

STUDY OF URINARY TRACT INFECTIONS IN SOME GROUPS OF POPULATION IN DURRËS

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Abstract

Introduction: Urinary tract infections (UTIs) are among the most common bacterial infections. Microorganisms frequently isolated include *Escherichia coli*, other Enterobacteriaceae and some Gram-positive strains. *Aims:* 1) Recognition of microbial cargo situation of urine, 2) Determination of pathogens, 3) The application of microbiological methods, 4) Determination of microbial cargo by sex, age group and according to the season, 5) Study of the correlation between urinary leukocytouria and microbial cargo. *Settings and Design:* Prospective study was done in the Health Directory in Durrës. *Methods and Material:* The study included all the patients who were admitted or visited the outpatient departments in the Health Directory and had urinary tract infection confirmed by positive urine culture reports. As the ground for planting urine is used blood agar, endo agar, McConkey, etc.. *Results:* UTI was diagnosed using mid stream urine (MSU) culture. The prevalence of infection has been found 31.8%. A total 700 urine samples have been analyzed for isolation and identification of bacterial isolates. Out of which 223 (31.85%) samples has been found to have significant bacteriuria and remaining 477 samples has been found to have either non significant bacteriuria or very low bacterial count or sterile urine. In the present study, out of 223 isolated pathogens the most common isolate was *Escherichia coli* (89%), followed by *Staphylococcus aureus* (6.7%), *Proteus vulgaris* (3.2%) and *Pseudomonas aeruginosa* (1.1 %). Age group most affected by *Escherichia coli* is 61-75 years (28.6%). *Conclusions:* In this study are presented significant data showing univariate analysis that accompanying leukocyturia with *Escherichia coli* is significant. Women are more susceptible to urinary tract infections, especially against *Escherichia coli*.

Keywords: *Escherichia coli*, *Staphylococcus aureus*, *Proteus vulgaris*, *Pseudomonas aeruginosa*

INTRODUCTION

A UTI is an infection in the urinary tract. Infections are caused by microbes—organisms too small to be seen without a microscope—including fungi, viruses, and bacteria. Bacteria are the most common cause of UTIs. Normally, bacteria that enter the urinary tract are rapidly removed by the body before they cause symptoms. However, sometimes bacteria overcome the body's natural defenses and cause infection. An infection in the urethra is called urethritis. A bladder infection is called cystitis. Bacteria may travel up the ureters to multiply and infect the kidneys. A kidney infection is called pyelonephritis.

The most common bacteria implicated as causative agents of UTI generally originate in the intestine and include but not limited to *E. coli*, *Pseudomonas* spp, *Streptococcus* spp, *Proteus* spp., *Klebsiella* spp., *Staphylococcus* spp, *Neisseria gonorrhoea*, *Chlamydia trachomatis*, *Candida* spp, *Mycoplasma*. Extremes of age, female gender, pregnancy, instrumentation, urinary tract infection, neurologic dysfunction, renal disease, and expression of A, B and H blood group oligosaccharides on the surface of epithelial cells are predisposing factors for the development of UTIs (Al-Sweih et al., 2008).

In recurrent uncomplicated UTIs, reinfection occurs when the initially infecting bacteria persist in the fecal flora after elimination from the urinary tract, subsequently recolonizing the introitus and bladder (Hooton TM., 2001) . A number of host factors appear to predispose otherwise healthy young women to recurrent UTIs. These include local pH and cervicovaginal antibody changes in the vagina; greater adherence of uropathogenic bacteria to the uroepithelium; and possibly pelvic anatomic differences, such as shorter urethra-to-anus distance.

Women may be more susceptible to UTI because their urethral opening is near the source of bacteria (e.g., anus, vagina) and their urethra is shorter, providing bacteria easier access to the bladder. 50-80% women experience urinary tract infection at least once or twice in their lives (Puri R. & Malhotra J.,2009).

