Measurement of Fentanyl

Scope

The qualitative and quantitative measurement of fentanyl is demonstrated using a low-cost HPLC.

Background

“The abuse of pharmaceutical morphine and synthetic opioids has become a problem among health care professionals including physicians, pharmacists and nurses\(^1\). One survey indicated that fentanyl was the most popular substance abused by anesthesiologists\(^2\). Medical Institutions have dealt with drug abuse by health care workers through workplace urine drug-testing programs and/or for-cause testing after an incident that may or may not have affected patient care occurred”\(^3\).

Urine tests do not address the diversion of fentanyl for off-site use or illegal distribution.

We describe here the application of the C-Vue\(^\text{®}\) HPLC (www.c-vuelc.com) to the qualitative and quantitative measurement of fentanyl for use in hospital pharmacies as part of a program to deter and discourage the diversion of fentanyl.

Sample Analysis Protocol

A 10ul neat sample of fentanyl is injected into the C-Vue\(^\text{®}\) HPLC before the fentanyl is removed from the control of the pharmacy to confirm the concentration. The total volume is noted.

Once the fentanyl is returned for disposal, a second analysis is performed and the volume noted for comparison with the initial volume. In case the fentanyl is diverted and replaced with another material e.g., distilled water or saline, it will be immediately apparent and the event may be reported to proper authority. The returned sample should be retained for subsequent analysis by a referee technology e.g. GC-MS or LC-MS.
Instrumentation

C-Vue® Portable Liquid Chromatograph

Column: Chromolith Performance RP 18e 4.6mm x 25mm: Injection Volume: 10ul fixed loop

Solvent Delivery, 760ul/minute Detection: UV@214nm

Eluent: acetonitrile//Water/70% HClO4 67/33/0.157  C-Vue® Data Reduction Software
Peak one is the solvent Vo; peak two is the 50ppm fentanyl standard.
Plot of six concentrations of fentanyl

**Statistical Summary**

Retention time reproducibility and injection precision were determined by the injection of the 70.6ppm fentanyl standard four times with the following results:

<table>
<thead>
<tr>
<th>Injection</th>
<th>Retention time (minutes)</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.425</td>
<td>0.5150</td>
</tr>
<tr>
<td>2</td>
<td>1.394</td>
<td>0.5238</td>
</tr>
<tr>
<td>3</td>
<td>1.377</td>
<td>0.5028</td>
</tr>
<tr>
<td>4</td>
<td>1.405</td>
<td>0.5137</td>
</tr>
<tr>
<td></td>
<td><strong>Average 1.400 +/- 0.06 minutes</strong></td>
<td><strong>Average 0.5138 +/- 0.0056</strong></td>
</tr>
<tr>
<td></td>
<td>Qualitative reproducibility +/- 0.043 minutes</td>
<td>Quantitative reproducibility 1% relative</td>
</tr>
</tbody>
</table>
Conclusion

The C-Vue® Liquid Chromatograph has been demonstrated as an effective means for the measurement of typical doses of fentanyl permitting an effective deterrent to diversion.

References