Performance Evaluation of the Atellica IM Thyroid Stimulating Hormone 3-Ultra Assay and Impact of Biotin

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Background
Measurements of thyroid stimulating hormone (TSH) produced by the anterior pituitary are used in the diagnosis of thyroid or pituitary disorders. The Atellica IM Assay from Siemens Healthcare Diagnostics is a new automated high throughput immunoassay (IA) analyzer. The Atellica IM Thyroid Stimulating Hormone 3-Ultra (TSH3-UL) Assay is for in vitro diagnostic use in the quantitative determination of TSH (thyrotropin) in human serum and plasma (EDTA and heparin) using the Atellica IM Assay.

The goal of this study was to verify the analytical performance of the Atellica IM TSH3-UL Assay on the Atellica IM 1600 Analyzer in a real-world laboratory. Studies included precision, linearity, and method comparison between the Atellica IM 1600 Analyzer and the method established in the laboratory (ADVIA Centaur TSH3-UL and Roche cobas TSH assay). In addition, the potential impact of biotin interference on the Atellica IM TSH3-UL Assay and on the Roche cobas TSH assay was evaluated.

Principles of the Atellica IM TSH3-UL Assay
The Atellica IM TSH3-UL Assay is a third-generation assay that uses proven advanced chemiluminescent Acridinium Ester technology. The Atellica IM TSH3-UL Assay employs anti-TSH monoclonal antibody covalently bound to paramagnetic particles, an FITC-labeled anti-FITC monoclonal antibody and a tracer consisting of a proprietary acridinium ester and an anti-TSH mouse monoclonal antibody covalently bound to paramagnetic particles for chemiluminescent detection. It does not require wash steps and does not require the use of radioactive materials.

Methods
Precision and linearity within-lab
- Precision studies used one reagent lot, one Atellica IM 1600 Analyzer, five test days, five replicates, one sample total = 25 samples.
- Samples were normalized to the mid-immunoassay range. The Liquid Control Level 1 (PR09L1) and 3 (PR90L3), and TSH-stimulating hormone sample pool material (TSHP). Qual control was performed daily for each run. One freshly thawed aliquot of QC material was centrifuged prior to testing. Results were analyzed using the ANOVA method.
- Linearity studies used one reagent lot, one Atellica IM 1600 Analyzer, one ADVIA Centaur System and one Roche cobas System. Over ten thousand samples were tested in triplicate. Prior to testing, an aliquot was thawed and centrifuged. Weighted Deming regression analysis was performed. Samples with discrepant results between the assays tested on the different analyzers were repeat tested; and if discrepancies persisted, the clinical status of the patient, FT4 and FT3 results, and biotin treatment were determined. Samples with discrepant results between the assays tested on the different analyzers were repeat tested; and if discrepancies persisted, the clinical status of the patient, FT4 and FT3 results, and biotin treatment were determined.
- The Atellica IM TSH3-Ultra Assay shows good correlation to the ADVIA Centaur TSH3-Ultra and Roche cobas TSH assay.

Statistics
Precision analysis and linearity analysis was performed using a Siemens internally developed software program based on the CLSI guidelines. 1.2 Method Comparison analysis was performed using the Analyte-K applet, version 3.08 for Microsoft Excel.

Results
Precision
The standard deviation (SD) and coefficient of variation (CV) observed for all samples, demonstrated acceptable results. Within-run imprecision (n=10) ranged from 1.3 to 5.5 CV and total precision (within-lab) ranged from 2.0 to 6.4 CV (Table 1).

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Mean attractiveness</th>
<th>Repeatability</th>
<th>Within-Lab %CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR09L1</td>
<td>0.070</td>
<td>0.06</td>
<td>3.0</td>
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<tr>
<td>PR90L3</td>
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<td>0.09</td>
<td>10.5</td>
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<td>TSHP</td>
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<tr>
<td>PR09L1</td>
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<td>0.08</td>
<td>6.4</td>
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</table>

Biotin interference
Samples spiked with biotin (500 ng/mL) and un-spiked control samples were run in duplicate on both the Atellica IM TSH3-UL Assay and Roche cobas TSH assay.

Conclusions
- The Atellica IM TSH3-UL Assay demonstrated good precision.
- The Atellica IM TSH3-UL Assay was linear across the assay range and met acceptance limit criteria (Figure 3).
- The Atellica IM TSH3-UL Assay is suitable for use in a clinical laboratory.

References:

Siemens Healthineers. 2020. Available at: https://www.siemens-healthineers.com