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STUDY CONCERNING THE INCIDENCE OF ESCHERICHIA COLI IN URINE SAMPLES

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Abstract

Escherichia coli (E. coli) belongs to the Escherichia genus, Enterobacteriaceae family. It is a Gram-negative bacilli, aerobeand facultative anaerobe, non sporulating, without capsular material on their surface, motile, as a result of the ciliary apparatus, and by means of peritrichous flagella,or non-motile. It grows in normal environments (broth and nutrient agar) at the optimum temperature of 37 ° C.

E.coliis by far the most common etiologic agent causing urinary tract infections (UTI). Host factors play a decisive part regarding UTI. Diabetes, genetic or acquired immunodeficiencies, colon malformations, obstructive uropathies, vesicoureteral reflux, or pregnancy increase therisk of UTI.

The urinary tract infectionmay manifest itself or it may show no symptoms.It affects any segment of the urinary tractand as a result of anatomical relations, once installed in a segment it extends to others: urethritis, prostatitis, cystitis, orpyelonephritis. Sometimes it manifests as an acute episode, self-limited to the lower urinary tract.

Key words: Escherichia coli,urinary tract infection

INTRODUCTION

Escherichia coli (E. coli) was isolatedand first described in 1885 by the German pediatrician Theodor Escherichthat discovered itcolonizesthe intestinal tract of the infant. (Barzoi, D., S. Meica et al., 1999)

To mark the tropism and its isolation frequency, the author named itBacterium coli commune. In 1919 Castelani and Chalmers permanentlyname it Escherichia coli, as a tribute brought toEscherich, the one that first identified the bacteria. (Barzoi, D., S. Meica et al., 1999)

Escherichia coli,belongs to the Escherichia genus, Enterobacteriaceae family.It is a Gram-negative bacilli, aerobe and facultative anaerobe, nonsporulating, without capsular material on their surface, motile, as a result of the ciliary apparatus, and by means of peritrichous flagella, or non-motile. It grows in normal environments (broth and nutrient agar) at the optimum temperature of 37 ° C. A 24 hour broth culture produces an intense turbidity, sometimes a ring on the surface, and in older culturesnot adherent, abundant deposit. On the surface of nutrient agar colonies are 2-6 mm diameter, opaque, pigmented, slightly convex, type S.

E. coli is a conditionally pathogenic bacteriawith multiple pathogenic phenotypes(pathotypes). Chromosomal genes, and especially thereassortment of diverse virulence factors through plasmid transfers and

lysogenic conversion generatesin the case of thisconditionally pathogenic bacteria theformation of several diarrheagenic and uropathogenicpathotypes. (Buiuc, D., M. Negut, 2008)

Urinary Tract Infection (UTI) is one of the most common pathological conditions.

E.coliis by far the most common etiologic agent causing urinary tract infections. Host factors play a decisive part regarding UTI. Diabetes, genetic or acquired immunodeficiencies, colon malformations, obstructive uropathies, vesicoureteral reflux, pregnancy increase the riskof UTI.(Buiuc, D., M. Negut, 2008)

MATERIAL AND METHOD

The present study was conducted for two years, 2014-2016, in Oradea, including the months of November, December, January and February. It was recorded the total number of positive quantitative urine cultures for Escherichia coli, the total number of quantitative urine cultures performed in the four months of each year, analyzing the results after these two years of the survey.

Urine samples have been collected from the patients. The first morning specimen was harvested in sterile plastic containers with transparent lid and wide mouth.

The following procedure was used for preparation and specimen collection: after a basic hygiene protocol using soap and water, therewere collected 20 and 50 mlmid-stream specimen of urine, trying to prevent any contamination by microorganisms carried by the hairs, or any particles from the perineal region. The containers were properly labeled.

The samples were seeded onto blood-agar growth media(E.coliforms colonies of 2-3 mm, grey-white, round, convex, moist, smooth surface and regular edges, causing hemolysis),MacConkeyagar (weak selective medium used for the isolation ofmembers of the Enterobacteriaceae family, E. coli forms lactose-fermenting colonies,pink to red, itcan be surrounded by a pink halo, non-mucoid),UTI agar(chromogenic media used for the identification and differentiation of microorganisms causing major urinary tract infections - E coli. It results in pink colonies)Chromatic Candida(chromogenic medium for isolating Candida species).

