Precision Analysis of QAP data for Serum Creatinine

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Introduction and Aim

- Serum creatinine assays are vital for identifying, staging and monitoring renal disease.
- A minimum precision standard of 0.75 x the within-person biological variation (CVwi) has been proposed as a general standard (1).
- Under this criteria the analytical CV for serum creatinine should be less than 3.1% (CVwi serum creatinine: 4.3%, 2).
- Creatinine results may also be used for estimation of GFR in various formulae.
- The NKDEP has proposed a total error for serum creatinine results of +/-15% for GFR estimation using the MDRD formulae.
- This total error must include assay bias, assay imprecision and assay non-specificity.
- This study is targeted at assessing assay precision for serum creatinine assays in current use in Australia and New Zealand.

Data Source

- The RCPA – AACB Chemical Pathology QAP General Chemistry program includes duplicate samples at each of 8 concentrations of analyte in each cycle.
- In two QAP cycles each concentration level is analysed 4 times.
- This data allows assessment of long-term precision for each enroled analyser at 8 analyte concentrations.
- This precision data is independent of bias or matrix effect, except where the matrix may affect precision.
- Data for serum creatinine from Cycles 66 and 67 of the General Serum Chemistry program were obtained from the QAP for analysis. These are the first two cycles from 2004 covering the period from January to August.
- The identity of all laboratories was not revealed to the investigator.

Data Analysis

- For each laboratory enroled in the General Chemistry Program the four creatinine results for each level of analyte concentration were identified.
- Only data sets where all 32 results for serum creatinine were available were included (16 results from each cycles).
- The average, SD and CV were determined for each analyser at each of the 8 concentrations of serum creatinine.
- Data was subdivided on the basis of instrument manufacturer and median values used for comparison.

Example Data

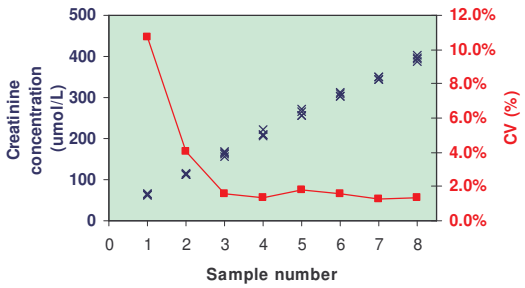

Figure 1. Example of raw data (blue crosses) and precision (CV, red squares) for one laboratory in the QAP program.

Reporting Interval

- The data presented to the QAP was reported using reporting intervals of either 1 umol/L (n=326) or 10 umol/L (n=172).
- Figure 2 shows the median CVs for all data reported to the nearest 10 umol/L and for all data reported to the nearest 1 umol/L.
- This difference was true separately for data from Vitros, Beckman-Coulter, Roche Hitachi and Roche Integra analysers.
- The difference was not seen for Dade-Behring analysers.

  NOTE: The analysers classed as showing this difference has changed from the abstract due to the use of medians rather than averages as a measure of central tendency.
- All further analysis was limited to data reported to the nearest 1 umol/L.

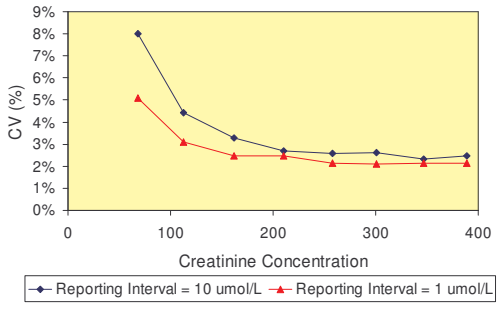

Figure 2. Median precision profile for all data reported with reporting interval of 1 umol/L (red triangles, n=326) and with a reporting interval of 10 umol/L (blue diamonds, n=172).

Precision Profiles

- The median precision profiles for most major analyser groups (using only data reported to 1 umol/L) is shown in figure 3.
- The figure also shows the minimum precision standard (0.75 x within-person CV, 0.75 x 4.3% = 3.1%)
- It can be seen that no analyser groups meet this standard at the lowest creatinine concentration and only Vitros at the top of the reference interval.
- At the lowest concentration, within-analyser imprecision is a major component of the allowable +/-15% total error for MDRD calculation (equivalent to a CV of 7.5%).

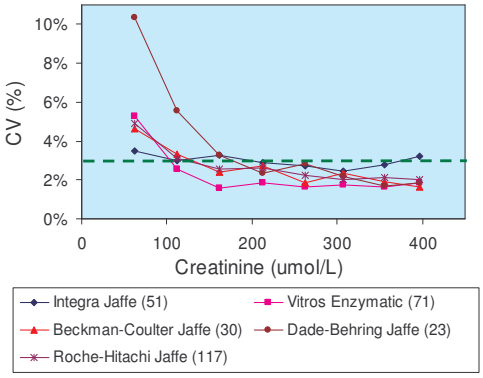

Figure 3. Median precision profiles for serum creatinine assays from the named manufacturers. The green dashed line is the highest acceptable CV standard.

Conclusions

- Current serum creatinine assays generally do not meet precision criteria according to biological variation for results within the reference interval.
- Note that the described data are median values and half of laboratories have poorer performance.
- At low concentrations within-analyser variation consumes a significant proportion of the MDRD allowable total error budget.
- Improvement in assay precision will improve detection of smaller changes in renal function
- Measurement should be performed to the nearest one umol/L when assay precision is being assessed.

Acknowledgement

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