

# Evaluation of the BDProbeTec™ ET Assay for Diagnosis of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* Infections

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## ABSTRACT

■ *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (GC) are important agents of sexually transmitted disease. Nucleic acid detection tests for diagnosis of infection are widely available commercially, and are sensitive and specific when compared to culture. Recently, nucleic acid amplification tests, using several different formats, have become available. These tests offer even higher sensitivity than hybridization assays. The goal of this study was to evaluate a nucleic acid amplification system (BDProbeTec™ ET; BD Biosciences, Baltimore, MD) for the diagnosis of CT and GC infections in both female and male patients. Results were compared with a nucleic acid hybridization test currently in use in our laboratory (GenProbe PACE® 2C assay; GenProbe, San Diego, CA). Samples were obtained from patients in the Emergency Department at the UTMB teaching hospital and an OB-GYN outpatient clinic. For female patients, two extra swabs (one BDProbeTec™ ET swab and one Abbott LCX® swab) were collected in addition to the GenProbe swab; for male patients, a urine sample was submitted in place of a second swab. A total of 291 swabs and two urine samples were tested in this study. Using the PACE® assay, 22 samples were positive for CT; an additional 8 samples were positive using the BDProbeTec™ ET assay. For GC, 15 samples were positive by the PACE® assay, an additional 4 were positive using the BDProbeTec™ test. To confirm the results of the BDProbeTec™ ET assay, the discrepant samples (positive by the BDProbeTec™ ET assay but negative by the PACE® 2C assay) were also tested with the Abbott LCX® probe system (Abbott Laboratories, Abbott Park, IL). 100% of the CT tests were confirmed by LCX assay; one GC test was determined to be a false positive by BDProbeTec™ ET assay. The results of this study indicate that the BDProbeTec™ ET assay is a sensitive and specific test for the diagnosis of CT and GC infections. The assay is relatively easy to perform, and results are obtained quite rapidly (within 3 hours). Additional advantages of this assay are that no confirmatory assays are required and the test may be performed on urine samples.

## INTRODUCTION

■ Sexually transmitted diseases (STDs) are major public health concerns in the U.S. Two common agents of STD are *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (GC). In 1997, 324,901 cases of gonorrhea were reported in the U.S, representing a rate of 122.5 per 100,000 persons. The number of CT infections reported to the CDC in 1997 was 526,653, a rate of 207 per 100,000 persons (1). In women, the majority of CT infections are asymptomatic. Both CT and GC carry the risk of serious complications and sequelae, and transmission of the organism to newborns during childbirth. For these reasons, sensitive and specific tests for screening and diagnosis of CT and GC infections are necessary. Nucleic acid detection tests for diagnosis of infection are widely available commercially, and are sensitive and specific when compared to culture. Nucleic acid amplification tests, using several different formats, are now available commercially, and reportedly have higher sensitivity and specificity than hybridization tests. The goal of this study was to evaluate a nucleic acid amplification test (BDProbeTec™ ET; BD Biosciences, Baltimore, MD) for the diagnosis of CT and GC infections in both female and male patients, and to compare the amplification test with a hybridization test currently in use in our laboratory (GenProbe PACE® 2C assay; GenProbe, San Diego, CA).

## METHODS

### Study Design and Methods

■ Patients who were seen in the UTMB Emergency Department or at an outpatient OB-GYN clinic between August 1999 and March 2000 were enrolled into the study. Specimens collected for this study consisted of endocervical swabs or urine specimens. For female patients, two extra swabs (one BDProbeTec™ ET swab and one Abbott LCX® swab) were collected in addition to the GenProbe swab; for male patients, a urine sample was submitted in place of a second swab. The order in which the three swabs were collected was randomized. Following collection, the GenProbe PACE® 2C tests were run within two days; the BDProbeTec™ ET swabs were processed within 6 days (according to the manufacturer's instructions) then the processed specimens held at -70°C until the time of the assay. LCX® swabs were immediately frozen and held at -70°C until the time of assay. All BDProbeTec™ ET and LCX specimens were tested within 90 days of collection. The GenProbe PACE® 2C and BDProbeTec™ ET assays were performed in the UTMB Clinical Diagnostic Laboratory, according to manufacturer's directions. All specimens were tested by both the BDProbeTec™ ET assay and GenProbe PACE® 2C assay. If the results of the two tests were not in agreement, the discrepant specimens were also tested using the LCX® test. LCX tests were performed by the UTMB Infectious Diseases Reference Laboratory. A true positive was defined as any sample with positive results by at least two methods; a false positive was defined as positive by one method only. All samples in agreement by both BDProbeTec™ ET and GenProbe PACE® 2C assay were defined as true positive or true negative.

