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Microbial infection and colonization in pregnant women and newborns

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Microorganisms capable of interfering with the reproductive function of women

- The **top microorganisms** involved in UGT infections, and considered as causes of female cervicitis, PID, infertility, and preterm delivery are:
  - ***C. trachomatis***
  - ***N. gonorrhoeae***,
  - bacterial vaginosis (***Gardnerella vaginalis*** infections)
  - ***Ureaplasma urealyticum*** and ***Mycoplasma hominis***
- An important role in female infertility: ***Treponema pallidum***, ***Candida*** spp., ***Cytomegalovirus, Trichomonas vaginalis, Toxoplasma gondii,*** etc.
- ***GNB, GPC:*** some other **causes of the acute inflammatory diseases of the UGT, in infertile, pregnant women or neonate infections**.

INFECTIONS OCCURRING AROUND THE TIME OF BIRTH

Effects on the foetus and neonate

- **Viral infections**
  - **(rubella, CMV)** - less damaging to the foetus when maternal infection takes place late in pregnancy,
  - but **varicella-zoster virus** at this time can lead to limb deformities and other severe lesions in the newborn.

- **Bacterial infections** (**group B streptococci, *E. coli, Klebsiella, Proteus, Bacteroides,* staphylococci, *Mycoplasma hominis)*** originating from the vagina and perineum are more important,
  - occurring especially when **foetal membranes have been ruptured** for more than 1-2 days, and resulting in **chorioamnionitis, maternal fever, premature deliver**
  - Or acquired **after delivery**, giving **later onset disease**.
  - infants of **low birth weight** (less than 1500g) tend to be more severely effected
  - **Neonatal septicaemia often progresses to meningitis** – frequently fatal unless treated.
  - **Clinical diagnosis is difficult because the infant shows generalized signs:** respiratory distress, poor feeding, diarrhoea and vomiting, but early diagnosis is essential and requires **emergency treatment**.

Miscellaneous neonatal infection

- Infection may reach the newborn infant **during the first week or two after birth**, rather than during delivery.
- **Group B beta-haemolytic streptococci and GNB can still cause serious infection at this time, often with meningitis**.
- **Herpes simplex may come from cold sores** of attending adults.
- During the **first week or two of life the nose of the neonate becomes colonized with *S.aureus*** which can enter the nipple during feeding to cause a breast abscess. These infections are preventable when hospital staff pay vigorous attention to **hand washing and aseptic techniques**.
- In developing countries:
  - The umbilical stump, may by infected with ***Clostridium tetani,*** *r*esulting in neonatal tetanus.
  - Gastroenteritis with ***E. coli, Salmonella*** etc., rather than **rotaviruses**
    - an important problem during the neonatal period as well as during infancy.
    - diarrhoea leading to water and electrolyte depletion is particularly serious in low birth weight infants.
    - breast feeding gives some protection by supplying specific antibodies and other less well-characterized protective factors.

Effects on the mother

- **Puerpural sepsis** was a **major cause of maternal death in Europe** in the **19th Century**.
- In 1843 **Oliver Wendell Holmes** made the unpopular suggestion that it was carried on the hands of doctors,
- and four years later **Ignaz Semmelweiss in Vienna** showed how it could be prevented if doctors washed their hands before attending a woman in labour and practised aseptic techniques.

Effects on the mother

- Major culprits for puerperal sepsis were:
  - **Group A beta-haemolytic streptococci** ,
  - Other possible organisms include anaerobes such as ***Clostridium perfringens*** or ***Bacteroides, and E. coli***.
- The streptococci came from the nose, throat or skin of hospital attendants whereas the others were derived from the mother's own faecal flora.
- Puerpural sepsis, which carried up to 10% mortality until the 1930s, is now, like septic abortion, **less common in developed countries**.
- **Predisposing factors include:**
  - **premature rupture of the membranes,**
  - **instrumentation**
  - **and retained fragments of membrane or placenta.**
- Where there is **postnatal pyrexia or massive discharge**, **high vaginal swabs and blood cultures should be taken.**

Infections in newborns

- Remain one of the most significant problems in modern medicine
- **Once the foetus is infected it is susceptible**.
  - Its immune defences are poor;
  - **IgM and IgA antibodies are not produced in significant amounts until the second half of pregnancy**
  - and **cell-mediated immune responses are poorly developed or absent**, with inadequate production of the necessary cytokines,
  - **The newborn's microbiome** contributes to the development of its immune system,
  - **Antibiotics administered during pregnancy alter the microbiome and may influence disease risks in newborns.**

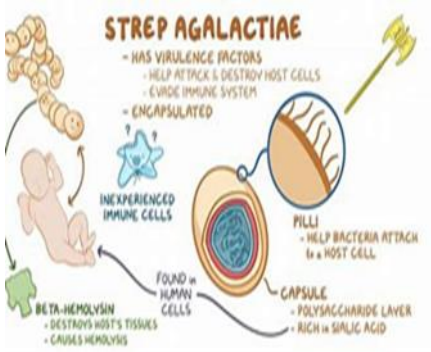
Vaginal colonization with bacteria that can cause infections in newborns

E.coli, Klebsiella cervical colonization

- **The predominant flora in the vagina** is represented by *Lactobacillus* and *Streptococcus* spp.;
- However, **the presence of other bacteria** such as ***E. coli, Klebsiella* spp.** can be very important, although not necessarily synonymous with infection.
- ***E. coli* in the vagina can cause symptomatic or a symptomatic infections and is associated with neonatal sepsis**. These strains possess **several virulence factors that allow vaginal and/or endocervical colonization**.
- *E. coli* - **important cause of neonatal respiratory tract infections** and is associated with **high mortality**,
- High prevalences of ***Klebsiella* ESBL** colonization that can be transmitted to newborns at birth have also been reported.
- **Maternal-to-newborn transmission** of *E. coli :*
  - **can cause early infections in newborns**
  - **can occur:** after infection of the amniotic fluid, after rupture of membranes, or during the passage of the newborn through the vaginal canal during birth.

S.aureus and group B streptococcus cervical colonization

- ***E. coli* and group B streptococcus** are cited as the two **most frequent bacteria isolated from neonates with sepsis or meningitis**
- **Neonates born at preterm gestational ages** are more likely to develop neonatal sepsis and meningitis
- **The rates of vaginal colonization with *Staphylococcus* spp.** range from 5 to 26% and there is **increasing incidence of infections in pregnant women as well as neonates caused by these organisms**
  - ***S. aureus* is more prevalent in vaginal tract of pregnant women when compared to the other species**



THE STUDY OF MICROBIAL INFECTIONS/COLONIZATION DURING PREGNANCY

Material and method

- This is an observational, retrospective study which included **all strains isolated from pregnant women hospitalized in our hospital, due to any infectious disease** between **01.09.2021-01.09.2022 during one-year period**

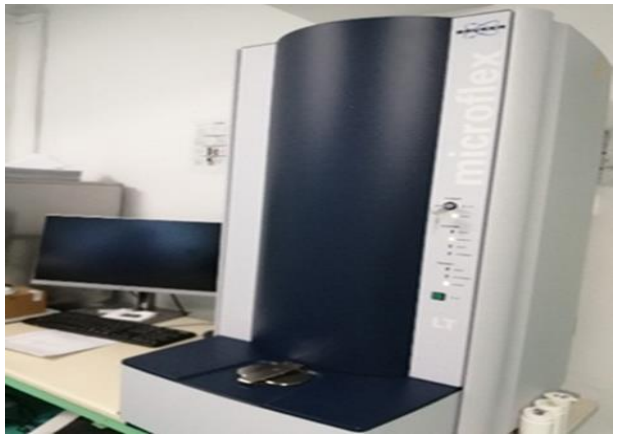
- "Pius Brinzeu" Clinical County Emergency Hospital Timișoara (SCJUPBT), is a tertiary medical care unit with 1,174 beds, of which 82 beds are in Obstetrics-Gynecology Departments.

- Microbial Identification - with the help of **MALDI-TOF**

- Antimicrobial sensitivity tests - with the help of **VITEK system** with MIC determination (2021 CLSI standards)

