Antibiotic Susceptibility of Group B Streptococcal Strains in Women of Child-Bearing Age. Recommendations for Prevention and Control of Perinatal Group B Streptococcal Disease

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Abstract

Objective: *To describe antibiotic sensitivity of strains isolated from women of child-bearing age.*
Method: *Were reviewed opinions available and are discussed the relevant articles and their points of view. There were analyzed samples from 782 patients who presented for different reasons at the „Cantacuzino" National Institute for Research and Development for Microbiology and Immunology (NIRDMI) medical laboratory in a seven months period (September, 2006 - March, 2007). The antibiotic susceptibility of GBS strains isolated from these patients was analyzed.*
Results: *The majority of strains isolated were sensitive to penicillin (96.2%), ampicillin (97.1%) and cefuroxime (99.1%). The sensitivity to quinolones was over 91.7%. Were identified relatively few strains resistant to erythromicin (5%), clindamycin (5.3%), and chloramphenicol (6.8%), compared to medical literature.*
Conclusion: *Even if there is no surveillance system for group B streptococcal diseases (GBSD) in our country, on the basis of information from medical international literature, we can assume that GBSD represent a public health problem.*
Further studies of clinical and public health importance are needed in order to sustain the best prevention strategy for GBSD in Romania.
Keywords: *Group B Streptococcus, perinatal, screening strategies, antibiotic susceptibility*

Background

The genus Streptococcus includes 5 clusters and a number of species. The pyogenic streptococci (cluster 1) are mainly beta-hemolytic species that could be pathogenic for humans and animals. S. pyogenes and S. agalactiae represent 2 clearly defined species[1-5].

The classification of streptococci has been based on different criteria, which are described elsewhere[1-6]. The serologic grouping (Lancefield) divided streptococci into groups (A-H, K-U), but for clinical purposes the typing is done only for the groups A-C, F, and G. The polysaccharides of groups A and B contain an identical backbone, but differ in side branches. S. agalactiae is included in Group B Streptococcus (GBS).

Group B streptococci are catalase-negative, facultative anaerobes, gram-positive diplococci (or short chains) that produce a narrow zone of β-hemolysis on blood-agar (Figure no. 1). They are resistant to bacitracin, give a positive sodium hippurate hydrolysis, and produce CAMP factor. GBS could be serologically classified using the wall carbohydrate antigens, and the capsular polysaccharides (9 serotypes).

Even if it has been identified in intestinal tract and vaginal flora of 10-40% healthy individuals, GBS is an important cause of invasive infections in neonates and some adults (immunosuppressed, with underlying diseases, older than 65 years of age)[1-2,4-5,7-12]. GBS vaginal colonization occurs more frequent in some ethnic groups, and is influenced by diabetes mellitus (during pregnancy), and sexual activity (frequent intercourses, multiple partners), but not by pregnancy itself[4,10,18-21].

We can discuss about 2 clinical forms of neonatal disease, the early-onset infection (EOI), when the systemic infection develops during the first 6 days of life (some cases in the first hours, the mean age being 12 hours), and the late-onset infection (LOI), when the onset is between 7 days and 89 days of age (the mean age being 24 days). If in EOI the maternal obstetric complications are frequent, and the case-fatality ratio could be quite high, in LOI the maternal obstetric complications are not common, and the case-fatality ratio is lower (less than 3%)[4-9,13-17].

There are several risk factors for EOI. Prenatal GBS colonization represents an important risk factor (vertical transmission of GBS from mother to fetus would occur after the onset of labor or membrane rupture). Positive urine culture (in any concentration) with GBS, intra-amniotic infection, fever (more than 38°C) during labor, membrane rupture (with more than 2 hours in preterm delivery, and more than 18 hours in term delivery), intrauterine fetal monitoring, and a previous baby with GBS disease are some other risk factors[4,7-9,13-17,22-25].

Young infants with EOI could present sepsis, pneumonia, and meningitis (more often in LOI); poor feeding, jaundice, abnormal temperature, respiratory distress, lethargy, hypotension, could as well be present in neonates with infections other than GBS.

In LOI, GBS bacteriemia could be discovered if blood cultures are performed. The signs mentioned above could be registered, as well as different signs of focal infections. The fulminant infection could rapidly progress to septic shock and death, or could be followed by permanent neurologic sequelae. GBS infection could affect very low birth weight infants, with a prolonged hospitalization, at more than 3 months of age.

Although adult infections do not represent the purpose of this document, we would like to mention the endometritis and wound infection, associated with Caesarean section, after delivery. During pregnancy or the postpartum period, women can contract amnionitis, sepsis, or rarely, meningitis caused by GBS[4,7,12].

