A comparison of calculations used in different countries for estimation of Feto-Maternal Haemorrhage (FMH)

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Background

Practices in estimation of feto-maternal haemorrhage (FMH), and anti-D immunoglobulin (lg) dosing vary according to local policy, national guidelines, and anti-D lg manufacturer. Variables in FMH include the technique used (acid elution (AE) or flow cytometry (FC)), and calculation variables include; maternal blood volume, correction factor for size of fetal cells and the percentage of fetal cells which have taken up the stain. An error may lead to maternal sensitisation to the D antigen and potential haemolytic disease of the fetus and newborn. In the UK, British Society for Haematology (BSH) guidelines(1) are followed, which for both AE and FC assumes a maternal red cell volume of 1800mL, a fetal cell size correction factor of 1.22, and for AE only, a staining correction factor of 0.92.

UK NEQAS (BTLP) provide an EQA scheme for FMH estimation(2), with results being submitted as mL of packed cells, using the BSH guideline calculations(1).

Aims

The aim was to gather information on how non-UK laboratories calculate estimated FMH, and how this impacts the EQA scheme and participants using alternative guidelines.

Methods

An online questionnaire designed to determine the calculations used for AE and FC testing was sent to 46 non-UK/Republic of Ireland UK NEQAS FMH participants in 14 countries, and also to 229 FC users in 39 countries registered with UK NEQAS Leucocyte-Immunophenotyping.

Fifty five sets of results were received; these were filtered to remove duplicate and incomplete responses, and respondents who do not measure FMH, leaving 31 sets of data.

Results

Testing profile of respondents

Location of respondents

Acid elution staining correction factor

Most participants did not state that a correction factor was used, however 0.92 (and 1.22 for fetal cell size) was built into the BSH formula when using 2400 as the maternal blood volume.

Resultant bleed volumes from all reported formulae

(Betal cells = 0.18%)

<table>
<thead>
<tr>
<th>Formula</th>
<th>Maternal Blood Volume (mL)</th>
<th>Fetal cell size</th>
<th>Stain correction</th>
<th>Bleed Volume Result (mL)</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE BSH</td>
<td>1800</td>
<td>1.22</td>
<td>0.92</td>
<td>4.31</td>
<td>PCs</td>
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<tr>
<td>AE Other 1</td>
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<td>N/A</td>
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<td>1.22</td>
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<td>8.62</td>
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<tr>
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<td>N/A</td>
<td>9.00</td>
<td>WB</td>
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<tr>
<td>FC BSH</td>
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<tr>
<td>FC Other 3</td>
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<td>WB</td>
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<td>4735</td>
<td>1.22</td>
<td>N/A</td>
<td>10.40</td>
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</tr>
</tbody>
</table>

The BSH calculations resulted in smaller bleed volumes than other calculations.

Insufficient data was received to determine if different anti-D lg dosing regimens are in use which would offset the smaller bleed volume result.

Reporting units

Guidelines used

Some respondents indicated results are reported in mLs of whole blood but other data provided contradicts this; this is of questionable significance provided dosing is based on the correct reporting unit.

Nearly half of respondents reported using calculations found in the BSH guideline. Although only one respondent reported using the CLSI formula, overall analysis suggests that all laboratories are using calculations based on either BSH or CLSI guidelines.

Summary / Conclusions

- A comparison of overall calculations showed that all result in similar bleed volumes, with BSH calculations giving the lowest. This indicates that overseas calculations would result in sufficient anti-D lg being administered, provided that comparable anti-D lg dosing strategies were used.
- Although many laboratories did not report using a specific guideline, analysis of the data indicates that nearly all laboratories are using formulae based on BSH or CLSI guidelines.
- Two laboratories stated that BSH guidelines are used for reporting EQA but different guidelines are used in clinical practice. Reporting an FMH EQA result that has been calculated using a non-BSH formula will affect the accuracy score for the participant, and has the potential to skew the overall data used to calculate all scores. However, reporting using the calculations used in clinical samples is often of more benefit for the participant.
- This study has allowed UK NEQAS (BTLP) to understand and address the limitations of an international EQA scheme and to gain knowledge of overseas practice that can be used to inform UK guideline review.

References