- Genes identification with **Unyvero system** in one case of newborn BSI

Existing Microbiology Lab facilities/Microbiological diagnosis



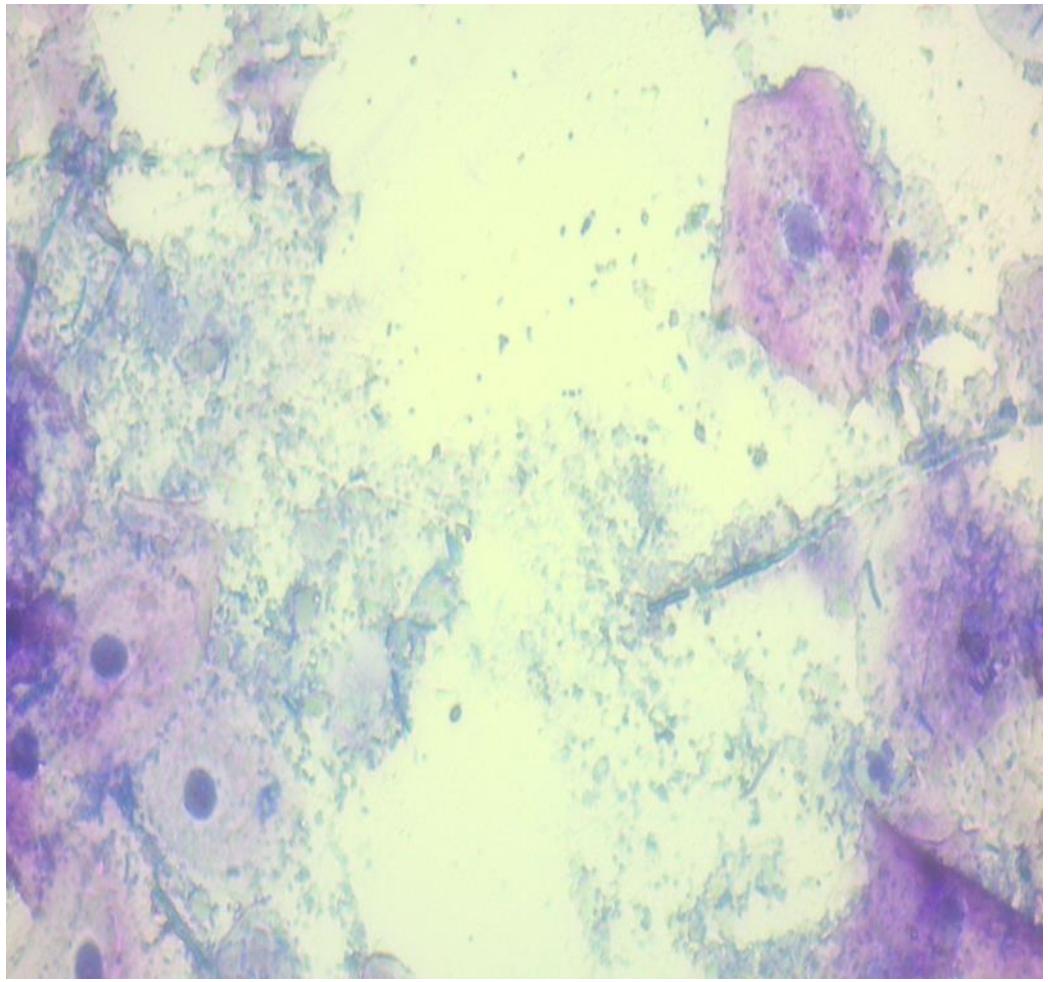
Material and method

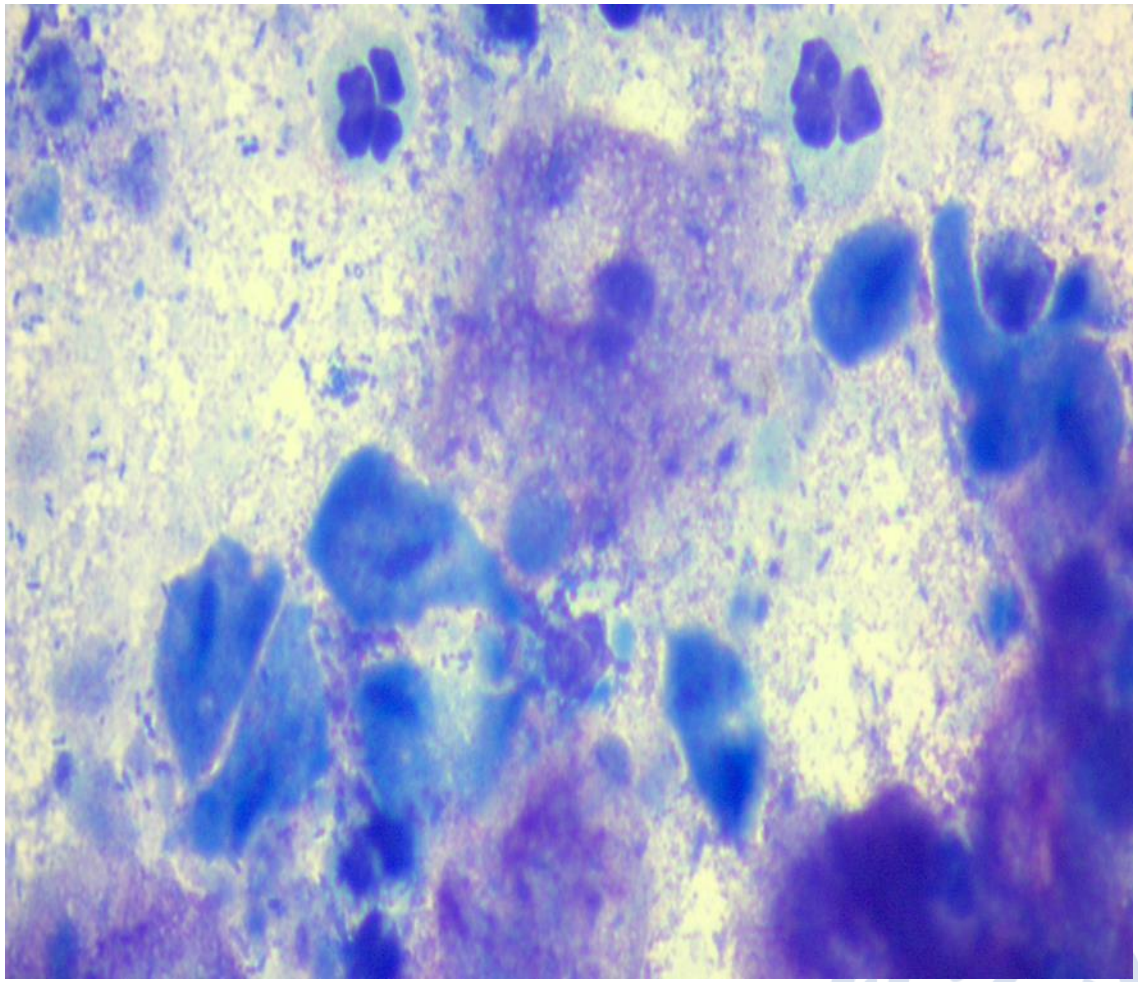
- During 01.09.2021-01.09.2022
- 260 pregnant women under medical follow-up were monitored for:
  - **Maternal diseases**: hypertension, kidney diseases, thyroiditis, anemia, etc.
  - **Maternal diseases associated with pregnancy**: preeclampsia, pathological pregnancy, placenta praevia

Total nr of patients from OG	Pregnant women	Gynecology Patology
506	260	246
%	51.38	48.62

Samples	Cervical samples	Urine cultures	Amniotic fluids	Peritoneal fluids	Wound secretions	Sputum
275	250	15	3	2	4	1

Microscopical examination: from our own collection: Zeiss Primo Star microscope with digital video camera





Microscopical examination: from our own collection:
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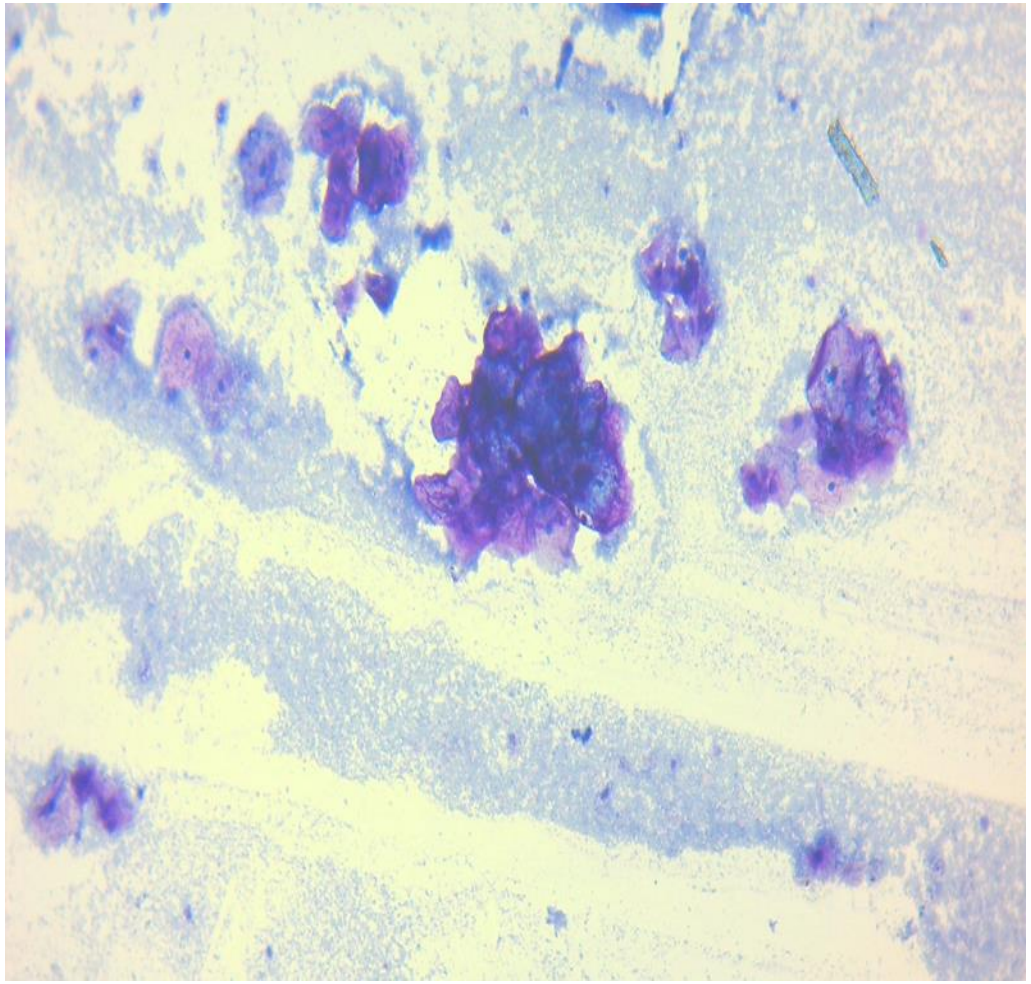