The prevalence of UTIs among women is thought to increase even further with age, with bacteriuria occurring in 10%–15% of women aged 65–70 years and 15%–20% of women aged 180 years (Nygaard IE & Johnson JM., 1996; Nicolle LE., 1994; Boscia JA, Kobasa WD & Knight RA, et al., 1986).

UTIs in men are far less common than in women, and need investigating to find an underlying cause. These causes may include narrowing of the urethra (a stricture), a previous STI, a bladder stone or a problem with the prostate gland.

Ways to diagnose a UTI are via urinalysis and/or urine culture. A sample of urine is examined under a microscope by looking for indications of infection — bacteria or white blood cells in the urine.

MATERIALS AND METHODS

Midstream urine specimens were collected from 700 (350 males and 350 females) patients who were admitted or visited the outpatient departments in the Health Directory, Durrës and had urinary tract infection confirmed by positive urine culture reports. The urine samples were collected into sterile bottles. As the ground for planting urine is used blood agar, endo agar, McConkey, etc..

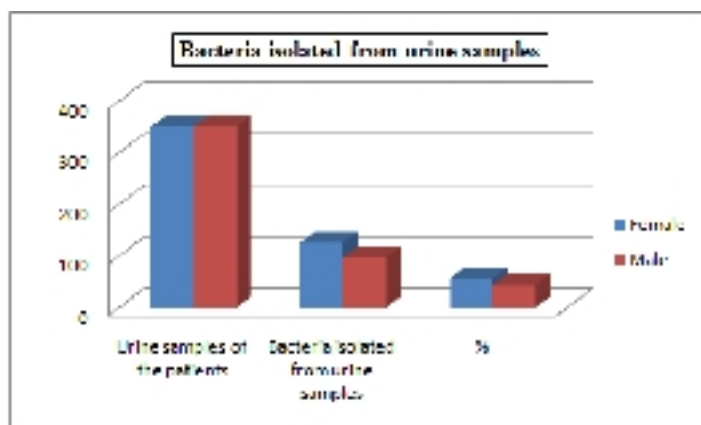
Planting of urine in the terrain is done in such a way that we can count colonies and based on them to find the number of bacteria / ml urine; therefore are been developed quantitative methods of urine culture (Hysko M, 2007; Papajorgji M et al 2002).

As the ground for planting urine is used blood agar, endo agar, McConkey, etc.. For *Proteus*, to avoid increasing its pervasive and allowing separate potential colony growth to be counted, we prepare the ground with the highest percentage agar (4-5%) by Sonnenwirth (JH Benson, 2001 ; Papajorgji M et al 2002).

The collection of samples was carried out in Health Directory, Durrës. Data analysis was carried out on the basis of a preliminary plan using statistical package EpiInfo version 7.

RESULTS AND DISCUSSION

A total of 700 persons, aged 1 years up to 90 years , were included in the study: 350 females (50%) and 350 males (50%). All the urine samples were grouped into 6 age group and analyzed for isolation and identification of bacterial isolates. Out of which 223 (31.85%) samples were found to have significant bacteriuria consisting of 126 (56.5%) from females and 97 (43.5%) from males as detailed in Fig. 1.



The remaining 477 samples were found to have either non significant bacteriuria or very low bacterial count or sterile urine.

The gram-negative bacteria constituted the largest group with a prevalence of 216 (96.9%) while gram-positive bacteria constituted only some 7 (3.1%) of the total isolates.

Fig. 1. Bacteria isolated from urine samples

The bacteria isolated were *E. coli* (28.29%), *S. aureus* (2.00%), *P. vulgaris* (0.68%) and *P. aeruginosa* (0.29%). The highest proportion of isolates were *E. coli* (28.29%) and *S. aureus* (2.00 %) accounting for 95 % of the total number of isolates recovered from the urine samples. Other less-frequent isolates in aggregate caused 5% of infections.

