

# Detection of *Chlamydia trachomatis* in urinary samples from women

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## Abstract

**With a mean age of 21 years 197 women at risk for an infection with *Chlamydia trachomatis* (CT) had a urinary sample (20 ml first-void urine, minimum 4 hours from prior micturition) analysed with an enzyme immunoassay (IDEIA-III) for the detection of CT. They also had samples taken from both cervix and urethra for cultivation on McCoy's cells and testing with an enzyme immunoassay (Chlamydiazyme), plus verification of positive samples in the enzyme immunoassay (EIA) with monoclonal antibodies against CT. The urethral samples were compared against the urinary samples with regard to sensitivity and specificity in detecting CT. Women with a positive culture for CT and/or a positive verified EIA from either the cervix or the urethra, were regarded as "true" infections with CT. The prevalence of CT was 12.2%. The urinary EIA sample had a sensitivity of 84% whereas the urethral EIA sample had a sensitivity of 57%. The specificity was 98% and 100% for the urinary samples, and the urethral samples respectively. It is concluded that the urinary sample is superior to the urethral sample, and that the urinary sample could be used for screening programs, to detect CT among women.**

## Introduction

To detect *Chlamydia trachomatis* (CT) infections in women samples for culturing or direct detection are usually taken from cervix and urethra. Some women experience pain when the urethral sample is taken, and some have symptoms of urethritis afterwards. Because of this some young women are reluctant to have samples taken, particularly if they have no symptoms of disease. Women infected with CT are often asymptomatic.<sup>1-3</sup> Infections with CT may cause serious complications like salpingitis, increased risk of ectopic pregnancy and infertility.<sup>4-6</sup> It is therefore

of great importance to find and treat these asymptomatic women.

Owing to the invasive sampling procedure, screening programmes are difficult to perform. Earlier, urinary specimens had been compared with urethral samples to detect CT using the cell culture technique. The sensitivity for the urinary samples was however not acceptable.<sup>7</sup> Recently a method has been described to detect CT with enzyme immunoassay (EIA) in urinary samples from men.<sup>8-11</sup> The aim of this study was to examine women at risk for CT infection with the standard invasive sampling from the cervix and the urethra and to compare with a urinary sample, for the detection of CT.

## Subjects and methods

One hundred and ninety seven women, either pregnant, wanting an abortion or attending the family planning clinic were studied. Their mean age was 21 years (range 16-46). The women were asked to leave a urinary sample (20 ml first-void urine, minimum 4 hours from prior micturition). The invasive samples were then taken from urethra and endocervix after the cervix had been wiped clean with a large cotton swab. Samples for cultivation on McCoy's cells were taken with ENT swabs and samples for enzyme immunoassay (Chlamydiazyme, Abbott) were taken with EZE swabs. All the positive samples in the enzyme immunoassays had to be verified in immunofluorescence microscope with CT monoclonal antibodies (Syva, Micro Trak) before they were regarded as truly positive. The urinary samples (20 ml) were centrifuged at 3000 g for 20 minutes; the sediment was resuspended in 1 ml disruption buffer and analysed with enzyme immunoassay (IDEIA-III, Novo Bio labs) in accordance with the manufacturers instructions. Positive samples were verified as above. The criteria for a CT infection in the urethra or in the cervix, was a positive culture and/or a positive Chlamydiazyme test positively verified with CT monoclonal antibodies.

## Results

Of the 197 women entered in the study 23 (11.6%) had positive endocervical CT cultures. Twenty-four (prevalence 12.2%) women were positive for CT in one or more of the samples (cultures from cervix and urethra and EIA cervix and urethra). Twenty-three

women had a positive IDEIA-III urinary test (11.6%). Four of those women who were negative in the urinary IDEIA-III test were positive just in the endocervical sample but not in the sample from the urethra. Three of the negative (cultures and EIA) samples from cervix and urethra were positive in the urinary IDEIA-III test only (table 1). The sensi-

Table 1 Comparison of urinary IDEIA-III against EIA and/or tissue culture (cervix/urethra) for the detection of CT.  $n = 197$ .