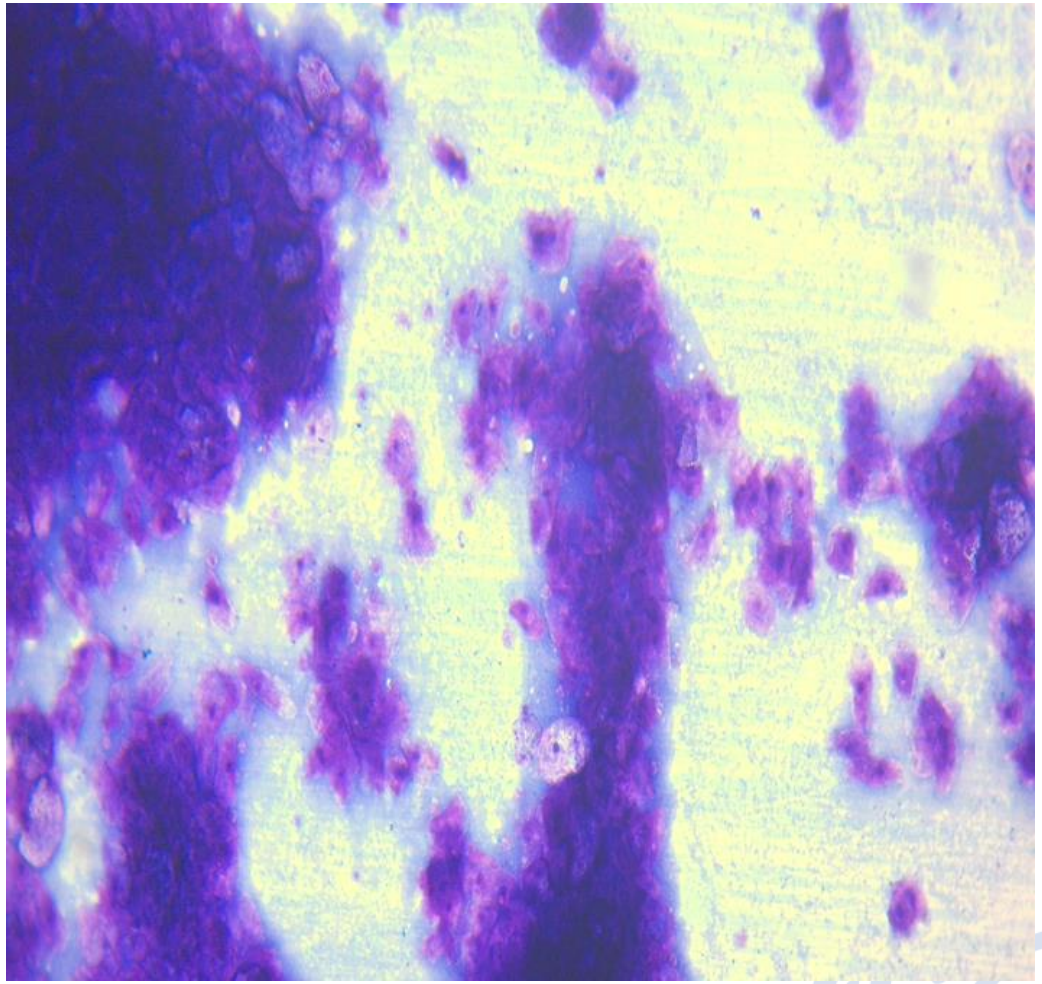

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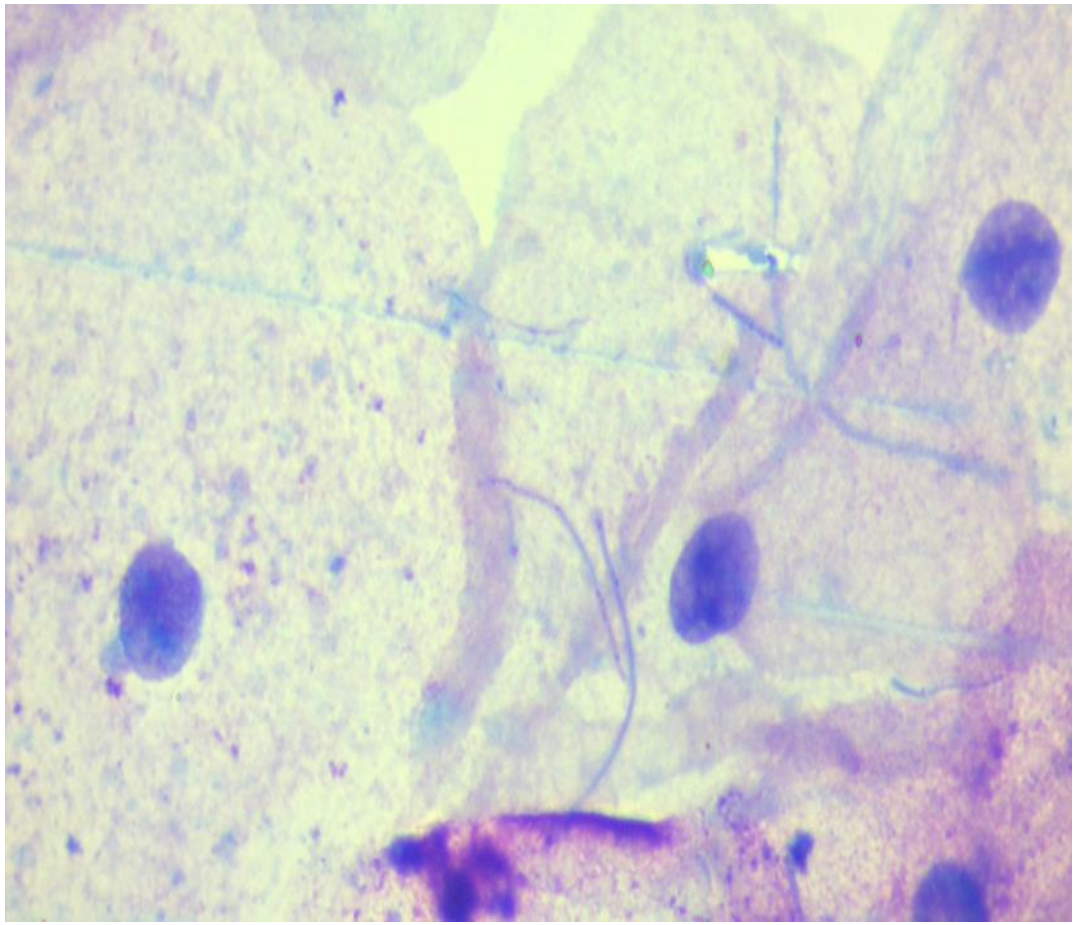
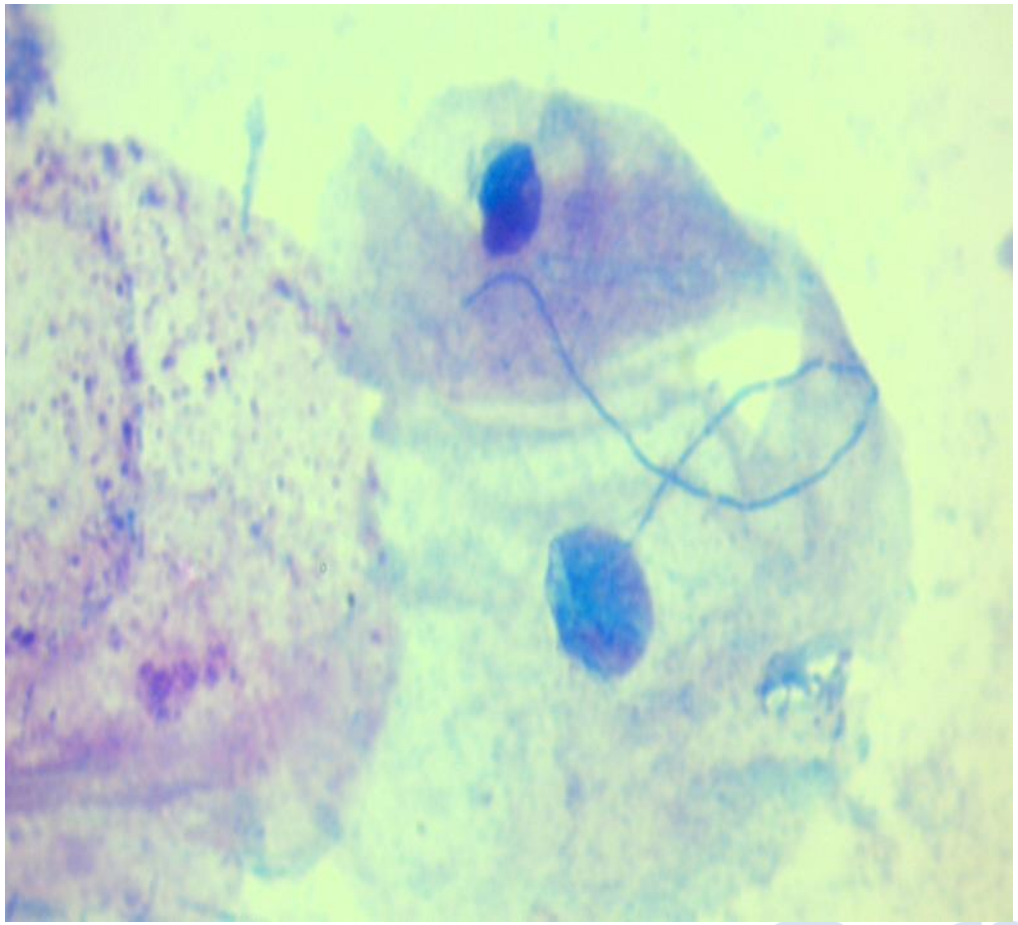
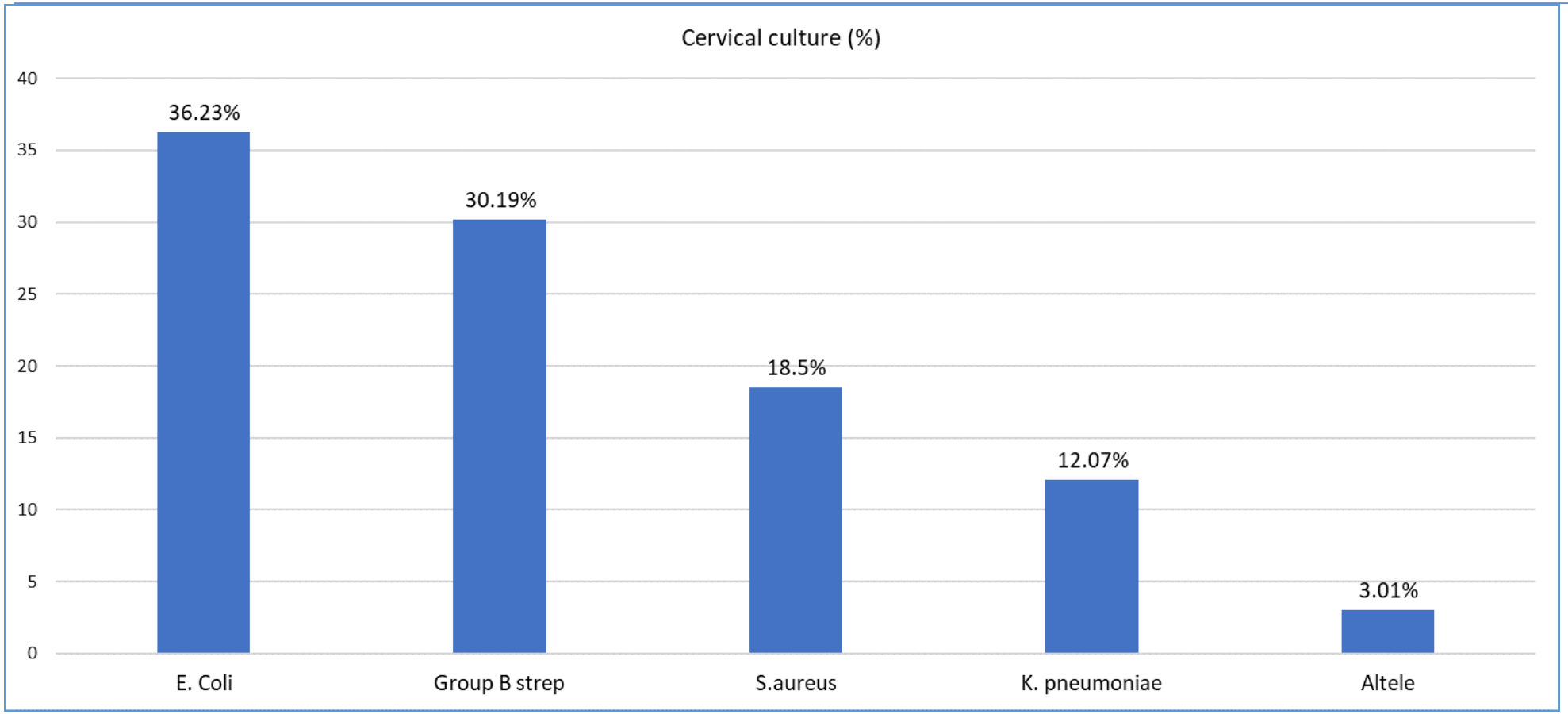




