ELECTRONIC SUPPLEMENTARY INFORMATION

Lewisite exposure biomarkers in urine by liquid chromatography – inductively coupled plasma tandem mass spectrometry: with an accelerated matrix-matched stability study

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Overview of the results provided in the supporting information:

Table S1 LC-ICP-MS instrumentation parameters as performed on the Agilent 7500ce.

Table S2 Determination of CVAOA in urine by LC-ICP-MS (single quadrupole) accuracy using the consensus mean and standard deviation of NYS DOH PT materials (n = 17 labs).

Table S3 Determination of CVAOA in urine by LC-ICP-MS/MS (tandem) accuracy using the consensus mean and standard deviation of NYS DOH PT materials (n = 18 labs).

Table S4 ANOVA calculation of coefficients of variation (CV) from seven day/run, seven replicate CVAOA precision data (n = 49) on the single quadrupole instrument.

Figure S1 Chlorine measured at m/z 35Cl+ was chromatographically resolved from CVAOA and the AsAc internal standard by LC-ICP-MS.

Figure S2 Comparison of least square linear regression models of the calibration curve from the single quadrupole ICP-MS (Agilent 7500ce).
Table S1 LC-ICP-MS instrumentation parameters as performed on the Agilent 7500ce.

**HPLC**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
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<tbody>
<tr>
<td>System</td>
<td>Agilent 1200 Series</td>
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<tr>
<td>Column</td>
<td>Ascentis 5 µm RP-amide, 100 mm × 2.1 mm i.d.</td>
</tr>
<tr>
<td>Column temp. (°C)</td>
<td>30 ± 0.8</td>
</tr>
<tr>
<td>Autosampler temp. (°C)</td>
<td>4 ± 1</td>
</tr>
<tr>
<td>Mobile phase (isocratic)</td>
<td>11.5 mM TBAH, 5 mM succinic acid, 2% IPA, pH 5.5</td>
</tr>
<tr>
<td>Mobile phase flow rate (mL/min)</td>
<td>1.0</td>
</tr>
<tr>
<td>Injection volume (µL)</td>
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**ICP-MS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
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<tr>
<td>RF power (W)</td>
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<tr>
<td>Plasma gas flow rate (L/min)</td>
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<td>Auxiliary gas flow rate (L/min)</td>
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<tr>
<td>Nebulizer gas flow rate (L/min)</td>
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<tr>
<td>Makeup gas flow rate (L/min)</td>
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<tr>
<td>Nebulizer</td>
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<tr>
<td>Spray Chamber temp. (°C)</td>
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<tr>
<td>Ion lens voltages</td>
<td>Optimized daily</td>
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<tr>
<td>Cell entrance (V)</td>
<td>–22</td>
</tr>
<tr>
<td>Cell exit (V)</td>
<td>–22</td>
</tr>
<tr>
<td>Octopole bias (V)</td>
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</tr>
<tr>
<td>Kinetic energy discrimination (V)</td>
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</tr>
<tr>
<td>Integration time (s)</td>
<td>0.3</td>
</tr>
<tr>
<td>Isotopes monitored (scan type)</td>
<td>$^{75}$As$^+$ (time-resolved analysis)</td>
</tr>
<tr>
<td></td>
<td>$^{76}$Ar$_2^+$ (is necessary to list as an internal standard; however, the internal standard correction is deselected)</td>
</tr>
<tr>
<td>Acquisition time (min)</td>
<td>5</td>
</tr>
<tr>
<td>Repetition</td>
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Table S2 Determination of CVAOA in urine by LC-ICP-MS (single quadrupole) accuracy using the consensus mean and standard deviation of NYS DOH PT materials (n = 17 labs)

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Reported Value (µg/L)</th>
<th>Z-Score</th>
<th>Consensus Mean (µg/L)</th>
<th>Consensus SD (µg/L)</th>
<th>Bias (%)</th>
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<tbody>
<tr>
<td>LW1401-01-12</td>
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<td>-</td>
<td>ND</td>
<td>-</td>
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<td>LW1401-02-12</td>
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<td>LW1401-03-12</td>
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<td>121</td>
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<tr>
<td>LW1401-04-12</td>
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<td>0.14</td>
<td>159</td>
<td>14.8</td>
<td>+1.3</td>
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<tr>
<td>LW1401-05-12</td>
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<td>313</td>
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<td>+5.4</td>
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<tr>
<td>LW1401-06-12</td>
<td>419</td>
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<td>411</td>
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<td>LW1401-07-12</td>
<td>904</td>
<td>0.24</td>
<td>876</td>
<td>115</td>
<td>+3.2</td>
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<tr>
<td>LW1401-08-12</td>
<td>1260</td>
<td>0.17</td>
<td>1230</td>
<td>173</td>
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<tr>
<td>LW1401-09-12</td>
<td>1670</td>
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<td>1640</td>
<td>253</td>
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<tr>
<td>LW1401-10-12</td>
<td>2770</td>
<td>−0.04</td>
<td>2790</td>
<td>478</td>
<td>−0.7</td>
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Table S3 Determination of CVAOA in urine by LC-ICP-MS/MS (tandem) accuracy using the consensus mean and standard deviation of NYS DOH PT materials (n = 18 labs)

