GBS colonizes the oral cavity, respiratory tract, gastrointestinal and genitourinary tract. The risk of transmission is up to 70%. Postpartum infections arise from other family members or from hospital environment. GBS colonization in pregnant women in full-term pregnancy is the most important predisposing factor that increases 25 fold the risk of developing early onset disease in newborn. It varies with ethnic groups, with equal numbers of women being colonized in a transitory, intermittent or persistent manner and depends on age, sexual activity, contraceptive methods used (Bigos et al., 2012).

Perinatal antibiotic prophylaxis should be given to pregnant women who carry GBS in the vagina and/or rectum, if in the course of pregnancy was bacteriuria diagnosed with GBS etiology, or if the neonatal GBS infection occurred in previous children born by this patient. Indication for antibiotic prophylaxis is also 35–37 week of pregnancy before labor before, if pregnant woman in labor was admitted to the hospital after more than 18 hours after disruption of fetal membranes and in case of intrapartum fever (Bigos et al., 2012).

An aim of our study was the comparison of antibiotic susceptibility of *Streptococcus agalactiae* strains isolated from various samples taken healthy or infected pregnant women, neonates (group A – wards: Gynecology, Obstetrics, Pregnancy Pathology, Neonatal, Neonatal Intensive Care Unit) and other adult patients hospitalized in various hospital wards group B – wards: Internal Diseases, Urology, Transplantology, Surgery, Orthopedics) during 2010–2013.

The retrospective analysis included isolates from vaginal/rectal swabs, blood, urine, swab, cervix, blood, external ear swabs. Swabs from vagina/rectum were transported in a transport Amies medium and submitted for culture within 24 hours, they were cultured on the Todd – Hewitt’s broth (24 hours incubation, 37°C, aerobic atmosphere). They were subcultured on the CHROMagar – Strep (bioMerieux) and blood agar. Other samples were cultured according to routinely used protocol. After incubation, the cultures were reviewed for the presence of characteristic for GBS colonies and latex agglutination test detecting polysaccharide C characteristic for group B was performed (bioMerieux). Susceptibility to erythromycin, clindamycin and vancomycin was performed in case of isolates from swabs from vagina/from patients allergic to penicillin – information was given on referral form. GBS isolates other patients had susceptibility tests done routinely. Retrospective
analysis was made on the basis of information contained in Hospital IT System.

Incidence of colonization in consecutive years and number of examined vaginal/rectal swabs is 12.4% in 2010 (1409); 17% in 2011 (2125); 19.6% in 2012 (2348); 16.4% in 2013 (2401), respectively. All GBS strains were isolated from healthy pregnant women not allergic to penicillin and therefore no susceptibility test was performed.

Susceptibility analysis to benzyl penicillin, erythromycin, clindamycin and vancomycin was performed for GBS isolates from group B patients. All strains were susceptible to benzyl penicillin and vancomycin. Constitutive and inductive macrolide – lincosamide – streptogramin B resistance mechanisms were identified. Results of resistance rate are presented in Table I.

Sensitivity of bacterial cultures in detection of *S. agalactiae* varies from 50 to 84.3%. Underestimation of GBS neonatal disease can be related to non-hemolytic GBS isolates (5–8% of all isolates). Sensitivity of late antenatal cultures for identifying colonization status at delivery varies from 54.3–87%; specificity 96%; positive predictive value 87% and negative predictive value 95–97%. An important limitation of the detection of GBS in culture is the need for viable organisms and for an average culture period of 48–72 hours. Even if the swab would be taken according to procedure just before labour, it can give false negative result. Routine vaginal swab culture between 35 and 37 hbd has its limitations, because approximately 6% of pregnant women is colonized later (Edwards et al., 2002; Verani et al., 2010; Verani and Schrag, 2010; Brown et al., 2013; Savini et al., 2013; Szymusik et al., 2014). Incidence of GBS colonization obtained by the gold standard – culture – reported by various authors is presented in Table II.

According to de-Paris et al. (2011) culture method was positive in 15.96% samples, while the PCR technique in 26.99%. Of the 221 culture-negative samples, 13% were positive with PCR Positive results of intrapartum PCR DNA were reported in 35 minutes and negative results confirmed in 50 minute. According to the studies performed by Abdelazim (2013) the sensitivity and specificity of intrapartum PCR test was 98.3% and 99%, respectively. Positive predictive value of intrapartum PCR test was 86.4% and negative predictive value – 97.4% (NIHCE, 2015).

Poncelet-Jasserand et al. (2013) stated that 70% of early-onset neonatal GBS infections were associated with mothers whose colonization status was either unknown or negative at the time of screening (35–37 hbd). The cost of reagents and labor was 13 times higher for PCR detection than for the use of chromogenic media. Helali et al. (2012) estimated that positive result of screening at 35–37 week's gestation resulted in unnecessary anti-

---

### Table I

<table>
<thead>
<tr>
<th>Year</th>
<th>Benzyl-penicillin</th>
<th>Erythromycin</th>
<th>Clindamycin</th>
<th>Vancomycin</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0/19</td>
<td>5/15</td>
<td>0/4</td>
<td>0/12</td>
</tr>
<tr>
<td>2011</td>
<td>0/15</td>
<td>0/3</td>
<td>4/8</td>
<td>0/41</td>
</tr>
<tr>
<td>2012</td>
<td>0/3</td>
<td>11/30</td>
<td>30/51</td>
<td>0/53</td>
</tr>
<tr>
<td>2013</td>
<td>0/3</td>
<td>10/41</td>
<td>19/50</td>
<td>0/52</td>
</tr>
<tr>
<td>Total</td>
<td>0/40</td>
<td>26/89 (29%)</td>
<td>53/113 (47%)</td>
<td>0/158 (0%)</td>
</tr>
</tbody>
</table>

