STUDY CONCERNING THE INCIDENCE OF ESCHERICHIA COLI IN URINE SAMPLES

Vlad Ioana Andra

University of Oradea, Faculty of Environmental Protection, 26 Magherust; 410048 Oradea, Romania, e-mail: ioana_andravlad@yahoo.co.uk

Abstract

Escherichia coli (E. coli) belongs to the Escherichia genus, Enterobacteriaceae family. It is a Gram-negative bacilli, aerobe and 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. coli is 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 the risk of UTI.

The urinary tract infection may manifest itself or it may show no symptoms. It affects any segment of the urinary tract as a result of anatomical relations, once installed in a segment it extends to others: urethritis, prostatitis, cystitis, pyelonephritis. 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 isolated and first described in 1885 by the German pediatrician Theodor Escherich that discovered it colonizes the intestinal tract of the infant. (Barzoi, D., S. Meica et al., 1999)

To mark the tropism and its isolation frequency, the author named it Bacterium coli commune. In 1919 Castelani and Chalmers permanently name it Escherichia coli, as a tribute brought to Escherich, 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, 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. A 24 hour broth culture produces an intense turbidity, sometimes a ring on the surface, and in older cultures not 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 generates in the case of this conditionally pathogenic bacteria the formation of several diarrheagenic and uropathogenic pathotypes. (Buiuc, D., M. Negut, 2008)

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

E.coli is 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 risk of 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, there were collected 20 and 50 ml mid-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 of members of the Enterobacteriaceae family, E. coli forms lactose-fermenting colonies, pink to red, it can 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, especially Gram-positive bacteria, inhibited on the weak selective medium for 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 and allows 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 10³ and 10⁵ UFC/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 quantitative urine samples, of which 823 were found positive for E. coli as the only bacteria (in over 10⁵ CFU/ ml), 794 were found positive for E. 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 600 quantitative urine cultures, of which 250 were found positive for E. coli as the only bacteria, 200 E. coli 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 489 quantitative 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, 300 tested 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 589 quantitative urine cultures, of which 223 were identified in E. coli, 154 tested positive for E. coli and other bacteria, and 212 were without clinical significance. (Table. no 1) and (Figure no. 1)
The incidence of E. coli positive urine cultures from the total number of quantitative urine cultures collected (average values 2014-2116)

<table>
<thead>
<tr>
<th>Period</th>
<th>Total number of quantitative urine cultures collected</th>
<th>E. coli positive urine cultures</th>
<th>E. coli urine cultures associated with other bacteria</th>
<th>Urine cultures without clinical relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>600</td>
<td>250</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>December</td>
<td>489</td>
<td>170</td>
<td>140</td>
<td>179</td>
</tr>
<tr>
<td>January</td>
<td>670</td>
<td>180</td>
<td>300</td>
<td>190</td>
</tr>
<tr>
<td>February</td>
<td>589</td>
<td>223</td>
<td>154</td>
<td>212</td>
</tr>
</tbody>
</table>

Fig. 1 The incidence of E. coli positive urine cultures expressed 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 aged 0-20 years, 200 women aged 20-40 years, 15 women aged 40-65 years, and 10 women aged over 65.

In December, from the 170 E. coli positive urine samples, 150 of them were collected from females, i.e.: 7 to girls aged 0-20 years, 110 women aged 20-40 years, 25 women aged 40-65 years, and 8 women aged over 65 years.

In January, from the 180 E. coli positive urine samples, 171 were collected from females, namely: 10 in girls aged 0-20 years, 127 women aged 20-40 years, 24 women aged 40-65 years and 10 in women aged over 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 of E. coli positive urine cultures, based on age and gender (female)  
(average values 2014-2116)

<table>
<thead>
<tr>
<th>Period</th>
<th>E. coli positive urine cultures (female gender)</th>
<th>Age group 0-20 years</th>
<th>Age group 20-40 years</th>
<th>Age group 40-65 years</th>
<th>Age group over 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>220</td>
<td>5</td>
<td>200</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>December</td>
<td>150</td>
<td>7</td>
<td>110</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>January</td>
<td>171</td>
<td>10</td>
<td>127</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>February</td>
<td>200</td>
<td>9</td>
<td>180</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>
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 also positive for Candida spp.

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

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

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

### Table 3

<table>
<thead>
<tr>
<th></th>
<th>E.coli positive urine samples</th>
<th>E.coli and Candida spp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>250</td>
<td>100</td>
</tr>
<tr>
<td>December</td>
<td>170</td>
<td>77</td>
</tr>
<tr>
<td>January</td>
<td>180</td>
<td>29</td>
</tr>
<tr>
<td>February</td>
<td>223</td>
<td>80</td>
</tr>
</tbody>
</table>
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 may increase the risk of UTI.

• 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 required instrumentation.
REFERENCES