Microorganisms and their AMR patterns from clinical samples (other then cervical)

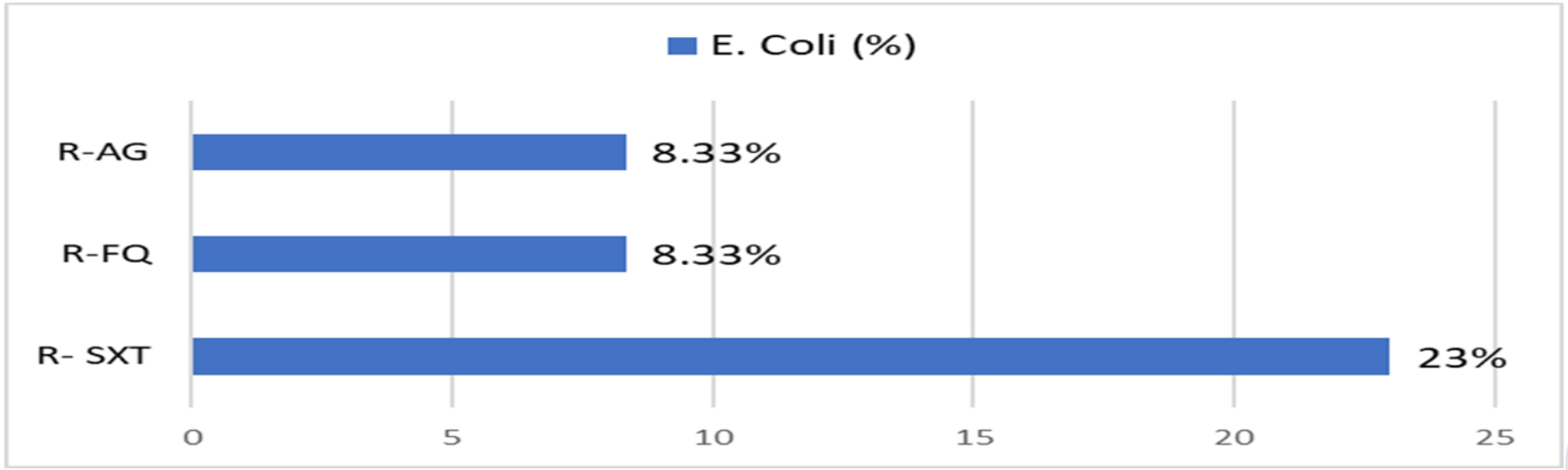
Sample	nr	Microorganisms (N)	Resistance phenotypes	Diagnosis/treatement
Urine	15	***E.coli* (13)** Strepto group B (1) *Enterococcus* spp (1)	**1 ESBL *E.coli***	UTI
Amniotic fluid	3	*S. epidermidis* (1) *S. lugdunensis* (1) *E. faecalis* (1)	Without acquired resistance phenotypes	-
Peritoneal fluid	2	S1. *P. aeruginosa* and *A. baumannii* S2 – *S. aureus*	***A. baumannii* (CR)** *S.aureus* -– BL producing phenotype	**Post cesarean complications solved by total hysterectomy**
Sputum	1	*C. albicans*	-	SARS-Cov 2 infection
Wound secretions	4	*S. aureus* (2) *Klebsiella* spp. (2)	*S. aureus* (BL/ MLSB) ***Klebsiella* spp (CASE)**	**post caesarean section**

Microorganisms from cervical samples: 250



E.coli

E. Coli	Abortion	Premature birth	Ectopic pregnancies	Pregnancy in evolution/full-term
96	33	8	7	48
%	**34.37%**	8,33%	7.29%	**50%**



Group B streptococcus

Group B strep	Abortion	Premature birth	Ectopic pregnancies	Pregnancy in evolution/full-term
80	12	4	4	60
%	15%	5%	5%	**75%**

Group B strep	R- Te	MLSB	R- FQ	R - P	MDR
80	49	20	9	6	22
	61.25%	25%	11.25%	7.5%	**27.16%**

- **27% (22) of the strains were MDR phenotype, associating Resistance to BL / FQ / MLSB).**
- These **MDR strains** were identified from **pregnant women in 7-19 weeks** of pregnancy, in the stage of imminent abortion or metrorrhagia.