In many countries, perinatal GBS infections are considered serious and important public health problems.

Material and methods

We have studied the available data in both national and international medical literature, in order to analyze and present an up-dated document regarding the prevention and control of perinatal GBS disease.

We have studied the samples taken from 782 patients who presented out for different reasons (including on their own initiative), at the „Cantacuzino" National Institute for Research and Development for Microbiology and Immunology (NIRDMI) medical laboratory in a seven month period (September, 2006 - March, 2007). We have performed a study regarding the antibiotic susceptibility of GBS strains isolated from these patients.

For isolation, identification, and antibiotic susceptibility testing we have used classical methods, which are described elsewhere[1-2,4-5,26-27].

The statistical analysis was performed using the software, Epi Info 6.0.4.

Results

There is no surveillance system for GBS infections in Romania. There are no statistical data at a national level regar-

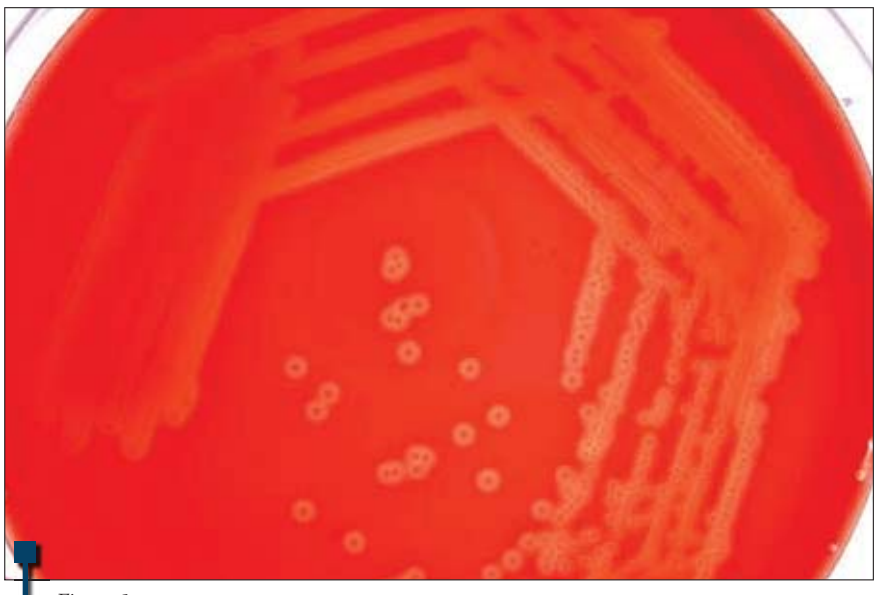


Figure 1

ding invasive infections with GBS.

No clinical guide books have yet been published on this subject in Romania. The "Cantacuzino" NIRDMI will publish a guideline for prevention of neonatal infections.

There is no surveillance system for GBS infections at European Union (EU) level. There are studies performed in different EU countries[9,12,15,17,19-20].

There are surveillance systems for these infections in USA and other countries that have already implemented activities for prevention and control of perinatal GBS infections[4,7-8,16,22-24,28-32].

At a global level, the US and the UK are leaders of opinion for the control of GBS infections and have drawn up 2 major methods of handling the situation.

Considering GBS infections an important public health problem, health authorities from the USA started to build a nation-wide prevention program in 1990. The collaboration between public health authorities, clinicians, researchers, professional organizations (e.g. American College of Obstetricians and Gynecologists and American Academy of Pediatrics), and even parent advocacy groups gave birth to the first recommendations for intrapartum prophylaxis to prevent perinatal GBS disease in 1996-1997, up-dated in 2002-2003.

Two prevention methods are to be considered (in any of these strategies, pregnant women with GBS bacteriuria, or who previously gave birth to an infant with EOI would receive intrapartum antibiotic prophylaxis):

- The risk-based approach;
- The culture-based screening approach.

Medical systems that are using the risk-based approach offer intrapartum chemoprophylaxis to pregnant women in the presence of any of the following risk factors: preterm delivery (less than 37 weeks), rupture of membranes for more than 18 hours, intrapartum fever of more than or equal to 38.0°C.

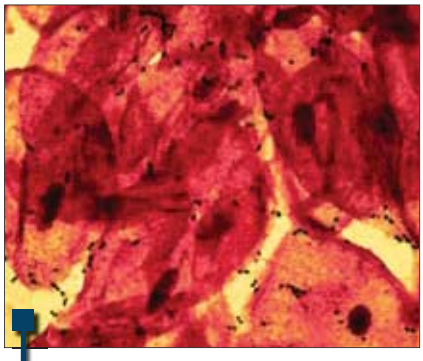


Figure 2

In the culture-based screening approach, all pregnant women are screened for vaginal and rectal GBS colonization between 35 and 37 weeks of pregnancy, and will receive chemoprophylaxis, if positive.