* based on data given on lab reports, not on microbiological test

### Table II

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Colonization incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>1995–2007</td>
<td>11.3–17.9</td>
</tr>
<tr>
<td>Ireland</td>
<td>1998–2004</td>
<td>11.8–25.6</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>2000–2002</td>
<td>21</td>
</tr>
<tr>
<td>Greece</td>
<td>2003</td>
<td>6.6</td>
</tr>
<tr>
<td>Turkey</td>
<td>2003–2005</td>
<td>6.5–10.6</td>
</tr>
<tr>
<td>Scandinavia</td>
<td>2003–2008</td>
<td>24.3–36.0</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2004</td>
<td>29.3</td>
</tr>
<tr>
<td>Germany</td>
<td>2006</td>
<td>16.0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2006</td>
<td>21.3</td>
</tr>
<tr>
<td>Pakistan</td>
<td>2007</td>
<td>18</td>
</tr>
<tr>
<td>Poland</td>
<td>2007–2008</td>
<td>11.4</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2010–2011</td>
<td>18</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2011–2012</td>
<td>11.3–15.4</td>
</tr>
<tr>
<td>Republic of Congo</td>
<td>2012–2013</td>
<td>20</td>
</tr>
<tr>
<td>Republic of South Africa</td>
<td>2014</td>
<td>30.9</td>
</tr>
</tbody>
</table>
biotic prophylaxis for 13.6% of pregnant women in the study compared to 4.5% for women using the intrapartum PCR test. This resulted in incremental costs of €36 and €173 to the health care system and hospital, respectively, for each mismanaged patient. Molecular tests have not identified susceptibility to antibiotics (penicillin, erythromycin, clindamycin) (Church et al., 2011; Kasahara et al., 2010).

Penicillin is still the first-line antibiotic effective against GBS. Recently non-penicillin-susceptible GBS isolates have been reported in Japan and the United States due to a Q557E mutation in pbp2x (Kasahara et al., 2010). The substantial increases of erythromycin-resistant GBS isolates were observed in England and Wales (< 3% in 1990s to 15% in 2010 (Clifford et al., 2011). Clifford et al. (2011) observed higher number of strain resistant to clindamycin than to erythromycin in isolates from New Zealand and Australia. Seo et al. (2010) have described GBS strains resistant to clindamycin and susceptible to erythromycin belonging to serotypes Ia, Ib, III and VIII. This mechanism was based on gene lnu (B). Arana et al. (2014), in 2014, reported the first human S. agalactiae isolate in Europe with new mechanism of resistance to clindamycin based on gene lnu (B). In 2014 in USA two vancomycin-resistant invasive S. agalactiae strains were isolated (both serotype II, multilocus sequence type 22). The strains were carrying van G elements (Srinivasan et al., 2014). The increasing resistance rate might give a rise to a new epidemiological situation. Furthermore, women arriving from various countries with high resistance rates to erythromycin or/clindamycin might be admitted to Polish hospitals. They may constitute reservoir of multiresistant S. agalactiae. Lack of knowledge of local epidemiological data can contribute to ineffective empirical therapy. In the Table III are presented resistance rates to erythromycin and clindamycin in various countries in the world.

Experts had revised procedures that could improve current practices for prevention of perinatal GBS disease and facilitate consensus towards European guidelines and their implementation. If a woman is determined to be at high risk for anaphylaxis, a vaginal-rectal swab should be collected between 35–37 weeks gestation and susceptibility to clindamycin and erythromycin should performed by means of D-zone test. Erythromycin is not recommended because of high rates of resistance present in GBS and to subtherapeutic concentrations in amniotic fluid and fetal serum. Clindamycin could be a proper choice (DiRenzo et al., 2015).

The increasing resistance rate might give a rise to a new epidemiological situation. Annual resistance pattern analysis performed by local microbiological laboratory is required for an effective empiric therapy. Additionally, at the time of migrating refugee population knowledge of epidemiological data might contribute to better medical care.

### Table III

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Antibiotic resistance (number of resistant strains/ number of tested strains)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Erythromycin</td>
</tr>
<tr>
<td>Spain</td>
<td>1992–2009</td>
<td>30/212</td>
</tr>
<tr>
<td>Italy</td>
<td>2002–2005</td>
<td>15/91</td>
</tr>
<tr>
<td>Poland</td>
<td>2006–2010</td>
<td>6/22</td>
</tr>
<tr>
<td>Australia</td>
<td>2002–2006</td>
<td>3/47</td>
</tr>
<tr>
<td>Egypt</td>
<td>2008</td>
<td>5/3/8</td>
</tr>
<tr>
<td>Syria</td>
<td>2008</td>
<td>39/72</td>
</tr>
<tr>
<td>Israel</td>
<td>2010</td>
<td>15/88</td>
</tr>
<tr>
<td>Malasia</td>
<td>2010–2011</td>
<td>24/103</td>
</tr>
<tr>
<td>Republic of South Africa</td>
<td>2012</td>
<td>27/128</td>
</tr>
</tbody>
</table>

### Literature