S.aureus

S. aureus	Abortion	Premature birth	Ectopic pregnancies	Pregnancy in evolution /full-term
49	6	5	1	38
%	12.24%	10.20%	2.04%	**75.51%**

S. aureus (%)	B-lactamase	MRSA	MLSB	R - M	R-FQ	R - SXT	MDR
Nr.	22	15	13	13	5	5	19
%	44.89%	**30.61%**	26.53%	26.53%	10.2%	10.2%	**38.77%**

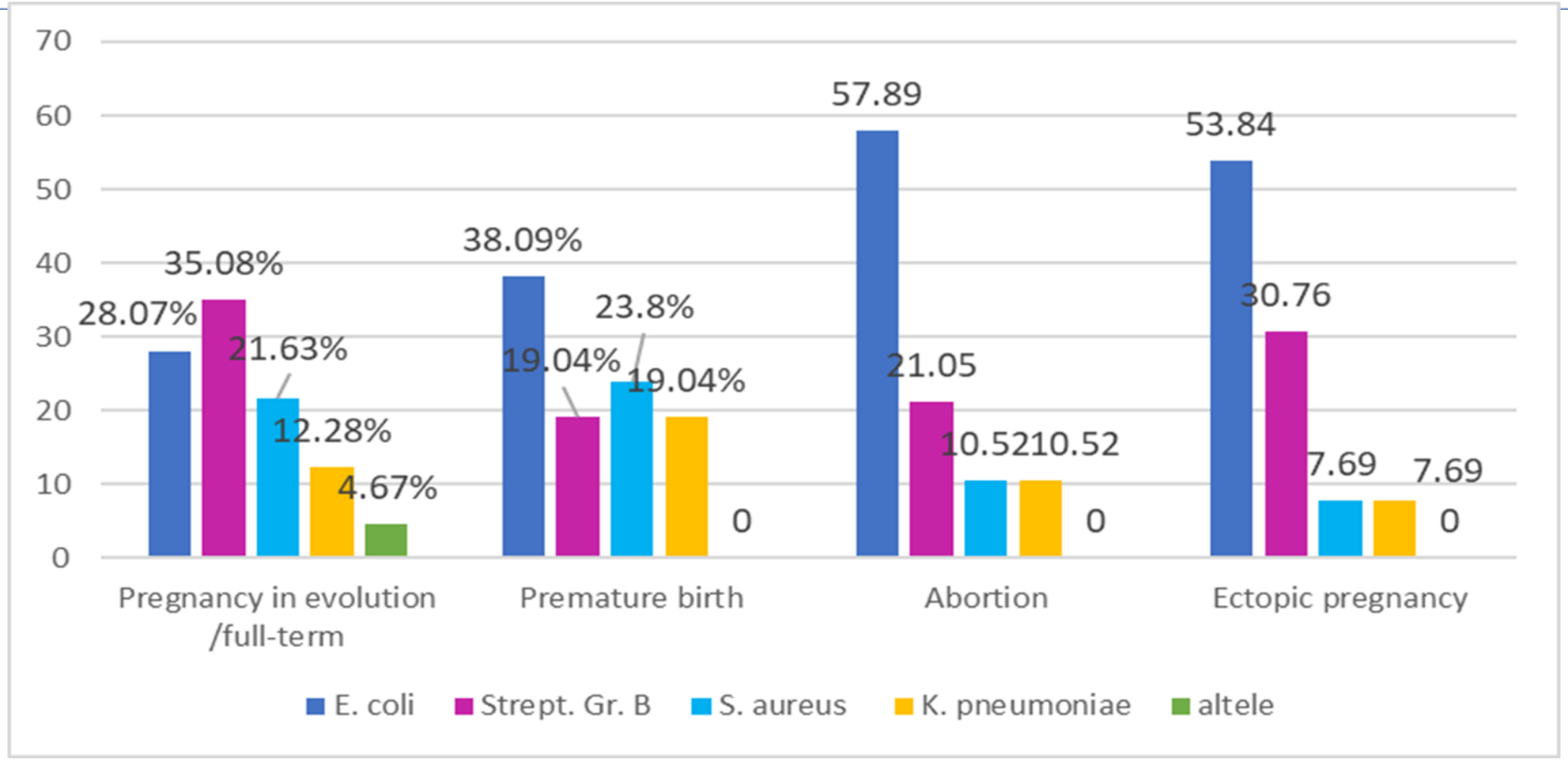
- **30.61% of the strains were MRSA and 38.77% were MDR phenotype, associating Resistance to BL/ FQ / MLSB.** Of the pregnant women with **MRSA, approximately 1/4 were hospitalized for abortion** in progress or imminent abortion and the rest, **3/4, for monitoring/delivery**.

K. pneumoniae

K.pneumoniae	Abortion	Premature birth	Ectopic pregnancies	Pregnancy in evolution /full-term
32	6	4	1	21
%	**18.75%**	12.5%	3.12	**65.62%**

K. pneumoniae	ESBL	FQ-R	SXT-R	AG-R	MDR
32	2	2	5	1	1
%	6.25%	6.25%	15.62%	3.12%	3.12%

Comparative presentation of pathogens/ pathology (%)