If the incidence of perinatal GBS disease, before the implementation of prevention and control programs was 2-3 cases per 1,000 live births (with an estimated 7,500 cases of neonatal GBS disease annually), by active surveillance, the public health authorities identified an important decrease, in the USA. The EOI incidence decreased to 0.5-0.6 cases per 1,000 live births in 1999. Even though the incidence of invasive GBS infections among pregnant women decreased too, LOI incidence remained quite the same. The USA surveillance system has estimated that intrapartum chemoprophylaxis prevented approximately 4,500 EOI cases and saved 225 newborns, per year. Other studies from Australia and Canada described a comparable decline in EOI incidence.

Low incidence of EOI was reported in studies from Italy (0.37 per 1000 live births), The Netherlands (0.32 from 0.54 per 1000 live births), Portugal (0.54 per 1000 live births) etc.

The incidence of EOI in the UK (there is no screening program for GBS) is approximately 0.48-0.6/1000 births, being quite similar to the USA (after universal screening and intrapartum antibiotic prophylaxis).

In order to identify the intrapartum colonization, classical or modern microbiology tools can be used.

We must swab both the lower vagina and rectum (if appropriate explanation is provided, the collection could be performed by the woman, herself). Even without definitive diagnostic importance, the microscopy should be performed for each single sample. In the figure no. 2 we can observe cocci in diplo and in chains and vaginal cells (the lack of inflamatory response is quite suggestive for GBS infection).

We must place both swabs in an enrichment broth for 18-24 hours (35-37°C, 5-10% CO_2). Then, we sub-cultured on blood-agar for 24-48 hours (same conditions). If the enrichment broth is not used, the isolation of GBS could fail. In „Cantacuzino" laboratory we use direct blood-agar plating (Figure no. 3). The beta-hemolytic colonies, bigger that for S. pyogenes or other streptococci (Figure no. 1) are identified (microscopy, biochemical reactions, immunological reactions). In „Cantacuzino" laboratory we use a commercial latex agglutinations test in order to identify the B group (Figure no. 4). Then we test for antibiotic sensitivity (Figure no. 5).

Until recently, the sensitivity to penicillin (P) and ampicillin (AMP) was universally accepted[7,12,33-36], even the reduced sensitivity to P was described since 1994[11,37-38]. In our study, 8 strains were intermediate to P (3.8%).

The treatment of patients with hypersensitivity (allergy) to penicillin and betalactams could become a challenge as the resistance to erythromycin (E), clindamycin (DA) and other molecules is increasing[7,12,35-40].

In order to evaluate the sensitivity of GBS, we have sampled 782 patients who presented themselves for different reasons (including on their own initiative), at the „Cantacuzino" NIRDMI medical laboratory in a seven month period. We have studied the GBS positive samples from 252 patients (33.51%).

We initially considered the results from all female patients (242, 95.6% of all cases). Subsequently, we decided to analyze the data obtained for the 211 people aged 15-49, considered as child-bearing age. The mean as the median age for the studied cases was 32.

The antibiotic sensitivity results are presented in graph no. 1. There were no resistant strains (only intermediate) to penicillin (P), ampicillin (AMP), chloramphenicol (C) and erythromycin (E). The results of the resistance to the studied antibiotics are presented in table no. 1.

The strains studied were sensitive in more than 96.2%, and up to 99.1% for beta-lactams. Resistance phenomenon ranged from 0.9% to 6.8% for the various utilized antibiotics.

The attempt to correlate the phenomenon of sensitivity/resistance to antibiotics with the age groups had no statistical significance.

Ciprofloxacin (CIP) and ofloxacin (OFX) were not tested for all strains, but

there was mainly an alternate testing, either to CIP (136 strains), or to OFX (86 strains); some strains were tested to both quinolones. Out of these, 6 were sensitive to both, whereas 3 were sensitive to OFX but intermediate to CIP.

Neither did the comparative analysis of the values for beta-lactams allow any statistical inference.

Nevertheless, considering the 6 strains intermediate to AMP, one of them was also intermediate to P, while the other 5 were sensitive to P. As for the 8 strains intermediate to P, one was intermediate to AMP as well, while the other 7 were sensitive to AMP.

Most of the strains sensitive to P (97.5%) were also sensitive to AMP (96.5%) within this comparative study (the values differing slightly, but being very close to the values obtained for each antibiotic taken separately).