The plates were incubated aerobically overnight at 37 ° C.

The next day the plates were carefully examined using reflected light and through transparency.

Blood-agar plates support the growth of a wider range of bacteria, especiallyGram-positive bacteria, inhibited on the weak selective mediumfor the Gram-negative bacilli.The plate with the differential weak selective medium avoids possible deadlock created by the Proteus invasion

of the blood-agar plate andallows differentiation between Gram negative bacilli colonies.(Buiuc, D., M. Negut, 2008)

The identification of the E. coli species in urine samples was established based on our UTI chromogenic medium resulting in pink colonies produced by E.coli.

The results were differentiated according to the type of developed colonies.Isolates in quantities below 103 CFU/ ml were considered to be contaminated, so without clinical significance, the ones with over 105 CFU/ ml being considered of clinical significance. In the case of isolates between 10^3 and 10^5UFC/ml, it has been requested the collection of a new urine sample.

RESULTS AND DISCUSSIONS

We have reached the following results:Within the months of the survey was conducted, there were collected 2348 quantitativeurine samples, of which 823 were found positive forE. coli as the only bacteria(in over 105 CFU/ ml), 794were found positive forE. coli and other bacteria (between 104 and 105 CFU/ ml) and 731 were without clinical significance (below 103 CFU / ml).

In the months of November included in the two-year study there were collected 600quantitative urine cultures, of which 250 were found positive for E. coli as the only bacteria, 200 E. were found positive for E. coli and other bacteria, and 150 were without clinical significance.

In the months of December included in the two-year study there were collected 489quantitative urine cultures, of which 170 were found positive for E. coli as the only bacteria, 140 were found positive for E. coli and other bacteria, and 179 were without clinical significance.

In the months of January included in the two-year study there were collected 670 quantitative urine cultures, 180 of which were identified with E. coli, 300tested positive for E. coli and other bacteria, and 190 were without clinical significance.

In the months of February included in the two-year study there were collected 589quantitative urine cultures, of which 223 were identified in E. coli, 154tested positive for E. coli and other bacteria, and 212 were without clinical significance. (Table. no 1) and (Figure no. 1)

Table 1

The incidence ofE. coli positive urine cultures from the total number of quantitative urine culturescollected
(average values 2014-2116)

Period	Total number of quantitative urine culturescollected	E.colipositive urine cultures	E.coli urine culturesassociated with other bacteria	Urine cultureswithout clinical relevance
November	600	250	200	150
December	489	170	140	179
January	670	180	300	190
February	589	223	154	212