Blood culture result in a newborn with XDR *A. baumannii*

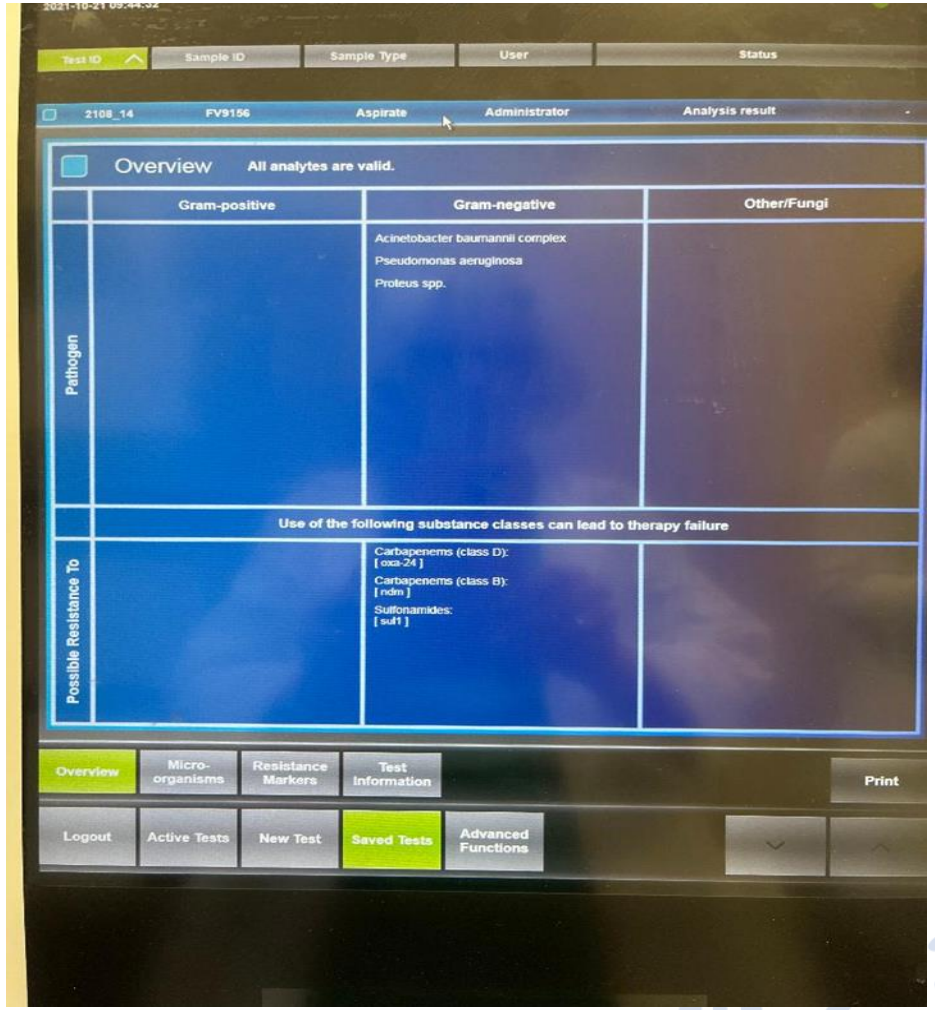
VITEK

Antibiograma AST-N222*

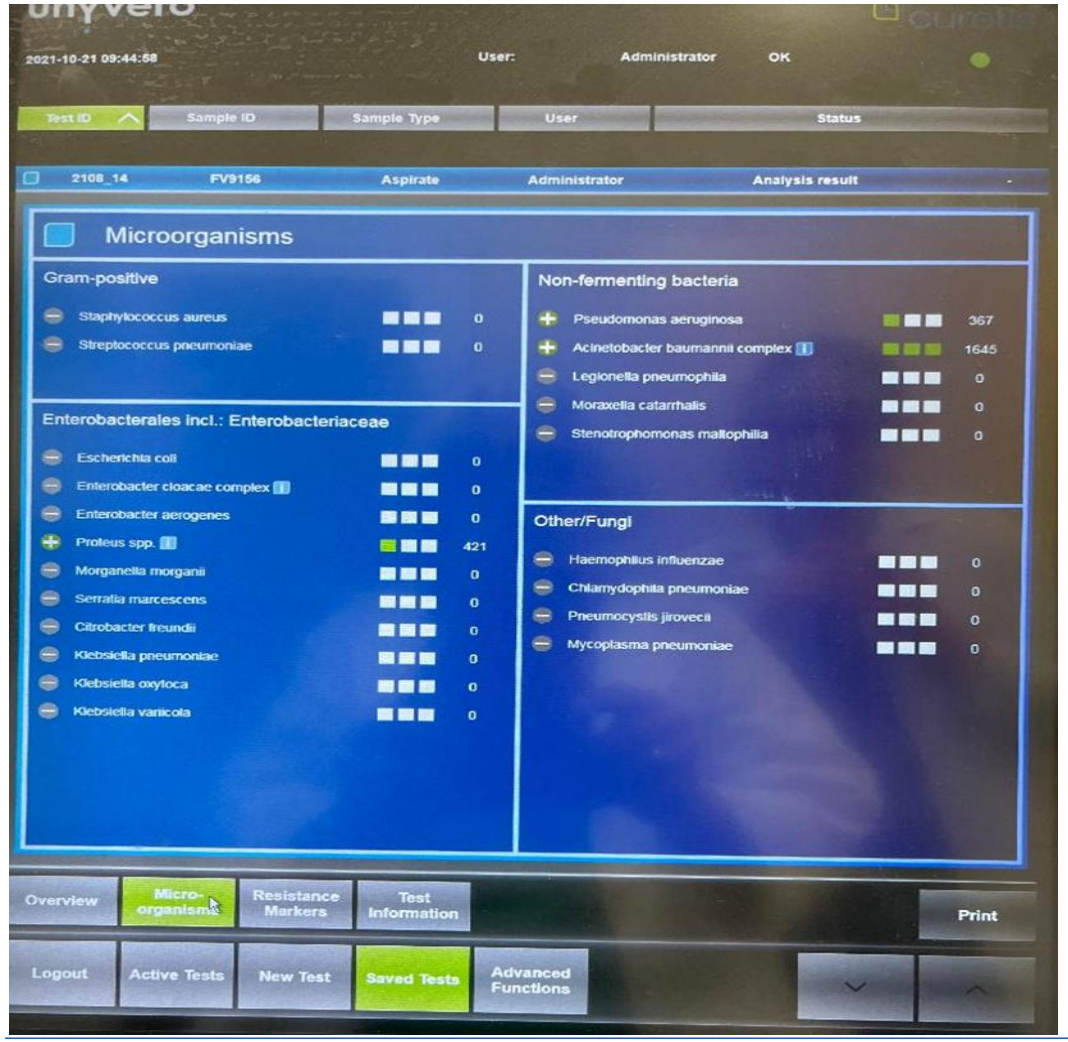
Metoda de lucru:

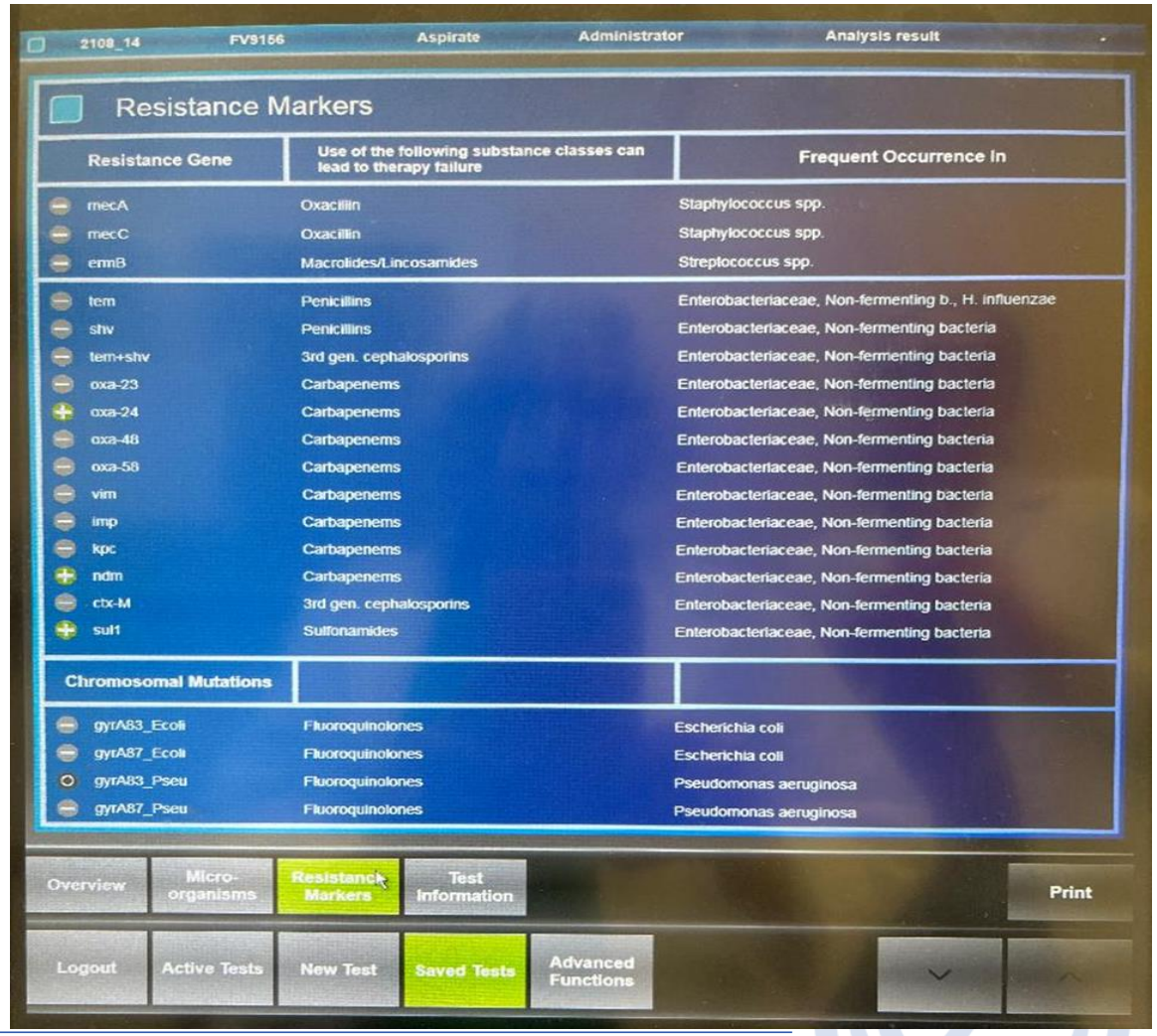
Denumire organism **Acinetobacter baumannii complex**

Sensibil		
Minocycline - CMI:<=1		
Intermediar		
Colistin - CMI:<=0.5		
Rezistent		
Ticarcillin - CMI:>=128	Ticarcillin/Clavulanic Acid - CMI:>=128	Piperacillin - CMI:>=128
Piperacillin/Tazobactam - CMI:>=128	Ceftazidime - CMI:>=64	Cefepime - CMI:>=64
Imipenem - CMI:>=16	Meropenem - CMI:>=16	Gentamicin - CMI:>=16
Tobramycin - CMI:>=16	Ciprofloxacin - CMI:>=4	Trimethoprim/Sulfamethoxazole - CMI:>=320

