Pilot study of use of the BioStar Optical ImmunoAssay GC point-of-care test for diagnosing gonorrhoea in men attending a genitourinary medicine clinic

Gonorrhoea remains the second most common bacterial sexually transmitted infection in the UK. In 2012, new diagnoses of gonorrhoea increased in both men and women by 21% from the previous year, with the greatest increase occurring in men (Public Health England, 2013). Certain groups remain at greater risk (e.g. individuals of black ethnicity) (Public Health England, 2013). The increase in new diagnoses is due to both more infections and an increase in diagnosis using nucleic acid amplification tests (NAATs) (Public Health England, 2013).

Although culture has been the gold standard for diagnosing gonorrhoea, the results are not immediately available. In contrast, point-of-care tests (POCTs) provide rapid results, enabling early detection of infection and reducing the risk of onward transmission (Peeling et al., 2006; Vickerman et al., 2005). POCTs are particularly advantageous for diagnosing high-risk patients who are unlikely to return for results and in syndromic management in resource-limited settings (Peeling et al., 2006; Vickerman et al., 2003). To ensure rapid tests are evaluated correctly, the World Health Organization has produced the ASSURED criteria (Peeling et al., 2006). However, in high-risk patients who are unlikely to return, a POCT with lower sensitivity would lead to more patients being treated than a test with higher sensitivity that does not produce an immediate result (Gift et al., 1999).

The development of a gonococcal POCT has been challenging (Watchirs Smith et al., 2013). This is because *Neisseria gonorrhoeae* belongs to a family of closely related bacteria, making it difficult to locate a specific target, and cross-reaction with genes from commensal and pathogenic *Neisseria* species can lead to high false-positive rates (Vickerman et al., 2005). The sensitivity of gonococcal POCTs varies and has been reported to be lower than that of both culture and NAATs, and is dependent on the site tested and the presenting symptoms of the patients used as a comparator (Alary et al., 2006; Benzaken et al., 2006; Suzuki et al., 2004). Despite this, gonococcal POCTs have been shown to be cost-effective in high-prevalence populations (Vickerman et al., 2006).

The BioStar Optical ImmunoAssay (OIA) GC POCT, which has been designed for use by healthcare workers, is approved for testing urine samples in men and cervical swabs in women. It is an immunochromatographic test that detects an epitope within the L7/L12 ribosomal protein specific for *N. gonorrhoeae*, which reduces cross-reactivity with other *Neisseria* species and increases the test’s specificity. We previously conducted a laboratory-based evaluation of this test, which revealed good correlation with most clinical isolates of *N. gonorrhoeae* (Samarawickrama et al., 2011). There are few published studies evaluating gonococcal POCTs in a clinical setting (Watchirs Smith et al., 2013). Here, we report the findings of a pilot study to compare the performance of the OIA GC POCT against routinely used NAAT, microscopy and culture in men.

Men aged ≥18 years attending the sexual health clinic at King’s College Hospital, London, were recruited over a 3-month period. Data were recorded on demographics, the presence of symptoms, whether the individual was a known gonorrhoea contact and whether he had a previous history of gonorrhoea. Men were instructed not to void for at least 1 h before the collection of urine and urethral samples. Collected urine (2 ml) was transferred into a filtration device and the urine was expressed into a waste container. The urine was tested according to the manufacturer’s instructions using the OIA GC POCT. We have described the method elsewhere (Samarawickrama et al., 2011). The Aptima Combo 2 (Gen-Probe) NAAT was performed on urine samples from all men to test for gonorrhoea, while urethral microscopy and gonococcal culture using modified Thayer–Martin medium were additionally performed in symptomatic men using urethral swabs. Results from the OIA GC POCT were compared with those from NAAT, microscopy and culture to calculate the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the POCT, as well as respective 95% confidence intervals (CIs). The study was approved by the NHS Research Ethics Committee. Participants provided written informed consent.

A total of 52 men were recruited. Most were black (28/52, 54%), while the remainder were white (13/52, 25%), mixed (9/52, 17%) or Asian (2/52, 4%). The median age was 32 years (interquartile range 26–39 years). Most of the men were heterosexual (43/52, 83%), while eight (15%) were men who have sex with men and one was bisexual. The majority (35/52, 67%) were symptomatic, with most having urethral discharge (17/35, 49%) and/or dysuria (26/35, 74%). Although none of the men was a gonorrhoea contact, 19% (10/52) had a previous history of gonorrhoea.

The prevalence of gonorrhoea was 10, 12 and 13% using NAAT, microscopy and culture, respectively. The sensitivity, specificity, PPV and NPV of the OIA GC POCT compared with NAAT, microscopy and culture are shown in Table 1. In total, six men had a positive result with the OIA GC POCT. All were symptomatic and four were positive on all other tests, while one was positive on NAAT but negative on urethral microscopy and culture. One patient had a positive result with the OIA GC POCT but was negative on all other
Individuals, the use of a POCT in certain high-risk patients may be beneficial, regardless of symptoms. In summary, a larger study is warranted to further evaluate the performance of the OIA GC POCT.

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Table 1. Performance of the OIA GC POCT against NAAT, urethral microscopy and culture

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity, n (%) (95 % CI)</th>
<th>Specificity, n (%) (95 % CI)</th>
<th>PPV, n (%) (95 % CI)</th>
<th>NPV, n (%) (95 % CI)</th>
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<tbody>
<tr>
<td>NAAT (n=52)</td>
<td>5/5 (100) (57–100)</td>
<td>46/47 (98) (89–100)</td>
<td>5/6 (83) (44–97)</td>
<td>46/46 (100) (92–100)</td>
</tr>
<tr>
<td>Microscopy (n=33)</td>
<td>4/4 (100) (51–100)</td>
<td>27/29 (93) (78–98)</td>
<td>4/6 (67) (30–90)</td>
<td>27/27 (100) (88–100)</td>
</tr>
<tr>
<td>Culture (n=32)</td>
<td>4/4 (100) (51–100)</td>
<td>26/28 (93) (77–98)</td>
<td>4/6 (67) (30–90)</td>
<td>26/26 (100) (87–100)</td>
</tr>
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</table>

tests. This heterosexual man was not a known gonorrhoea contact and had negative microscopy and culture results.

In this study, we evaluated the OIA GC POCT against routinely available tests for gonorrhoea, including NAAT, microscopy and culture. The OIA GC POCT produced a result within 30 min. The main benefit of this study is that it provides proof that, in principle, a POCT for diagnosing gonorrhoea is achievable. This is especially important in light of a recent systematic review of gonococcal POCTs that identified only three studies using immunochromatographic POCT devices and highlighted the need for further development of POCTs to detect N. gonorrhoeae (Watchirs Smith et al., 2013).

Although the sensitivity and specificity of the OIA GC POCT appear high compared with all three routine tests, these results need to be interpreted with caution. This study has a number of limitations, the main being a small sample size, leading to wide CIs. The small number of true positives also led to low PPVs. However, the high NPVs against all three tests suggest that the OIA GC POCT could be useful in preventing the overtreatment of certain high-risk individuals who are unlikely to return for results. This would be useful in situations where access to microscopy is limited (e.g. in primary care).

In addition, the majority of patients were symptomatic, which can result in overestimation of a test’s sensitivity. A larger sample would have enabled us to compare the OIA GC POCT’s performance in symptomatic and asymptomatic patients. However, gonorrhoea can present asymptotically, and, as our clinic is in an area with a gonorrhoea diagnosis rate of greater than 100 per 100 000 people and sees high numbers of black and young