		Cervix and/or Urethra EIA and/or cultivation		
		Pos	Neg	
Urine IDEIA-III	Pos	20	3*	23
	Neg	4†	170	174
		24	173	197

Prevalence 12.2% (24/197)

Specificity 98.3% (170/173)

Sensitivity 83.3% (20/24)

Positive predictive value 87.0% (20/23)

Negative predictive value 97.7% (170/174)

\*One of these three "false positive" was verified as positive with CT monoclonal antibodies. If this sample was considered as "true positive", a change in sensitivity and specificity would be observed (87.5% and 98.8% respectively).

†All of these four IDEIA-III negative patients had negative urethral samples.

Table 2 Comparison of the urethra EIA against cervix/urethra culture/EIA for the detection of CT.

		Cervix/urethra		
		Pos	Neg	
Urethra	Pos	14	0	14
	Neg	10	173	183
		24	173	197

Sensitivity 58.3% (14/24)

Specificity 100% (173/173)

Positive predictive value 100% (14/14)

Negative predictive value 94.5% (173/183)

Table 3 Comparison of urine (IDEIA-III) and urethra (Chlamydiazyme). ( $n = 197$ )

		Urethra EIA		
		Pos	Neg	
Urine IDEIA-III	Pos	13	10*	23
	Neg	0	174	174
		13	184	197

Sensitivity 100% (13/13)

Specificity 94.6% (174/184)

Positive predictive value 56.5% (13/23)

Negative predictive value 100% (174/174)

\*Five of ten "false positive" urinary samples were verified with CT monoclonal antibodies and of these five, four had positive cervical samples. If these verified samples were considered as "true positive", a change in specificity and positive predictive value was observed (97.2% and 78.3% respectively).

tivity and specificity was 83.5% and 98.3% respectively. One of these three false positive results was however positive and verified with monoclonal antibodies against CT. In table 2, the results from urethra EIA were tested against 24 positive cases (cervix and urethra samples culture and EIA). The sensitivity and specificity was 58.3% and 100% respectively. Results from urinary IDEIA-III were tested against the results from the urethral EIA (table 3). Twenty-three were positive in the urinary samples compared with 13 positive urethral samples. This gives a sensitivity for urinary IDEIA-III of 100% and a specificity of 94.6%. Five of the 10 false positive urinary samples were, however, verified with monoclonal antibodies against CT. If these samples are considered true positives, the specificity would be 97.2%.

## Discussion

Analysis of urinary samples for CT with IDEIA-III method compared with samples from the cervix and the urethra, analysed with Chlamydiazyme and tissue culture, had a sensitivity of 83.5% and a specificity of 98.3%. The corresponding figures for the urethral samples Chlamydiazyme was 56.5% and 100% respectively. Regarding the fact that approximately 10% of women infected with CT have a positive test only from the cervix, these results seem very favourable. Most women infected with CT have few, or no symptoms<sup>12</sup> and are not very likely to seek medical advice. Screening programmes with invasive samples from the urethra or cervix cannot be performed except among special groups of women, for example at family planning clinics etc. The analysis of urinary samples by EIA (IDEIA-III), which had a sensitivity of 83.5% and a specificity of 98.3% (table 1) screening programmes among women, seems more realistic. This study also showed that the IDEIA-III urinary test for CT was at least as effective as the urethral EIA. The sensitivity was 100% and the specificity was 94.6% (table 3). The method of taking invasive samples from the urethra has the disadvantage that it is painful while it is being taken, and for some hours afterwards. Owing to this, some urethral samples are perhaps not taken in an optimal way, and could thus be falsely regarded as negative.<sup>13</sup> Five of the 10 urinary samples which had corresponding negative urethral samples were verified as positive samples with the CT monoclonal antibody technique. This supports the finding in this study that the urinary sample is more sensitive than the urethral sample in detecting CT. This is also in accordance with preliminary results presented by Mårdh *et al.*<sup>14</sup> Chernesky *et al.*<sup>13</sup> studied 228 women and found a positive culture rate from invasive samples of 5.3%. They also tested IDEIA in urinary sediments and found a sensitivity of 69.2%. With the IDEIA-III method used in our study we found a sensitivity of

87.5%. There is room for improvement in the verification method. For example the centrifuging of samples would increase the sensitivity. These results suggest that the urethral sample could be substituted by an urinary sample in the routine examinations for the detection of CT. In conclusion we found the urinary IDEIA-III test to be sensitive and specific enough to be used in screening programmes, even in women. The urinary IDEIA-III test was superior to the urethral EIA test in detecting CT.

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