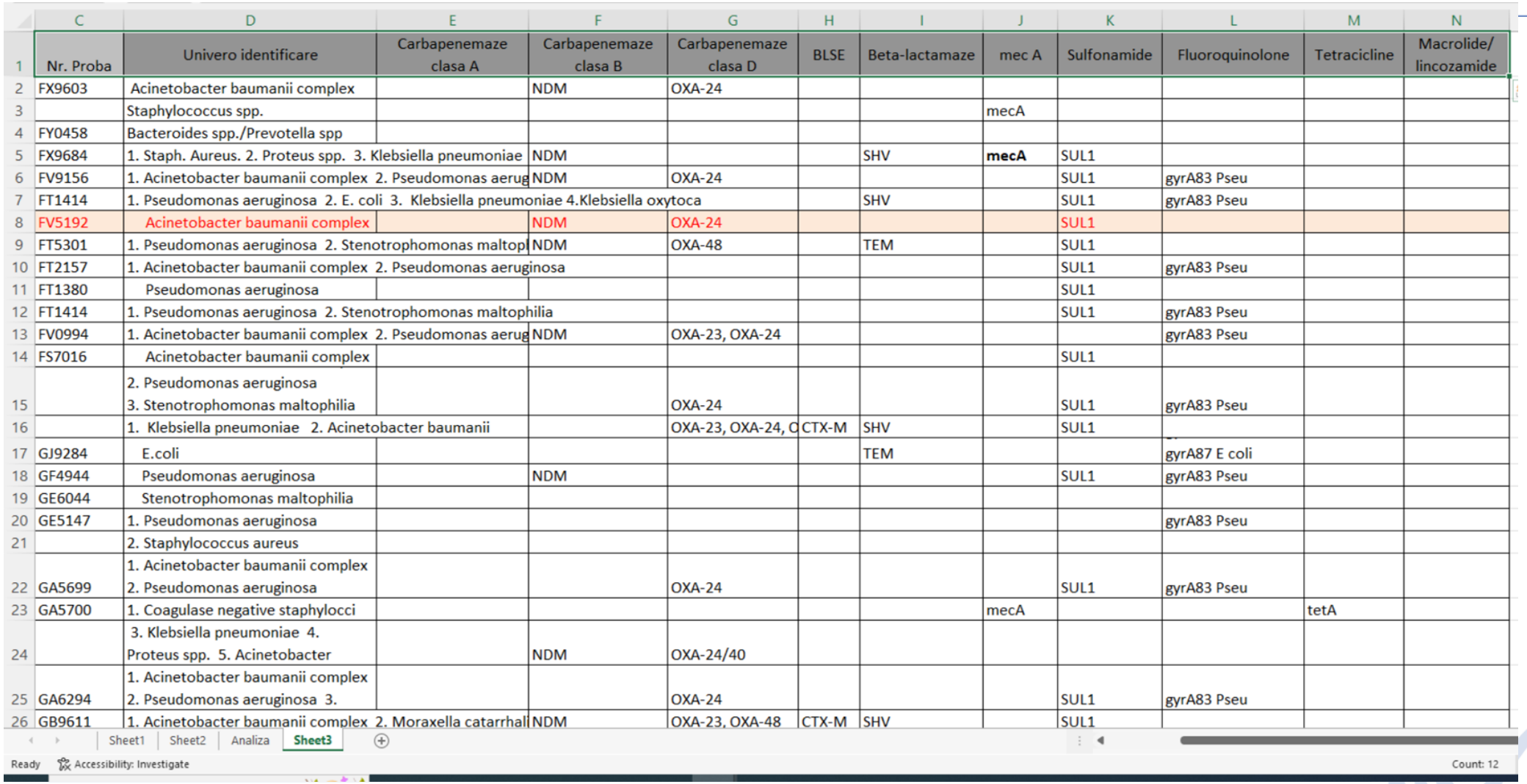


Blood culture result in a newborn with XDR *A. baumannii*





Blood culture result in a newborn with XDR *A. baumannii*



	C	D	E	F	G	H	I	J	K	L	M	N
1	Nr. Proba	Univero identificare	Carbapenemaze clasa A	Carbapenemaze clasa B	Carbapenemaze clasa D	BLSE	Beta-lactamaze	mec A	Sulfonamide	Fluoroquinolone	Tetracicline	Macrolide/ lincozamide
2	FX9603	Acinetobacter baumanii complex		NDM	OXA-24							
3		Staphylococcus spp.						mecA				
4	FY0458	Bacteroides spp./Prevotella spp										
5	FX9684	1. Staph. Aureus. 2. Proteus spp. 3. Klebsiella pneumoniae		NDM			SHV	**mecA**	SUL1			
6	FV9156	1. Acinetobacter baumanii complex 2. Pseudomonas aerug		NDM	OXA-24				SUL1	gyrA83 Pseu		
7	FT1414	1. Pseudomonas aeruginosa 2. E. coli 3. Klebsiella pneumoniae 4.Klebsiella oxytoca					SHV		SUL1	gyrA83 Pseu		
8	FV5192	Acinetobacter baumanii complex		NDM	OXA-24				SUL1			
9	FT5301	1. Pseudomonas aeruginosa 2. Stenotrophomonas maltopl		NDM	OXA-48		TEM		SUL1			
10	FT2157	1. Acinetobacter baumanii complex 2. Pseudomonas aeruginosa							SUL1	gyrA83 Pseu		
11	FT1380	Pseudomonas aeruginosa							SUL1			
12	FT1414	1. Pseudomonas aeruginosa 2. Stenotrophomonas maltophilia							SUL1	gyrA83 Pseu		
13	FV0994	1. Acinetobacter baumanii complex 2. Pseudomonas aerug		NDM	OXA-23, OXA-24					gyrA83 Pseu		
14	FS7016	Acinetobacter baumanii complex							SUL1			
15		2. Pseudomonas aeruginosa 3. Stenotrophomonas maltophilia			OXA-24				SUL1	gyrA83 Pseu		
16		1. Klebsiella pneumoniae 2. Acinetobacter baumanii			OXA-23, OXA-24, O	CTX-M	SHV		SUL1			
17	GJ9284	E.coli					TEM			gyrA87 E coli		
18	GF4944	Pseudomonas aeruginosa		NDM					SUL1	gyrA83 Pseu		
19	GE6044	Stenotrophomonas maltophilia										
20	GE5147	1. Pseudomonas aeruginosa								gyrA83 Pseu		
21		2. Staphylococcus aureus										
22	GA5699	1. Acinetobacter baumanii complex 2. Pseudomonas aeruginosa			OXA-24				SUL1	gyrA83 Pseu		
23	GA5700	1. Coagulase negative staphylocci						mecA			tetA	
24		3. Klebsiella pneumoniae 4. Proteus spp. 5. Acinetobacter		NDM	OXA-24/40							
25	GA6294	1. Acinetobacter baumanii complex 2. Pseudomonas aeruginosa 3.			OXA-24				SUL1	gyrA83 Pseu		
26	GB9611	1. Acinetobacter baumanii complex 2. Moraxella catarrhali		NDM	OXA-23, OXA-48	CTX-M	SHV		SUL1			

Sheet1 Sheet2 Analiza **Sheet3**

Ready Accessibility: Investigate Count: 12

Discussions

Streptococcus agalactiae

- could cause severe infections In neonates
- Group B Streptococcus (GBS), are often associated with GBS **transmission from their mothers during labor or birth.**
- Hence, it is necessary to develop a **universal method for screening vaginal-rectal** GBS **colonization in pregnant women worldwide**.
- The proposed method "**MALDI detection** with analysis of peaks of TOF (MDAPT)" detects GBS **directly from cultured broth with high sensitivity**. Therefore, it can be an alternative method for **GBS screening in pregnant women**, thereby contributing to the prevention of severe GBS infectious diseases in neonates.
- As previously reported, **10%-30% of pregnant women carry *Streptococcus agalactiae*, Group B Streptococcus (GBS), in their vagina or rectum, and approximately 50% of them vertically transmit GBS to their neonates during labor or birth.**
- Moreover, **1%-2% of the GBS-transmitted neonates develop severe GBS infectious diseases,** which have a **mortality rate of 19.2% in a preterm infant** and 2.1% in a full-term infant.(Tanno 2022)

Risk factors for newborn colonization and infection

Risk Factors

Multiple studies have identified risk factors for both colonization and infection with MDR-GN organisms, specifically ESBL-producing *Enterobacterales* and CRE, in hospitalized neonates (Table 3). Birth weight and gestational age, both markers of prematurity, are the most consistent risk factors identified across studies for infection caused by MDR-GN bacteria. Gestational age less than 37 weeks and very-low birth weight (<1500 grams) are independently associated with increased risk of MDR-GN colonization with and/or infection.(5,77-84)

Prolonged duration of hospitalization, associated with both prematurity and severity of illness, is a consistent and significant risk factor.(65,79,80,82,84-89) Molecular epidemiology suggests gradual incorporation of MDR-GN organisms from the hospital environment into the nascent newborn microflora occurs over time.(62) In one study, length of stay of more than 15 days was independently associated with ESBL-producing *K. pneumoniae* infection (adjusted odds ratio [OR] 4.1, 95% confidence interval [CI] [1.2,14.3]).(77) Similarly, another study found that neonatal MDR-GN carriage

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Neonatal early onset *E.coli* sepsis/meningitis

Neonatal early onset Escherichia coli sepsis: trends in incidence and antimicrobial resistance in the era of intrapartum antimicrobial prophylaxis

By: Alarcon, A (Alarcon, A) ; Pena, P (Pena, P) ; Salas, S (Salas, S) ; Sancha, M (Sancha, M) ; Omenaca, F (Omenaca, F)

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Abstract

Background. Although intrapartum antimicrobial prophylaxis has lowered the incidence of early onset group B Streptococcus (GBS) sepsis, there are concerns that the increased use of antibiotics may raise the incidence of non-GBS antimicrobial-resistant infections. The objective of this study was to determine trends in the incidence and antimicrobial resistance of early onset sepsis caused by Escherichia coli in the era of antimicrobial prophylaxis.

Methods. All neonates with early onset E. coli infection who were born at La Paz Hospital, Madrid, from January 1, 1992, through December 31, 2002, were identified from a microbiologic register of all neonatal infections. To evaluate the effect of the guidelines for GBS prevention, data were pooled and compared for: 1992 through 1995 (Period 1); 1996 through 1998 (Period 2); and 1999 through 2002 (Period 3).

Results. Early onset E. coli infection was diagnosed in 41 of 84 612 live births. The infection rate did not change significantly during the 3 time periods (0.56, 0.24 and 0.55 per 1000 during Periods 1, 2 and 3, respectively; P = 0.936, linear-by-linear association). The proportion of E. coli infections that were resistant to ampicillin in. creased significantly among preterm infants, from 25% (1 of 4) in Period 1, to 100% (2 of 2) in Period 2 and to 91% (10 of 11) in Period 3 (P = 0.017, linear-by-linear association), but not among term infants, with 67% (8 of 12) in Period 1, 50% (1 of 2) in Period 2 and 44% (4 of 5) in Period 3 (P = 0.317, linear-by-linear association).

Conclusions. Although the incidence of early onset sepsis caused by E. coli remained stable during the study period, antibiotic-resistant E. coli infections increased among preterm infants. On the whole these trends are reassuring with respect to GBS prophylaxis. However, the increase in the proportion of ampicillin-resistant infections in preterm infants suggests that continuing evaluation of the risks and benefits of prophylaxis in this group is critical.