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Reported Value (µg/L)</th>
<th>Z-Score</th>
<th>Consensus Mean (µg/L)</th>
<th>Consensus SD (µg/L)</th>
<th>Bias (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW1402-11-10</td>
<td>ND</td>
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<td>ND</td>
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<tr>
<td>LW1402-12-10</td>
<td>36.5*</td>
<td>−0.01</td>
<td>36.6</td>
<td>9.30</td>
<td>−0.3</td>
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<tr>
<td>LW1402-13-10</td>
<td>93.9</td>
<td>0.08</td>
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<td>LW1402-14-10</td>
<td>162</td>
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<td>LW1402-15-10</td>
<td>273</td>
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<td>LW1402-16-10</td>
<td>348</td>
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<td>LW1402-17-10</td>
<td>788</td>
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<td>790</td>
<td>52.9</td>
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<tr>
<td>LW1402-18-10</td>
<td>1220</td>
<td>0.13</td>
<td>1200</td>
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<td>+1.7</td>
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<td>LW1402-19-10</td>
<td>1570</td>
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<td>LW1402-20-10</td>
<td>2860</td>
<td>0.17</td>
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<td>LW1403-21-12</td>
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<td>LW1403-22-12</td>
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<td>LW1403-23-12</td>
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<td>LW1403-24-12</td>
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<td>14.0</td>
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<td>LW1403-25-12</td>
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<td>17.3</td>
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<tr>
<td>LW1403-26-12</td>
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<td>252</td>
<td>19.0</td>
<td>−1.6</td>
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<tr>
<td>LW1403-27-12</td>
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<td>0.36</td>
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<td>LW1403-28-12</td>
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<td>1122</td>
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<td>0.21</td>
<td>2178</td>
<td>151</td>
<td>+1.5</td>
</tr>
</tbody>
</table>

* Reported as present below the lowest calibrator (PLC).
Table S4 ANOVA calculation of coefficients of variation (CV) from seven day/run, seven replicate CVAOA precision data (n = 49) on the single quadrupole instrument

<table>
<thead>
<tr>
<th>Level</th>
<th>Grand Mean (µg/L)</th>
<th>Grand SD (µg/L)</th>
<th>Grand CV (%)</th>
<th>Within day/run CV (%)</th>
<th>Between day/run CV (%)</th>
<th>Intermediate CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QL</td>
<td>105</td>
<td>4.16</td>
<td>3.9</td>
<td>1.6</td>
<td>3.9</td>
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<td>QM</td>
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<td>41.7</td>
<td>4.9</td>
<td>2.2</td>
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<tr>
<td>QM</td>
<td>3359</td>
<td>149</td>
<td>4.4</td>
<td>1.9</td>
<td>4.3</td>
<td>4.7</td>
</tr>
</tbody>
</table>

Figure S1 Chlorine measured at m/z $^{35}$Cl$^+$ was chromatographically resolved from CVAOA and the AsAc surrogate internal standard by LC-ICP-MS. The abundance of chlorine was divided by a hundred-fold to bring onto scale of m/z $^{75}$As detection for the QH sample. Therefore analysis on single quadrupole instruments without a reaction/collision gas did not hinder quantitative analysis of CVAOA. However, chlorine was not chromatographically resolved from the tentatively assigned gem-CVAOA isomer and should not be integrated with single quadrupole ICP-MS (cell evacuated), because of the potential $^{40}$Ar$^{35}$Cl$^+$ polyatomic interference.
**Figure S2** Comparison of least square linear regression models for the calibration range obtained using a single quadrupole ICP-MS (Agilent 7500ce). The coefficient of variation was plotted (logarithmic scale) for each standard reprocessed using three least squares linear regression models; ordinary least squares (○, OLS), inverse of concentration weighted least squares (□, WLS \(1/x\)), and inverse of the square of concentration weighted least squares (▲, WLS \(1/x^2\)). The concentrations were calculated from the standards area response ratio (CVAOA/AsAc), slope, and intercept obtained from the daily calibration curve (\(n = 20\)).