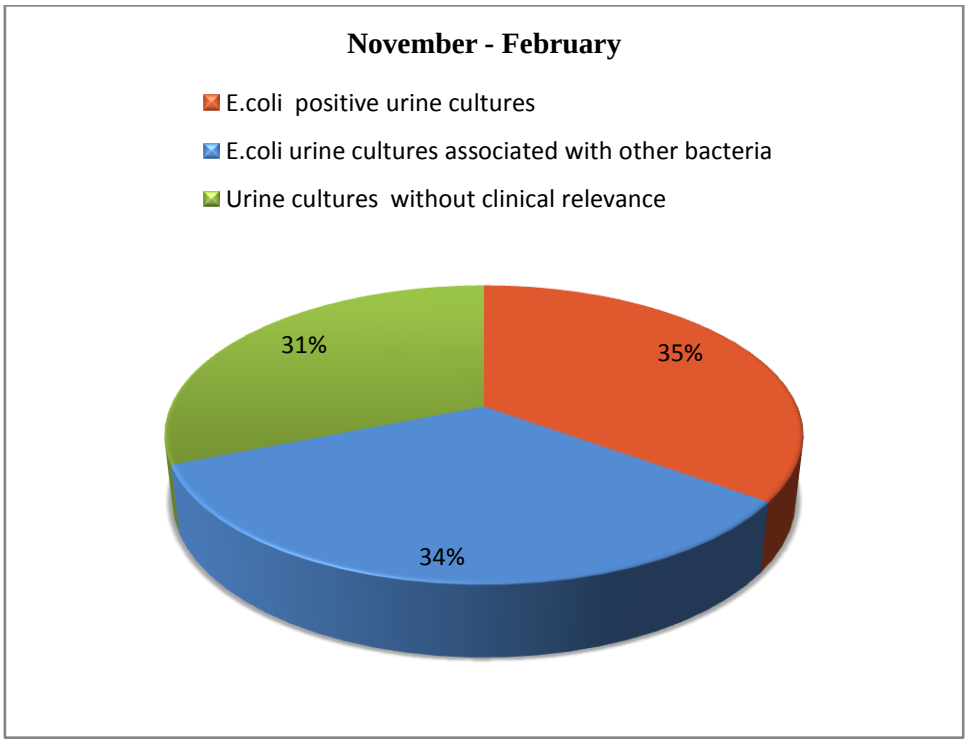

Fig. 1 The incidence ofE. coli positive urine culturesexpressed as percentage

Regarding the gender and age of the patients, analyzing the data obtained, it was found that E. coli urinary tract infection is more common in females between 20 and 40 years.

In November,from the 250 E. coli positive urine samples, 220 were collected from females, i.e.: 5 to girls aged0-20 years, 200 women aged20-40 years, 15 women aged40-65 years, and 10 women agedover 65.

In December, from the 170E. coli positive urine samples, 150 of them were collected from females, i.e.: 7 to girls aged0-20 years, 110 women aged20-40 years, 25 women aged40-65 years, and 8 womenaged over 65 years.

In January, from the180 E. coli positive urine samples, 171 were collected from females, namely: 10 in girls aged0-20 years, 127 women aged20 -40 years, 24 women aged 40-65 years and 10 in women agedover 65.

In February,from the 223 E. coli positive urine samples, 200 were collected from females, i.e.: 9 to girls aged 0-20 years, 180 women aged 20-40 years, 7 women aged 40-65 years and 4 women aged over 65 years. (Table no. 2) and (Figure no. 2).

Table 2

The incidence ofE. coli positive urine cultures, based on age and gender (female)
(average values 2014-2116)

Period	**E.colipositive urine cultures (femalegender)**	**Age group 0-20 years**	**Age group 20-40 years**	**Age group 40-65 years**	**Age group over 65 years**
November	220	5	200	15	10
December	150	7	110	25	8
January	171	10	127	24	10
February	200	9	180	7	4

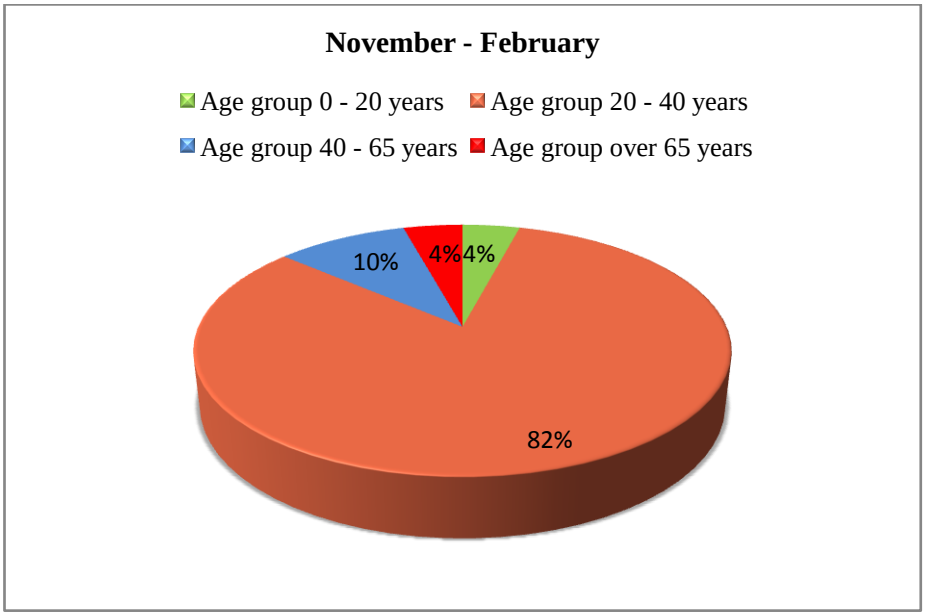

Fig. 2 The incidence ofE. coli positive urine cultures, based on age and gender (female)

