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Microbiology of urine samples from women presenting to primary care with symptoms of urinary tract infection (UTI): Results from the POETIC observational study

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Introduction

Resistance in Gram Negative Organisms - Studying Intervention Strategies (R-GNOSIS) is a large European collaborative focussing on multi drug resistant Gram-negative organisms. Work package 2, Point Of CarE Testing for Urinary Tract Infection in Primary Care (POETIC), encompasses an observational study of the presentation, management and outcome of uncomplicated UTI. Here we describe the microbiology of urine samples collected from GP centres in Cardiff, Southampton, Spain and the Netherlands.

Methods

593 urines were collected from women aged between 18 and 89 years presenting to GPs in the three countries with symptoms of UTI. The urines were cultured (50µL) onto UTI chromogenic agar using a spiral plater and total and species specific colony counts were calculated. Any pure or predominant isolates were identified by MALDI-ToF. All other bacteria present were identified according to chromogenic media. Bacterial growth was categorised as pure (PR), predominant (PD), mixed 2 isolates (M2), mixed >2 isolates (M>2) and no growth (NG). The PD was categorised as follows: the most abundant organism at 10^3 cfu/mL greater than the second organism. A presumptive UTI positive results was based on culture only, PR/PD $>10^5$ for the UK and PR/PD $>10^4$ for Spain and the Netherlands.

Organisms	$>10^5$	10^4 - $<10^5$	10^3 - $<10^4$	$<10^3$
ENB *(n=218)*	**79%** (173)	**16%** (34)	**1%** (2)	**4%** (9)
S. sap *(n=19)*	**79%** (15)	**16%** (3)	**0%** (0)	**5%** (1)
CNS (Non S. sap) *(n=28)*	**14%** (4)	**4%** (1)	**4%** (1)	**78%** (22)
ENT *(n=19)*	**21%** (4)	**10.5%** (2)	**10.5%** (2)	**58%** (11)
Group B Strep *(n=3)*	**33.3%** (1)	**0 %** (0)	**66.6%** (2)	**0%** (0)
Lactobacillus *(n=3)*	**0%** (0)	**0%** (0)	**100%** (3)	**0%** (0)
Candida *(n=1)*	**0%** (0)	**0%** (0)	**100%** (1)	**0%** (0)

Table 1. Percentage of each urinary pathogens at different cfu/mL in urines with pure and predominant growth .

Organisms	$>10^5$	10^4 - $<10^5$	10^3 - $<10^4$	$<10^3$
ENB	**87.8 %** (173)	**85%** (34)	**18.2%** (2)	**20.9%** (9)
S. sap	**7.6 %** (15)	**7.5%** (3)	**0 %** (0)	**2.3%** (1)
CNS (Non S. sap)	**2%** (4)	**2.5%** (1)	**9%** (1)	**51.1%** (22)
ENT	**2%** (4)	**5%** (2)	**18.2%** (2)	**25.6** (11)
Group B Strep	**0.5%** (1)	**0%** (0)	**18.2%** (2)	**0%** (0)
Lactobacillus	**0%** (0)	**0%** (0)	**27.3%** (3)	**0%** (0)
Candida	**0%** (0)	**0%** (0)	**9%** (1)	**0%** (0)

Table 2. Percentage of urinary pathogens present within each cfu/mL category in urines with pure and predominant growth.

Results

The results of 291 urines with PR or PD growth are shown in Tables 1 and 2. Of the PR/PD growths, *Enterobacteriaceae* (ENB) represented (173) 87.8% & (34) 85% at $>10^5$ and 10^4-$<10^5$cfu/mL compared with 18.1% and 20.9% at 10^3-$<10^4$ and $<10^3$cfu/mL (Table 2). Non *S. saprophyticus* coagulase negative staphylococci (CNS) and Enterococcus species (ENT) represented 2% & 2% of PR/PD growths at $>10^5$ and 2% & 5.5% at 10^4-10^5cfu/mL compared with 55.1% and 25.6% at $<10^3$cfu/mL. Table 1 shows that of the PR/PD with CNS and ENT isolated, 78% and 58% were seen at $<10^3$, confirming their role as contaminants. A selection of 1st and 2nd isolate combinations for mixed cultures are shown in Table 3. There were 206 mixed cultures in total, with the most common combination being *E. coli* and ENT at 14.5%, and a mixture of two different ENB at 1.9%. PR/PD growth was seen in 47-54% of urines from all age ranges. Percentages of *E. coli* in pure growth urines were similar in all age ranges, but increased with increasing age (Table 4). *S. saprophyticus* was more commonly seen at $>10^5$ in urines from age range 18-34yrs. Purity of growth was similar in all age ranges, however no growth was seen in 4.9% of 18-34yrs olds compared 9.8%, 12.9% & 8.2% in 35-49, 50-64 & 65-89 yrs. Using local microbiological criteria for UTI, 28.1% of 417 UK samples and 55.1% of 176 European samples were classed as presumed UTI positive.

Mixture	$>10^5$	10^4 - $<10^5$	10^3 - $<10^4$	$<10^3$
E. coli + ENT *(n=30)*	**20%** (6)	**33.3%** (10)	**23.3%** (7)	**23.3%** (7)
E. coli + CNS *(n=8)*	**0%** (0)	**50%** (4)	**12.5%** (1)	**37.5%** (3)
E. coli + ENB *(n=4)*	**50%** (2)	**0%** (0)	**25%** (1)	**25%** (1)
CNS + ENT *(n=23)*	**4.3%** (1)	**17.4%** (4)	**21.7%** (5)	**56.5%** (13)

Table 3. 1st and 2nd organism combinations for urines with mixed 2 isolates and mixed >2.

Age range	E. coli	ENB	S. sap	Group B	ENT	CNS
18-34 *(n=50)*	**72%** (36)	**6%** (3)	**20%** (10)	**0%** (0)	**2%** (1)	**0%** (0)
35-49 *(n=34)*	**73.5%** (25)	**17.6%** (6)	**2.9%** (1)	**2.9%** (1)	**2.9%** (1)	**0%** (0)
50-64 *(n=33)*	**84.8%** (28)	**6.1%** (2)	**3%** (1)	**0%** (0)	**3%** (1)	**3%** (1)
65-89 *(n=33)*	**87.9%** (29)	**12.1%** (4)	**0%** (0)	**0%** (0)	**0%** (0)	**0%** (0)

Table 4. Percentage prevalence of isolates at >10^5 cfu/mL in PR urines from patients with different age ranges.

Conclusions

E. coli **and other ENB were the most common urinary pathogen across all age ranges with** ***S. saprophyticus*** **more common in women under 34yrs old. Contamination (M2 & M>2) was similar in all age ranges.** ***E. coli*** **was also the most common species in mixed cultures. Enterococci and CNS, organisms usually considered to be contaminants, showed pure growths in some urine samples at $>10^5$, suggesting a need for re-evaluation of the definition of uropathogen. Higher UTI presumptive positives in Europe reflect a lower microbiological criteria for UTI.**

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