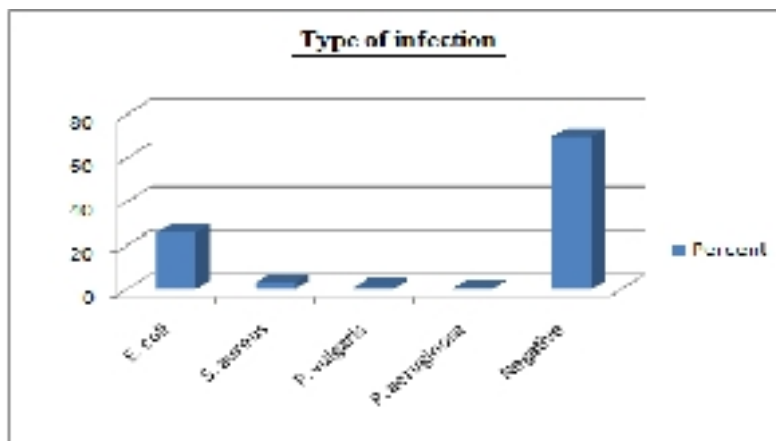
Tab. 1. Type of infection isolated from total urine samples.

TYPE OF INFECTION	Frequency	Percent	Cum.Percent
Escherichia coli	98	28.29%	28.29%
Negative	180	68.57%	96.86%
Proteus vulgaris	6	0.89%	97.75%
Pseudomonas aeruginosa	2	0.29%	98.05%
Staphylococcus aureus	14	2.00%	100.00%
Total	700	100.00%	100.00%

95% Conf Limits

Escherichia coli	25.01%	31.81%
Negative	64.97%	71.97%
<i>Proteus vulgaris</i>	0.35%	1.95%
<i>Pseudomonas aeruginosa</i>	0.05%	1.15%
<i>Staphylococcus aureus</i>	1.14%	3.42%

Viewing tables and chart, we notice that people are more affected by *Escherichia coli* in a much higher percentage than the three other bacteria: *Proteus vulgaris*, *Staphylococcus aureus* and *Pseudomonas aeruginosa*.



Pronounced prevalence of *Escherichia coli* in urinary tract infections, compared with other bacteria normally present in the gut, is indicative of a unique ability of this bacterium to invade, and to be placed in the urinary tract.

Fig. 2. Chart of percentages of cases with bacteria

Different types of genus *Proteus*, are also considered as frequent agents of urinary tract infections.

Proteus is invading bacterium and is directly related to infections of the upper urinary tract. Among opportunistic pathogenic bacteria as the cause of UTI is and *Pseudomonas aeruginosa*. This bacterium multiplies in environments with trace organic substances.

Staphylococci are considered more contaminants of urine. In our results the most frequently between *Staphylococci* is *Staphylococcus aureus*.

Samples obtained from female subjects (56.5%) yielded more bacteria than those obtained from males (43.5%). The sex distribution of patients in the present study was consistent with that of other studies (Snydman, 1991, Savas et al., 2006).

Several reports have indicated that females are more prone to having UTIs than males (Kolawale et al., 2009), because the urethra is shorter in females than males and is easily more readily transversed by microorganisms (Inabo and Obanibi, 2006).

Womens propensity to develop UTIs has also been explained on the basis of certain behavioral factors, including delays in icturation, sexual activity, the use of diaphragms and spermicides (both of which promote colonization of the periurethral area with bacteria). Also, the length of the urethea (urethra), the dried environment surrounding the meatus, and the antibacterial properties of prostatic fluid contribute to a lower rate of infection in males.

Tab. 2. Positive, negative and sterile cases of urine samples

TYPE OF RESULT	Frequency	Percent	Cum. Percent	
Negative	293	41.85%	41.86%	
Positive	223	31.86%	73.71%	
Steril	184	26.29%	100.00%	
Total	700	100.00%	100.00%	

95% Conf Limits		
Negative	38.19%	45.62%
Positive	28.44%	35.47%
Steril	23.09%	29.74%

In Fig. 3 are presented sterile, negative and positive cases with bacteria.