In some urine culture Escherichia coli was identified associated with Candida spp. The identification was made on the basis of the Chromatic Candida culture medium and the results are as follows:

In November, from the 250 E. coli positive urine cultures, a total of 100 were alsopositive for Candida spp.

In December, from the 170 E. coli positive urine cultures, 77 were alsopositive for Candida spp.

In January,from the 180 E. coli positive urine cultures,29 were alsopositive for Candida spp.

In February,from the 223 E. coli positive urine cultures, 80 were alsopositive for Candida spp. (Table no. 3) and (Figure no. 3)

Table 3

E.coliand Candida spp.(average values 2014-2016)

	E.coli positive urine samples	**E.coliandCandida spp.**
November	250	100
December	170	77
January	180	29
February	223	80

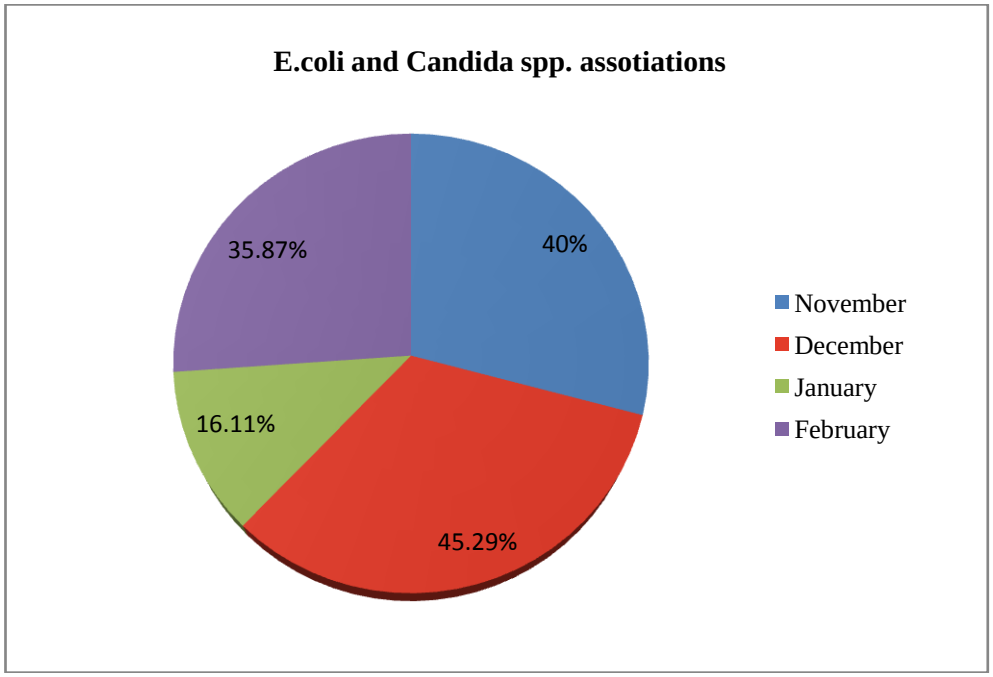

Fig. 3 The percentage of Candida spp.posivitve urine cultures out of the total number of E.coli positive urine cultures

The treatment of urinary tract infections caused by E. coli was based on an antibiogram, in order to choose the most effective antibiotic.

CONCLUSIONS

•Detection and proper treatment of urinary tract infections caused by E. coli is extremely important. Sometimes the infection manifests as a flare, self-limited in the lower urinary tract. Sometimes patients with innate or acquired predisposition; the episodes might repeat themselves and infection becomes chronic.

E.coli is by far the most common etiologic agent of urinary tract infections. Host factors play a decisive part regarding UTI. Diabetes, genetic or acquired immunodeficiencies,colon malformations, obstructive uropathies, vesicoureteral reflux, or pregnancy mayincrease the riskofUTI.