The stratified analysis for all three beta-lactams leads to some interpretation, even if it does not lend itself to statistical inference. If order to look at the results for the strains with intermediate value to P, as compared to the other 2 beta-lactams, we could examine the table no. 2. In the table no. 3 we can see the results for the strains sensitive to penicillin as compared to the other 2 beta-lactams.

Discussions

It is well known that the highest case fatality in children occurs during the first year of life, most fatalities being registered during the perinatal period (mainly after the onset of labor and 3 days after birth). Infections have an important contribution to this. Group B streptococci and Escherichia coli are known as the most frequent etiology of sepsis in neonates.

Perinatal Group B Streptococcal Diseases (GBSD) represent a public health problem in the EU and the USA. We consider that GBSD are of great concern to the public health sector due to their possible clinical severity and case fatality.

A USA report appreciated that direct medical costs of GBS neonatal disease before the implementation of prevention and control measures were $294 million, annually.

Due to the fact that we have not found any studies regarding the importance of this problem in our country, we analyzed the data provided in

Figure 3

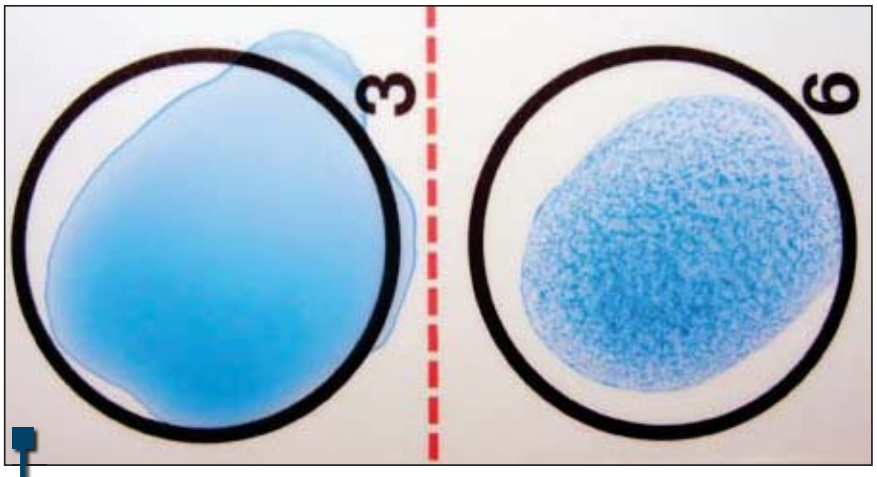


Figure 4

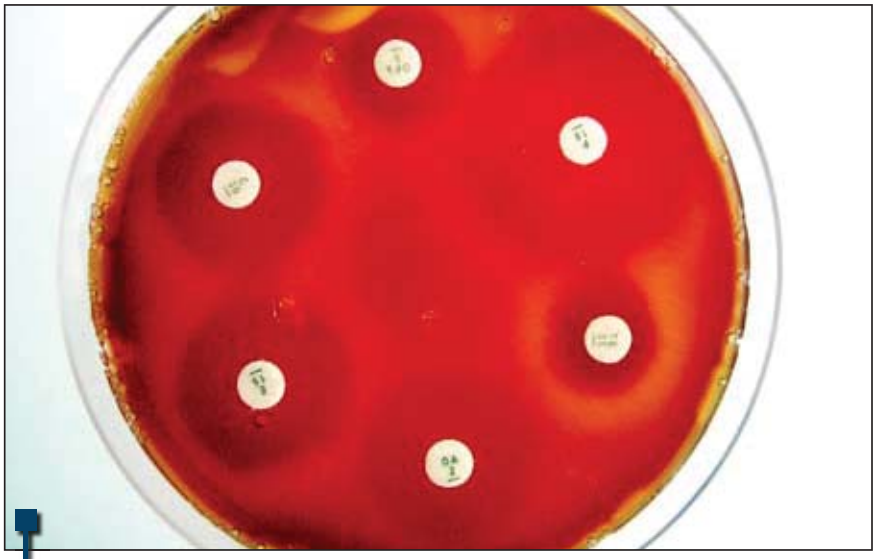
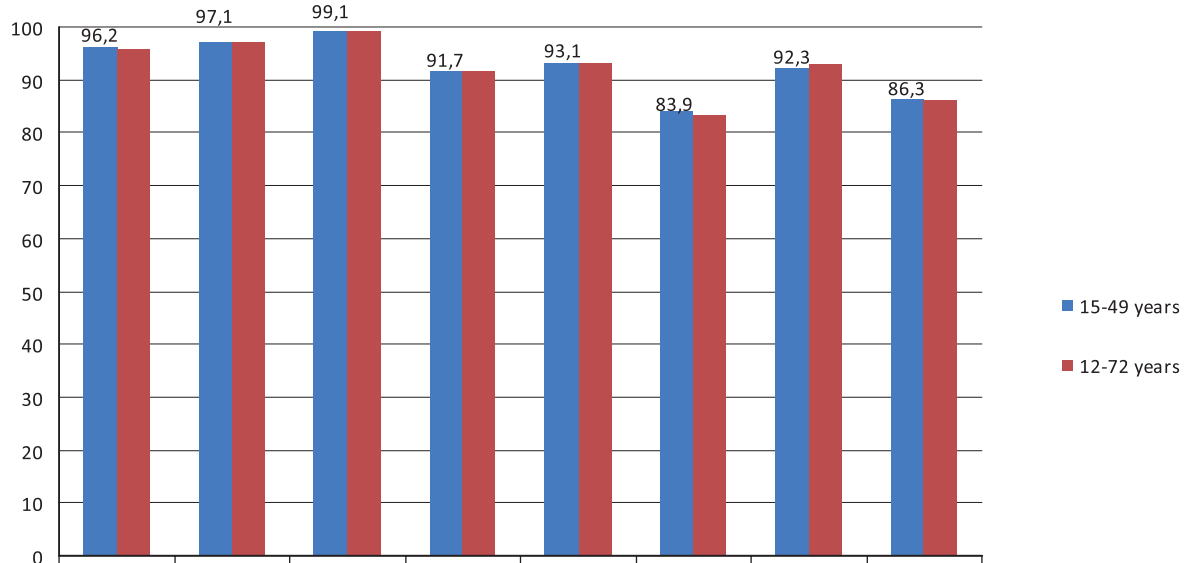