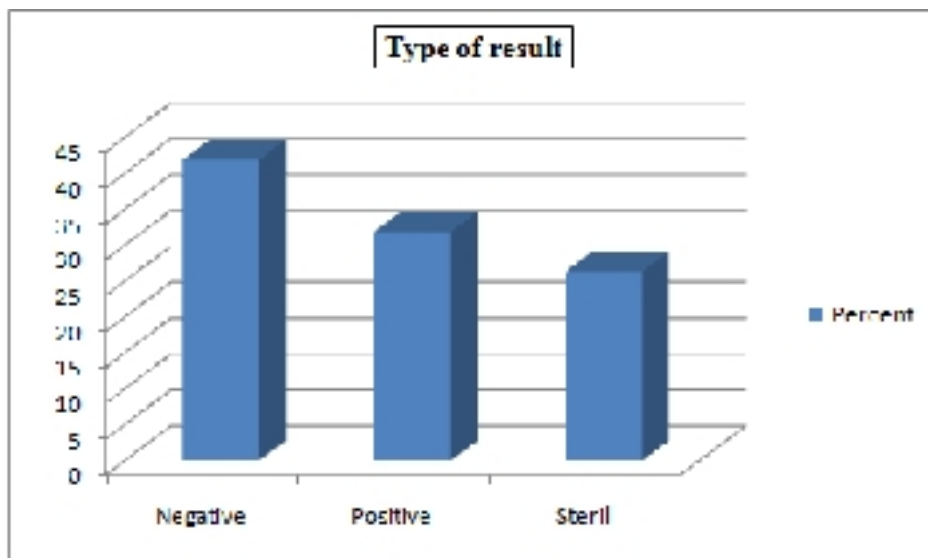









Fig. 3. Positive, negative and sterile cases of urine samples

We emphasize that if you use a good hygiene in urine then emerges sterile culture, that is to say that we do not have any kind of bacteria growing in the ground; while negative cases are them that have 2-3 colonies, which are not taken into account.

Of course, we have made an analysis by age. Ages which have proved most affected have been 61-75 years (24.29%) and 46-60 years to (18.14%).




Often the risk of urinary tract infections increases with age, therefore people often have concerns and do the analysis in this age (Aurora B. 2012).

Tab. 3. Frequency a bacteriological analysis by age group in total

AGE GROUP	Frequency	Percent	Cum. Percent		
≥ 76	90	12.86%	12.86%		95% Conf Limits 76 10.51% 15.62% 1 - 15 14.33% 20.04% 16 - 30 9.99% 15.00% 31 - 45 12.88% 18.37% 46 - 60 15.40% 21.24% 61 - 75 21.19% 27.67%
1 - 15	119	17.00%	29.86%		
16 - 30	86	12.29%	42.14%		
31 - 45	108	15.43%	57.57%		
46 - 60	127	18.14%	75.71%		
61 - 75	170	24.29%	100.00%		
Total	700	100.00%	100.00%		

Bacteriological analysis of urine usually are made after clinical analysis in wich the value of bacteria and leukocytes emerged over the rate.

Tab. 4. Frequency of bacteriological analysis

BACTERIE AND INFECTION	Frequency	Percent	Cum. Percent		
Negative	475	67.86%	67.86%		95% Conf Limits Negative 64.23% 71.28% Positive 28.72% 35.77%
Positive	225	32.14%	100.00%		
Total	700	100.00%	100.00%		

If in preparation are identified bacteria, then urine analysis is considered positive for bakteriuria (1 ml urine over 100,000 bacteria) and continue with bacteriological analysis. If in the preparation of the urine are diagnosed 10 or more leukocytes to the field, then and this urine sample is considered positive and advised to be done and bacteriological analysis.

Urine is a very good ground for the development of bacteria, especially gram-negative bacteria. Bakteriuria in clinical analysis of urine is almost always associated with specific bacteria of bacteriological analysis. Bacteria in the urine were found at a rate of about 32.14%.