•Urinary tract infections occur at all ages. In newborns and infants prevalence is higher in boys than in girls. Subsequently the ratio reverses increasingly with the stages of adulthood. The difference between the genders disappears in the elderly because of the faster growth in the prevalence of prostate disease in men and the requiredinstrumentation.

REFERENCES

1. Adalbert M.J., si col., 1991, Localized adherence and attaching- effacing properties of nonenteropathogenic serotypes of Escherichia coli. Infect. Immun, pp.59,1864-1868
2. Bilbiie V., Pozsgi N., 1985, Bacteriologiemedicala. EdituraMedicala, vol. II.
3. Barzoi, D., S. Meica et al., 1999, Toxiinfectiilealimentare. EdituraDiaconCoresi, Bucuresti, pp.314-316
4. Bridson E.Y., 1995, The Oxford Manual, 7-th ed. Alphaprint, Alton, Hants
5. Buiuc D., Duca E., Hurmuzache S., et al., 1984, Argumentepentru un algoritmmai economic al examenuluicitobacteriologic al urinei in conditiile ameliorarii controlului de calitate. Bacteriol. Virusol. Parazitol. Epidemiol, 29, pp. 355
6. Buiuc D., Negut M., 2008, Tratat de microbiologie clinica.EdituraMedicala, Bucuresti, pp.255-277, 695-722
7. Borriello S.P., Murray P.R., Funke G., 2005, Organ and system infections. In Topley and Wilson' sMicrobiology and Microbial infections, 10 thedn. Bacteriology vol. I, Hodder Arnold, London, pp. 509-768
8. Doyle M.P., 1990, Pathogenic Escherichia coli, Yersinia enterocoliticaand Vibrio parahaemolyticus. Lancet, pp. 336, 8723, 1111-1115
9. Duca E., Buiuc D., Hurmuzache S., 1985, O experienta de 15 ani: antibiograma pe cultura primara prinmetodadifuzimetrica, posibilitate si necesitate in investigareainfectieitractusuluiurinar. Bacteriol. Virusol. Parazitol. Epidemiol, 29, pp. 85
10. Edberg S., 1981, Methods of quantitative microbiological analyses that support the diagnosis, treatment and prognosis of human infection. CRC Critical Rev. Microbiol. 8, pp. 339
11. Edwards P.R., Ewing W.H., 1986, Identification of Enterobacteriaceae, 3-nd edn. Elsevier. New York
12. Freney J., Renaud F., Hansen W., Bollet C., 2000, Precis de Bacteriologie Clinique. Ed. Eska, Paris
13. Henry J.B., Threatte G.A., 2001, Clinical Diagnosis and Management by Laboratory Methods, 20 thedn. W.B. Saunders Co., Philadelphia
14. Iseneberg H.D., 1998, Essential Procedures for Clinical Microbiology, ASM Press, Washington D.C.
15. Mobley H.L.T., Warren J.W., 1996, Urinary tract infections: Molecular Pathogenesis and Clinical Managemnet, ASM Press, Washington D.C.
16. Murray P.R., Baron E.J., Jorgensen J.H., et al., 2003, Manual of Clinical Microbiology, 8 thedn. ASM Press, Washington D.C.
17. Salmon R.L., 1997, Outbreaks of Escherichia coli. BMJ, pp.314, 7076, 241
18. Stamey E.J., 1980, Pathogenesis and Treatment of Urinary tract Infections, Williams and Wilkins, Baltimore, pp. 1-342
19. Stokes E.J., Ridgway G.L., Wren M.W.D., 1993, Clinical Microbiology, 7 thedn. Edward Arnold, London, U.K.
20. Vandepitte J., Endgbaeck K., Piot P., et al., 1994, Bacteriologie clinique: techniques de base pour la laboratoire, O.M.S., Geneve
21. Washington W.Jr., Allen S., Janda W., et al., 2005, Koneman' s Color Atlas and Textbook of Diagnostic Microbiology, 6 thedn. Lippincott Williams & Wilkins, Philadelphia.