Figure 5

Graph nr. 1 Antibiotic sensitivity of GBS strains isolated from women tested on a 7 months period



	P	AMP	CXM	CIP	OFX	E	DA	C
15-49 years	96,2	97,1	99,1	91,7	93,1	83,9	92,3	86,3
12-72 years	95,8	97,1	99,2	91,8	93,2	83,5	92,9	86,0

Graphic 1. P - Penicillin, AMP - Ampicillin, CXM - Cefuroxime, CIP - Ciprofloxacin, OFX - Ofloxacin, E - Erythromycin, DA - Clindamycin, C - Chloramphenicol

medical literature. We consider that a surveillance system for GBSD in Romania should be established, at least as a sentinel system. We cannot simply extrapolate the data from specialist literature to evaluate the condition in our country. The majority of articles studied mention that introduction of chemoprophylaxis led to a fall in the incidence of EOI.

The culture-based screening approach strategy was more efficient and neonates born to women screened for GBS had a rate of EOI less than half of those born to women not screened; this strategy had better results than the risk-based approach.

Data from the USA surveillance system showed a decrease of EOI from 2-3 cases per 1,000 live births to 0.5-0.6 cases per 1,000 live births, and estimated that intrapartum chemoprophylaxis prevented approximately 4,500 EOI cases and saved 225 new-borns, per year. We can appreciate the USA active surveillance for invasive GBS that is ongoing in a multistate population of approximately 26 million. We value the collaboration between different specialties, professional organizations, public, parent advo-

Table 1

The classification of 211 GBS strains isolated in child-bearing age women according to the sensitivity tested against some antibiotic products

Test sensitivity results	Antibiotics							
	P (%)	AMP (%)	CXM (%)	CIP (%)	OFX (%)	E (%)	DA (%)	C (%)
Sensitive	202 (96.2)	203 (97.1)	209 (99.1)	121 (91.7)	81 (93.1)	151 (83.9)	192 (92.3)	177 (86.3)
Intermediate	8 (3.8)	6 (2.9)	0	11 (8.3)	3 (3.4)	20 (11.1)	5 (2.4)	14 (6.8)
Resistant	0	0	2 (0.9)	0	3 (3.4)	9 (5)	11 (5.3)	14 (6.8)
Total	210 (100)	209 (100)	211 (100)	132 (100)	87 (100)	180 (100)	208 (100)	205 (100)

P - Penicillin, AMP - Ampicillin, CXM - Cefuroxime, CIP - Ciprofloxacin, OFX - Ofloxacin, E - Erythromycin, DA - Clindamycin, C - Chloramphenicol
Cochran Chi Square = 79.3; p-value: <0.0000001
The distribution of the test sensitivity results is significantly different according with/ to the antibiotic product

cacy groups in order to elaborate and make publicly available recommendations for intrapartum prophylaxis to prevent perinatal GBS (Box no. 1). Authors from Portugal stated that GBS prophylaxis based only on risk factors would leave 78% of term babies who will present with EOI untreated.

All authors consider that LOI incidence remained unmodified, despite prevention and control program implementation.