If you want to see if there are correlations between each of the 4 bacteria and infection in urine do the following analysis:

Tab. 5. Linear Regression of *E. coli* and bacteria

Variable	Coefficient	Std Error	F-test	P-Value
<i>E. coli</i> and Bacteria	0.994	0.006	32638.4800	0.000000

CONSTANT	0.006	0.010	0.3703	0.543013
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Companionship of bacterinuria of clinical analysis

Correlation Coefficient: $r^2= 0.98$ with *Pseudomonas aeruginosa* and *Proteus vulgaris*, are respectively 100% that is also seen in the low number of cases with these two types of bacteria. While compatibility for *Escherichia coli* is in the order of 97.5% and *Staphylococcus saprophyticus* is 85.7%.

Tab. 6. Linear Regression of *P. vulgaris* and bacteria

Variable	Coefficient	Std Error	F-test	P-Value
<i>P. vulgaris</i> and Bacteria	0.999	0.016	4146.1200	0.000000
CONSTANT	0.001	0.031	0.0022	0.962839

Correlation Coefficient: $r^2= 0.86$

It explained that not always the first bacteria seen in a microscopy field for clinical analysis followed 100% of bacteria growing on selective grounds, and often the reason for not taking better the analysis.

The same reasoning is and for the companionship of leukocytes with bacteria.

Tab. 7. Cases with bacteria and leukocyte in clinical urine

LEUKOCYTE AND INFECTION	Frequency	Percent	Cum. Percent	
Negative	476	68.00%	68.00%	
Positive	224	32.00%	100.00%	
Total	700	100.00%	100.00%	

95% Conf Limits
 Negative 64.38% 71.42%
 Positive 28.58% 35.62%

As seen from the table bakteriuria is almost always accompanied by leukocytes determined in clinical tests. Positive assessment of a bakteriuria with less than 100 000 per ml, is helpful and accompanying bakteriuria with leukocituria.

Tab. 8. Linear Regression of bacteriuria and leukocyte

Variable	Coefficient	Std Error	F-test	P-Value
Bacteria and Leukocyte	0.996	0.003	105844.7200	0.000000
CONSTANT	0.009	0.005	2.8006	0.094680

Correlation Coefficient: $r^2= 0.99$

In most cases leukocituria pushes us seek uroculture. Only in some cases during antibiotic therapy or shortly after this break may have leukocitura without bakteriura. Leukocytes in urine are found in about 32% of cases.

If you want to see if there are correlations between each of the 4 bacteria and leukocyturia in urine do the following analysis:

Tab. 9. Linear Regression of *E. coli* and leukocyte

Variable	Coefficient	Std Error	F-test	P-Value
<i>E. coli</i> and Leukocyte	0.962	0.014	4471.1387	0.000000
CONSTANT	0.038	0.026	2.2040	0.138103

Correlation Coefficient: $r^2= 0.86$

Urinary leukocyte compatibility with *Escherichia coli* is in the order of 90%. If we compare the bakteriuria with leukocyturia, then we see that we shift small and not significant.

Tab. 10. Linear Regression of *S. aureus* and leukocyte

Variable	Coefficient	Std Error	F-test	P-Value
<i>S. aureus</i> and Leukocyte	0.999	0.010	9562.6000	0.000000
CONSTANT	0.001	0.020	0.0052	0.942686

Correlation Coefficient: $r^2= 0.93$

Urinary leukocyte compatibility with *Staphylococcus aureus* is in the order of 93.3%.

Tab. 11. Linear Regression of *P. vulgaris* and leukocyte

Variable	Coefficient	Std Error	F-test	P-Value
<i>P. vulgaris</i> and Leukocyte	0.999	0.016	4146.1200	0.000000
CONSTANT	0.001	0.031	0.0022	0.962839

Correlation Coefficient: $r^2= 0.86$

Analysis was carried out by each bacterium according to sex (male / female).