## Statistical analysis

■ The sensitivity and specificity were calculated using the following formulas:

$$\text{sensitivity} = \frac{\text{true positive}}{\text{true positive} + \text{false negative}}$$

$$\text{specificity} = \frac{\text{true negative}}{\text{true negative} + \text{false positive}}$$

The Chi-square test was used to determine if the results obtained with the BDProbeTec™ ET assay were significantly different from those obtained with the GenProbe PACE® 2C assay.

## REFERENCES

- 1 Division of STD Prevention. Sexually Transmitted Disease Surveillance, 1997. U.S. Department of Health and Human Services, Public Health Service, Atlanta: Centers for Disease Control and Prevention (CDC), September, 1998.

## RESULTS

■ A total of 293 samples were tested in this study. One specimen gave equivocal results in the BDProbeTec™ ET test and was dropped from the study. No specimens contained substances that inhibited amplification. For CT, 262 samples were negative and 22 samples were positive with both GenProbe PACE® 2C and BDProbeTec™ ET tests. (Table 1). There were 8 samples that were positive for CT using the BDProbeTec™ ET but negative by GenProbe PACE® 2C.

For GC, there were 273 negative samples and 15 positive by both tests. Four specimens were positive by BDProbeTec™ ET and negative by GenProbe PACE® 2C (Table 1). For both CT and GC, there were no specimens that were positive by the GenProbe test but negative using the BDProbeTec™ ET test.

To resolve the 8 discrepant CT tests and the 4 discrepant GC tests, the LCX® test was used. After discrepant analysis, one false positive GC test was found (Table 2).

### Sensitivity and Specificity of the BDProbeTec™ ET assay.

■ The sensitivity and specificity of the BDProbeTec™ ET assay for CT were both 100%. The GenProbe PACE® 2C assay had a sensitivity of 73% and a 100% specificity for CT. For GC, the sensitivity of the BDProbeTec™ ET was 100% and the specificity was 99.6%. The GenProbe PACE® 2C assay exhibited 78.9% sensitivity and 100% specificity for GC.

The BDProbeTec™ ET assay detected significantly more CT infections than the PACE® 2C assay ( $\chi^2 = 6.35$ ,  $p = .0133$ ). For GC, the two tests did not differ significantly ( $\chi^2 = 2.25$ ,  $p = .1336$ ).

Table 1. Comparison of BDProbeTec™ ET and GenProbe PACE® 2C Assays for Detection of CT and GC in endocervical and urine specimens

	Result by Assay		No. of specimens
	GenProbe PACE® 2C	BDProbeTec™ ET	
A. CT	positive	positive	22
	negative	negative	262
	negative	positive	8
B. GC	positive	positive	15
	negative	negative	273
	negative	positive	4

Table 2. Resolution of Discrepant Test Results using the LCX test

	Study ID #	BDProbeTec™ ET	GenProbe PACE® 2C	LCX®	Interpretation
CT Tests	0018	positive	negative	positive	true positive
	0025	positive	negative	positive	true positive
	0028	positive	negative	positive	true positive
	0046	positive	negative	positive	true positive
	0051	positive	negative	positive	true positive
	0109	positive	negative	positive	true positive
	0135	positive	negative	positive	true positive
	0257	positive	negative	positive	true positive
GC Tests	0028	positive	negative	positive	true positive
	0029	positive	negative	positive	true positive
	0125	positive	negative	positive	true positive
	0294	positive	negative	negative	false positive

## CONCLUSION

■ The results of this study indicate that the BDProbeTec™ ET assay is a highly sensitive and specific test for the diagnosis of CT and GC infections. Of 293 samples tested, only one false-positive GC result occurred. A sensitive test is especially important for diagnosis of CT infections, which are often asymptomatic in females. The increased sensitivity of the BDProbeTec™ ET test is achieved through the use of amplification technology. An advantage of the BDProbeTec™ ET test is the built-in amplification controls. This allows for rapid identification of samples containing inhibitors. When compared to other commercially available molecular assays for CT/GC diagnosis, the BDProbeTec™ ET assay is relatively easy to perform, and results are obtained quite rapidly (within 3 hours). Unlike the GenProbe PACE® 2C assay, no confirmatory tests are required. This allows for rapid reporting of test results. An additional benefit is the test may be performed on urine samples.