The laboratory diagnosis, starting from correct collection and process of specimens, the use of enrichment or selective media for isolation etc., have a critical role in successful implementation of the screening policy.

Until recently, GBS was sensitive to penicillins and other beta-lactams. Even if strains intermediate to penicillin were identified in the last 10-15 years, penicillin G is still the drug of choice, once the diagnosis is certified. In neonatal sepsis or meningitis without etiologic diagnosis, the treatment should start with a combination of penicillin/ampicillin and an aminoglycoside. For patients with penicillin hypersensitivity there is a need to test for erythromycin and clindamycin susceptibility, as the resistance to these molecules has increased.

Cases of GBS disease continue to occur despite prevention and control strategies. Inaccurate screening results, improper implementation of intrapartum chemoprophylaxis, or antibiotic failure may contribute to this persistence.

There is no surveillance system for GBS infections in Romania. There are no statistical data at a national level regarding invasive infections with GBS. No clinical guidebooks have yet been published on this subject in Romania. The "Cantacuzino" NIRDMI will publish a guideline for prevention of neonatal infections.

Due to the specific of the journal, we did not detail the methods used in microbiological diagnosis of GBSD or the methods used in testing for antibiotic susceptibility. Even though the information obtained cannot be extrapolated for the national level, the results obtained after the isolation and antibiotic sensitivity testing for the strains of GBS infected females represents an important guide for the situation of our country. Searching through the 4,313 articles posted on Pub Med/Medline in the last few years, we have not found articles of statistical relevance that describes the antibiotic resistance situation of GBS strains isolated from female patients. In the 1979-1998 there were 8 Romanian articles published on GBS, out of which 2 touch on the problem of antibiotic susceptibility, although they use a small number of isolated strains (about 30). The latest article, published in 2008 studied strains of GBS isolated from urinary infections. As we mentioned earlier (Table no. 1), in our study of female patients with ages between 15-49 we have identified strains intermediate to penicillin (8, 3.8%), in accordance with the data in the specialist literature. The majority of strains were sensitive to penicillin (96.2%), ampicillin (97.1%) and cefuroxime (99.1%). The sensitivity to quinolones was over 91.7%. We identified relatively few strains resistant to erythromicin (5%), clindamycin (5.3%), and chloramphenicol (6.8%), comparing to medical literature. Stratified analysis for the 3 betalactam drugs is presented in tables 2 and 3 and merits study.

Table 2

Results for the GBS strains with intermediate value to P (N=8), as compared to the AMP and CXM

CXM		AMP I	AMP S	Total
R		0	1	1
	>	0.0%	100.0%	> 12.5%
		0.0%	14.3%	
S		1	6	7
	>	14.3%	85.7%	> 87.5%
		100.0%	85.7%	
Total		1	7	8
		12.5%	87.5%	

S = sensitive
R = resistant
I = intermediate

	Chi-Square	P-value
Yates corrected:	1.47	0.22544232

Distribution of the test sensitivity results it is not significant different according with the antibiotic product

A weakness for our article is the lack of available national data, to compare with. We can assume, but we can not extrapolate the information from international literature to our country's situation.

Our study does not allow commentary regarding the pathology associated with GBS. Practically, we obtained data that could be obtained analyzing any specimen that was positive for GBS, regardless of the laboratory method used, the specific illness of the patient or their age group.

Another limit is that we did not perform an exhaustive analysis of the articles published in the medical literature. We consider this to be an important subject and recommend that a meta-analysis be performed, involving members of the academic community (including students), clinicians, microbiologists, specialists in public health. The Romanian study on the subject could be the starting point for the write-up of a national research project, which can then be extended perhaps, by means of international cooperation. There is a need of more international involvement of Romanian researchers, in this field.

Our study presents some technical limitations stemming from the fact that we did not utilize enrichment broth and

Table 3

Results for the GBS strains with sensitivity to P (N=200), as compared to the AMP and CXM

CXM		AMP I	AMP S	Total
	R	0	1	1
	>	0.0%	100.0%	0.5%
		0.0%	0.5%	
	S	5	194	199
	>	2.5%	97.5%	99.5%
		100.0%	99.5%	
	Total	5	195	200
		2.5%	97.5%	

S = sensitive
R = resistant
I = intermediate

	Chi-Square	P-value	
Yates corrected:	9.30	0.00228788	<---

Distribution of the test sensitivity results it is significant different according with the antibiotic products

selective media, which can significantly raise the rate of positive results (252/782; 33.51%). The fact that in the workup towards a positive diagnosis we did not use all of the types of tests available for identification is not necessarily a limitation. Still, it would have been useful to employ not only the standard disc diffusion antibiotic test, but also techniques that determine the minimum inhibitory concentration, at least for a part of the drugs tested. Another limitation is represented by the fact that in our evaluation we did not use the same battery of antibiotics for each single case. To overcome the limitations mentioned and to obtain data of national significance, apart from the public health studies already proposed, we consider necessary the to develop a research project based on a very good collaboration between clinic and laboratory, with the establishment of a relevant database, regarding the application of diagnostic and sensitivity testing methods that are standardized or in the process of being standardized at an European or global level.