Tab. 12. Type of infection in females

TYPE OF INFECTION	Frequency	Percent	Cum Percent
<i>Escherichia coli</i>	114	32.57%	32.57%
Negative	225	64.29%	96.86%
<i>Proteus vulgaris</i>	3	0.88%	97.74%
<i>Pseudomonas aeruginosa</i>	1	0.29%	98.03%
<i>Staphylococcus aureus</i>	7	2.00%	100.03%
Total	350	100.00%	100.03%

95% Conf Limits

<i>Escherichia coli</i>	27.74%	37.79%
Negative	58.99%	69.26%
<i>Proteus vulgaris</i>	0.22%	2.70%
<i>Pseudomonas aeruginosa</i>	0.01%	1.83%
<i>Staphylococcus aureus</i>	0.88%	4.26%

On the basis of the urine samples we see that women, support better growth of *E. coli* compared to the male urine samples. In our study females are affected with *E. coli* by 32.5% compared to men who are affected only 24%.

Tab. 13. Type of infection in males

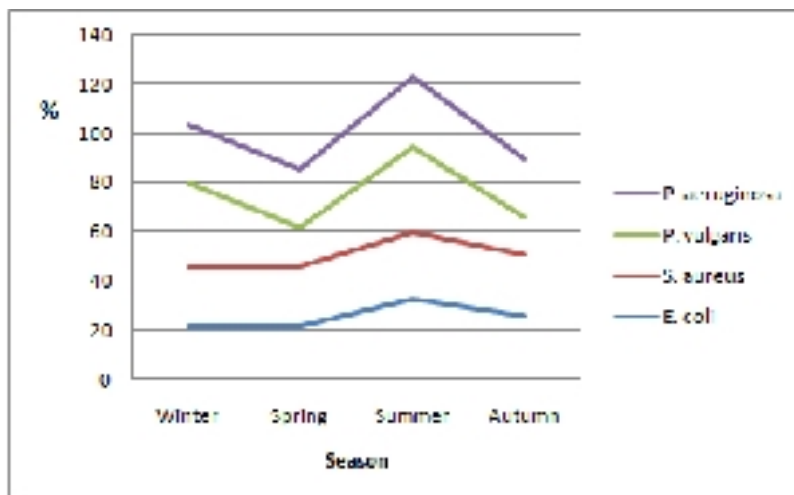
TYPE OF INFECTION	Frequency	Percent	Conf Percent
<i>Escherichia coli</i>	81	24.00%	24.00%
Negative	255	72.89%	96.88%
<i>Proteus vulgaris</i>	3	0.88%	97.71%
<i>Pseudomonas aeruginosa</i>	1	0.29%	98.00%
<i>Staphylococcus aureus</i>	7	2.02%	100.00%
Total	350	100.00%	100.00%

95% Conf Limits

<i>Escherichia coli</i>	19.69%	28.89%
Negative	67.82%	77.38%
<i>Proteus vulgaris</i>	0.22%	2.70%
<i>Pseudomonas aeruginosa</i>	0.01%	1.83%
<i>Staphylococcus aureus</i>	0.88%	4.26%

These differences between the sexes have to do with the pH of the urine and its osmolarity and this reinforces the hypothesis that among other factors, urinary tract infections occur more often in women.

We have made an analysis based on the seasons.



Distribution is different; therefore *E. coli* roof is in the summer, while in three other seasons have almost similar values. *P. vulgaris* have two peaks in winter and in summer; while two others: *P. aeruginosa* and *S. saprophyticus* have the same distribution almost the entire year.

Fig. 4. Distribution of cases according to the seasons

CONCLUSIONS

This paper describes a study undertaken to evaluate the prevalence and susceptibility patterns of bacterial strains isolated from patients diagnosed with UTIs in a referral Health Directory in Durrës, Albania.

Women are more susceptible to urinary tract infections, especially against *Escherichia coli*, resulting positive in 32.5% of cases.

Age groups most affected by bacterial infection are 61-75 years (24.29%) and 46-60 years to (18.14%).

In this study are presented and significant data showing univariate analysis that accompanying leukocyturia with *Escherichia coli* is significant.

Women are more susceptible to urinary tract infections, especially against *Escherichia coli*, resulting positive in 32.5% of cases in female urine samples compared to 24% of cases in male urine samples.

Greater frequency of infections with *Escherichia coli* and *Proteus vulgaris* is found in the hot summer season, which also affect many factors that have not been analysed in this study.

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