
- Limitations of manual annotation include variability between scoring, leaving this method subjective and qualitative (Bankhead et al., 2017).
- Automated image analysis software QuPath has shown much promise to be reproducible and faster compared to manual microscopic methods.

Hypothesis & Aims

Image analysis software QuPath will be similar if not more robust and reliable compared with manual evaluation as this can be subjective and unreliable. The main aim of this study was to validate the use of a specific image analysis programme QuPath against current gold standard manual evaluation.

Methods

- 100 colorectal cancer slides were retrieved from NIB prospective collection.
- Each slide was manually annotated using an upright microscope (BX53F) .
- Slides were scanned using an Aperio AT2 (Leica) scanner and uploaded onto digital pathology solutions Xplore, then transferred to QuPath.
- Each slide was visually evaluated on-screen on QuPath and estimation recorded.
- % tumour area calculated by QuPath software.
- Data analysis was done using SPSS.
- The control within this experiment is the ability of the software QuPath to differentiate between normal mucosal epithelium and tumour epithelium. QC carried out all stages by an expert molecular diagnostician.

Results and Discussion

![Graph 1: Tumour % Determination](image1)

**Figure 1** showing graph of % tumour using manual microscope method versus % tumour of visual method.

![Graph 2: Tumour % Determination](image2)

**Figure 2** showing % tumour using on screen evaluation versus % tumour using image analysis determination.

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Tumour Microscopical Evaluation (%)</td>
<td>75</td>
<td>60</td>
<td>20</td>
<td>80</td>
<td>53.27</td>
<td>13.09</td>
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<tr>
<td>Percentage Tumour On Screen Evaluation (%)</td>
<td>75</td>
<td>80</td>
<td>10</td>
<td>90</td>
<td>58.13</td>
<td>15.77</td>
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<tr>
<td>Percentage Tumour Image Analysis Determination (%)</td>
<td>75</td>
<td>87</td>
<td>10</td>
<td>97</td>
<td>66.37</td>
<td>20.52</td>
</tr>
</tbody>
</table>

Table 1, showing descriptive statistics of % tumour microscopically, on screen evaluation and image analysis determination.

- Pearson correlation coefficient from figure 1 is 0.318 which shows a positive relationship however figure 2 value is 0.535 which shows a stronger relationship compared with figure 1. The results correlate stronger using automated software compared with manual methods.

The increasing means from 53.27 for manual method to 66.37 for automated method supports the hypothesis that automated method shows concordance with manual method but more accurate.

Conclusion & Further Study

In conclusion, QuPath has shown promise to be more accurate compared with manual methods. This experiment could be done on other prospective protocols within NIB and larger number of cases used.

References

1. Bankhead et al. 2018 Lab Investigation, 38 (1) pp10.25
2. Bankhead et al., 2017 Nature, 7 (1) pp16878