For the reasons already discussed above we cannot present a great number of differences between our study and others presented in international specialty literature. There are a series of differences of opinion regarding the strategic handling, prevention and control of GBS infections at a global level. The results obtained regarding the sensitivity/resistance of the strains isolated represents a solid starting point of both practical - because relevant in the choice of adequate treatment- and theoretical importance, as it can be a starting point in the realization of studies with national relevance as well as in an international context. Such studies can support and have a practical importance. Our country will be able to offer useful results to the other EU countries or at a global level. The lack of published clinical and procedural guidelines in our country represents a drawback to clinicians. A first step in this direction would be to centralize available data for Romania and urge local centers, experienced clinicians, hospital and laboratory staff to provide a continuous flux of information for the development of efficient, statistically backed measures to reduce GBSD as well as other diseases.

We still don't have answers for a series of questions, for example: Why is the incidence of EOI in the UK, where no prevention and control program is applied, so close to the value of incidence in the US, where experience in prevention and control is almost 2 decades long?

Other questions that are still left unanswered are: What will be the efficiency/efficacy of intrapartum chemoprophylaxis, in which the drugs would be administered orally and not by intravenous/intramuscular injection or drip? What will be the evolution of GBS strains and what will be the level of resistance after the pressure exerted upon them by chemoprophylaxis? Will there be any large-scale adverse effects recorded, following the application of these strategies? What would be the result of applying prevention and control strategies similar to those for GBS to other bacteria involved in neonatal infections?

It is a real challenge to implement universal screening in all prenatal health care settings by promoting use of guidelines for prevention of GBSD, and to monitor potential adverse consequences of increased antibiotic usage.

To answer these questions, supplementary studies are necessary, based on representative samples which would imply important costs.

We assume that the important problem of EOI could be solved by immunization, not only by chemoprophylaxis. Immunization against GBS is feasible. If vaccination becomes available, it will prevent EOI and LOI sepsis as well as the pressure for antibiotic resistance. This could be cost-effective, durable and would prevent antimicrobial resistance. The most difficult issue is the decision of pharmaceutical companies to seriously tackle the vaccine production issue (at all levels).

In 2008, the European Commission Framework Seven project (HEALTH-F5-2007-200481) started, having as a title „Development of a Vaccine Against Neonatal Infections" (DEVANI). Its aim is to provide useful information for the development of a vaccine against neonatal infections caused by GBS. Public Health Institutes and Universities from Belgium, Bulgaria, Czech Republic, Denmark, Germany, Italy, Spain, and the United Kingdom are all participating in the project.

Until effective vaccines against GBS are available for clinical use, development and implementation of rapid and sensitive techniques (e.g. PCR or Real-time PCR) for screening of GBS

Box no. 1. CDC recommendations for the prevention of GBS disease (Schrag S, Gorwitz R, Fultz-Butts K, Schuchat A, Prevention of perinatal group B streptococcal disease. Revised guidelines from CDC. MMWR Recomm. Rep., 2002, 51: 1-22)

- All pregnant women should be screened at 35-37 weeks gestation for vaginal and rectal GBS colonization. At the time of labor or rupture of membranes, intrapartum chemoprophylaxis should be given to all pregnant women identified as GBS carriers. Colonization during a previous pregnancy is not an indication for intrapartum prophylaxis in subsequent deliveries.
- Women with GBS isolated from the urine in any concentration during their current pregnancy should receive intrapartum chemoprophylaxis. Prenatal culture-based screening at 35-37 weeks' gestation is not necessary for women with GBS bacteriuria. Women with symptomatic or asymptomatic GBS urinary tract infection detected during pregnancy should be treated according to current standards of care for urinary tract infection during pregnancy.
- Women who have previously given birth to an infant with invasive GBS disease should receive intrapartum chemoprophylaxis (without prenatal culture-based screening).
- If the result of GBS culture is not known at the onset of labor, intrapartum chemoprophylaxis should be administered to women with any of the following risk factors: gestation <37 weeks, duration of membrane rupture >18 hours, or a temperature >38.0°C. Women with known negative results from screening cultures within 5 weeks of delivery do not require prophylaxis to prevent GBS disease even if any of the intrapartum risk factors develop.
- Women with threatened preterm (<37 weeks gestation) delivery should be assessed for need for intrapartum prophylaxis to prevent perinatal GBS disease. An algorithm for management of women with threatened preterm delivery is provided by CDC (7).
- Culture techniques that maximize the likelihood of GBS recovery are required for prenatal screening. Collection of specimens for culture may be conducted in the outpatient clinic setting by either the patient, with appropriate instruction, or health-care provider (see other technical explanation in the document).
- If susceptibility testing is ordered for penicillin-allergic women, specimen labels should also identify the patient as penicillin allergic and should specify that if GBS is isolated, it should be tested for susceptibility to clindamycin and erythromycin (see other technical explanation in the document).
- Laboratories should report culture results and susceptibility testing results to the anticipated site of delivery and to the health-care provider who ordered the test.
- Health-care providers should inform women of their GBS screening test result and the recommended interventions.
- It is not recommended to treat GBS colonization.
- GBS-colonized women who have a planned cesarean delivery performed before rupture of membranes and onset of labor are at low risk for having an infant with early-onset GBS disease. These women should not routinely receive intrapartum chemoprophylaxis.
- For intrapartum chemoprophylaxis, the following regimen is recommended for women without penicillin allergy: penicillin G, 5 million units intravenously initial dose, then 2.5 million units intravenously every 4 hours until delivery. Because of its narrow spectrum of activity, penicillin is the preferred agent. An alternative regimen is ampicillin, 2 g intravenously initial dose, then 1 g intravenously every 4 hours until delivery.
- Intrapartum chemoprophylaxis for penicillin-allergic women takes into account increasing resistance to clindamycin and erythromycin among GBS isolates. History of penicillin allergy should be assessed to determine whether a patient is at high risk for anaphylaxis. Women who are not at high risk for anaphylaxis should be given cefazolin, 2 g intravenously initial dose, then 1 g intravenously every 8 hours until delivery. For women at high risk for anaphylaxis, clindamycin and erythromycin susceptibility testing, if available, should be performed on isolates obtained during GBS prenatal carriage screening. Women with clindamycin - and erythromycin- susceptible isolates should be given either clindamycin, 900 mg intravenously every 8 hours until delivery; OR erythromycin, 500 mg intravenously every 6 hours until delivery. If susceptibility testing is not possible, susceptibility results are not known, or isolates are resistant to erythromycin or clindamycin, the following regimen can be used for women with immediate penicillin hypersensitivity: vancomycin, 1 g intravenously every 12 hours until delivery.
- Routine use of antimicrobial prophylaxis for newborns whose mothers received intrapartum chemoprophylaxis for GBS infection is not recommended. However, therapeutic use of these agents is appropriate for infants with clinically suspected sepsis. An updated algorithm for management of infants born to mothers who received intrapartum chemoprophylaxis for GBS infection is provided by CDC.
- Local and state public health agencies, in conjunction with appropriate groups of hospitals, are encouraged to establish surveillance for early-onset GBS disease and to take other steps to promote perinatal GBS disease prevention and education to reduce the incidence of early-onset GBS disease in their states. Efforts to monitor the emergence of perinatal infections caused by other organisms are also encouraged.

status, and antibiotic susceptibility at presentation may help prevent additional cases of invasive GBS disease.

Conclusions

1. Perinatal Group B Streptococcal Disease still represents an important public health problem at an international level and should be taken into consideration in our country as well. Antibiotic susceptibility of Group B Streptococcal strains in women of child-bearing age should be known.

2. To understand what the situation of this pathology is in our country, we consider the establishment of a surveillance system for invasive GBS infections necessary, at least as a sentinel system.

3. The diagnosis and testing of the sensitivity to antibiotics of a GBS strain is not difficult, but the results are reliable only when there is good clinician-microbiologist collaboration, and the microbiological methods, starting with sample collection and processing, are strictly applied.

4. Studies of theoretical and practical importance, as are those mentioned in the discussion section, are necessary. It is imperative that Romania participate in international studies relevant to this field.

5. The majority of the strains that we studied were sensitive to penicillin (96,2%), ampicillin (97.1%) and cefuroxime (99.1%). The sensitivity to quinolones was over 91,7%. We identified relatively few strains resistant to erythromicin (5%), clindamycin (5,3%), chloramphenicol (6,8%), in comparison with medical literature.

6. It is necessary to establish a set of practical guides for the prevention and control of neonatal infections and to have a clinical guidebook / on this topic published.

7. Cases of GBS disease still occcur, despite prevention and control strategies. Until the development of a vaccine that could be of clinical use, we have at our disposal the diagnostic, prevention and control strategies implemented at a global level in the last 20 years. ■

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