Case Report: Fatal Outcome for a Preterm Newborn With Meningitis Caused by Extended-Spectrum beta-Lactamase-Producing Escherichia coli Sequence Type 1193

By: Oldendorff, F (Oldendorff, Frida) [1] ; Linner, A (Linner, Agnes) [2] , [3] ; Finder, M (Finder, Mikael) [2] , [4] ; Eisenlauer, P (Eisenlauer, Peter) [5] ; Kjellberg, M (Kjellberg, Malin) [2] , [3] ; Giske, CG (Giske, Christian G.) [5] , [6] ; Nordberg, V (Nordberg, Viveka) [2] , [4]

FRONTIERS IN PEDIATRICS

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Jump to

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Abstract

Introduction: In this case report, we describe an extended-spectrum beta-lactamase (ESBL) - Escherichia coli (E. coli) strain of sequence type (ST) 1193, a novel, virulent, multidrug-resistant (MDR) clone with a rapid global spread. ST 1193 has been more commonly associated with invasive disease than other ESBL-E. coli STs. To our knowledge, this is the first known case in Sweden where a newborn died of an ESBL-E. coli ST 1193 meningitis. We emphasize that the clinical knowledge about the properties of certain MDR-clones should be increased.

Case Report: A moderately preterm boy was born after preterm prolonged rupture of membranes. The mother had an ESBL-E. coli urinary tract infection during pregnancy. At 36 h of age he developed signs of infection and was given first-line therapy for early onset sepsis. Thereafter he developed seizures. The treatment was changed to cover suspected meningitis. Culture showed growth of the same ESBL- E. coli ST 1193 strain in the child's blood and cerebrospinal fluid, as well as in the mother's urine. Antibiotics were adapted. His condition deteriorated and he developed fulminant septic shock with treatment-resistant seizures. The boy passed away at 3 days of age.

Conclusion: This case highlights the risk of delay in diagnosis when a marking for carriage of MDR-bacteria is falsely removed from a medical record of a pregnant women. Further, it demonstrates that ESBL-E. coli ST 1193 infection in neonates can be fatal. Thus, studies regarding virulence factors of ESBL-E. coli infections in pregnant women and their children are needed to understand the association between this infection and severe invasive disease in newborn children.

Genital bacteria during pregnancy

Genital bacterial carriage during the last trimester of pregnancy and early-onset neonatal sepsis

By: Balaka, B (Balaka, B) ; Agbere, A (Agbere, A) ; Dagnra, A (Dagnra, A) ; Baeta, S (Baeta, S) ; Kessie, K (Kessie, K) ; Assimadi, K (Assimadi, K)

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Abstract

Bacterial infections remain a major cause of morbidity and mortality in newborn infants.

Objective. - To determine the bacterial ecology and pathological status of the genital organs during the last trimester of pregnancy and the germs of the following early-onset neonatal sepsis, in order to evaluate the risk of materno-foetal infections and to find out a drug prophylaxis.

Method. - Vaginal and endocervical samples, usually taken during the first trimester of pregnancy were delayed and taken during the last trimester of pregnancy. A macroscopic examination described the aspect of the vagina, the cervix uteri, leukorrhea and of possible inflammatory lesions or ulcerations. A microscopic examination searched for parasites, epithelial cells, clue cells and leukocytes. The appropriate bacteriological cultures were performed after reading the Gram stain and scoring the vaginal flora. The clinical and cytobacteriological aspects were used to identify the bacterial ecology and the pathological genital states. An exploration was carried out in every newbom suspected of infection.

Results. - Genital samples were collected from 306 pregnant women. Among them, 118 were at 29-32 weeks of gestation, 104 at 33-36, and 84 at 37-40. The most frequent germs were C albicans (33,5%), Enterbacteriaceae (20.3%) including E. coli (10.9%), S. aureus (15.4%), Gardnerella (13.6%), and Trichomonas (10.6%), in monomicrobian (79.2%) and polymicrobian carriage (20.8%). Lower genital tract pathological states such as vaginitis (29.4%), bacterial vaginosis (21.5%) or endocervicitis (10.4%), asymptomatic bacterial carriage (23.5%) and normal genital flora (15%) were identified. These pregnancies led to 334 live births with 27 cases of early-onset neonatal sepsis to which endocervicitis (25%) and vaginosis (19,7%) were most often linked.

Conclusion. - Genital samples at the last trimester of pregnancy could evaluate the risk of maternofoetal infections and allow to adapt a drug prophylaxis of Enterobacteriaceae, the most frequent germ of neonatal infections, as it has been done for Streptococcus agalactiae. But larger studies are required to evaluate the risk of matemofoetal infections and to state the drug prophylaxis. (c) 2005 Elsevier SAS. Tous droits reserves.

RESEARCH LETTER

Prevalence of *Escherichia coli* among samples collected from the genital tract in pregnant and nonpregnant women: relationship with virulence

Elisabet Guiral, Jordi Bosch, Jordi Vila & Sara M. Soto

Department of Clinical Microbiology, Hospital Clinic, IDIBAPS, School of Medicine, University of Barcelona, Barcelona, Spain

Correspondence: Sara M. Soto, Servei de Microbiologia, Hospital Clinic de Barcelona, Villarroel 170, esc. 11, 5 ª planta, 08036 Barcelona, Spain. Tel.: +34 932 275 522; fax: +34 932 279 327; e-mail: sarasotog@yahoo.es

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Abstract

Escherichia coli are enteric Gram-negative bacilli that can colonize the female genital tract and become implicated in different infections in pregnant women, including intra-amniotic infection, puerperal infections and neonatal infections. The virulence profiles of *E. coli* isolates from vaginal swabs from pregnant and nonpregnant women were compared. The *hly*-, *cnf*-, *pap*- and *iro*N-genes were found significantly more frequently in *E. coli* isolated from pregnant women in comparison with those isolated from nonpregnant women. *Escherichia coli* from pregnant women seem to be more virulent than from nonpregnant women developing severe infections, thereby increasing possible neonatal sepsis.

Vaginal colonization with GNB/GPC

Science, Hawassa Health Science College, Hawassa, Ethiopia; [2]School of Medical Laboratory Science, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia; [3]Department of Microbiology, Hawassa University, Comprehensive Specialized Hospital, Hawassa, Ethiopia; [4]School of Public Health, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia

Correspondence: Musa Mohammed Ali
Email ysnmss@yahoo.com

Methods: Institution-based cross-sectional study was conducted on pregnant women from October 13 to December 28, 2020, at government hospitals located in Hawassa, Ethiopia. Background data were captured using a structured questionnaire. Vaginal swabs were collected to isolate bacteria using the standard method. Antimicrobial susceptibility test was performed using the modified Kirby–Bauer disc diffusion method. Data were analyzed using SPSS. Factors that could predict vaginal colonization with potential neonatal disease-causing bacteria were determined using logistic regression.

Results: Overall bacterial colonization rate among pregnant women was 271 (98.9%) 95 CI (97.4–100.1). The prevalence of potential neonatal disease-causing bacteria was 95 (34.7%) 95 CI (28.8–40.1). The proportion of potential neonatal disease-causing bacteria were as follows: *Escherichia coli* (n=82, 29.9%), *Acinetobacter* species (n=9, 3.3%), *Staphylococcus aureus* (n=7. 2.6%), and *Klebsiella pneumoniae* (n=4, 1.5%). Pregnant women with a gestational age of 38–40 weeks were 1.9 times (AOR= 1.9, 95% CI= 1.0–3.4, p=0.04) were more likely to be colonized by potential neonatal disease-causing bacteria. All *E. coli, Klebsiella* species, and *Acinetobacter* species were susceptible to gentamicin and imipenem. All *S. aureus* were susceptible to penicillin, tetracycline, clindamycin, and erythromycin.

Conclusion: High proportion of pregnant women in this study were colonized with potential neonatal disease-causing bacteria. *E. coli* was the predominant bacteria. Most bacteria isolated in this study were susceptible to antimicrobial agents tested. Gestational age was significantly associated with the colonization rate of potential neonatal disease-causing bacteria.

Keywords: vaginal colonization, pregnant women, neonatal disease, antibiotic susceptibility, Hawassa, Ethiopia

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Clinical relevance of colonization with AMR bacteria

Clinical relevance of colonization with antimicrobial-resistant bacteria (AMRB) and methicillin susceptible *Staphylococcus aureus* (MSSA) for mothers during pregnancy

A. H. Dammeyer[1] · S. Heinze[1,2] · A. C. Adler[3] · L. Nasri[4] · L. Schomacher[1] · M. Zamfir[1] · K. Heigl[1] · B. Karlin[5] · M. Franitza[4] · S. Hörmansdorfer[1] · C. Tuschak[1] · G. Valenza[1] · U. Ochmann[2] · C. Herr[1,2]

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Abstract
Purpose The impact of colonization with antimicrobial-resistant bacteria (AMRB) and methicillin-sensitive *Staphylococcus aureus* (MSSA) of healthy pregnant women is not described in detail in Germany. In this study, we screened for MSSA and AMRB, especially for methicillin-resistant *S. aureus* (MRSA) as well as extended-spectrum beta-lactamase (ESBL)-producing *E. coli*. Potential risk factors for colonization with AMRB/MSSA and the potential effects of colonization with these on the obstetric population were investigated.
Methods From October 2013 until December 2015 pregnant women were screened before birth for colonization with AMRB/MSSA from the mammillae, nose, perianal and vaginal area. Before birth, the expectant mother was administered a standardized interview questionnaire by a trained interviewer. Data from the hospital admission records were also included.
Results Samples from 651 pregnant women were analyzed. Colonization with MSSA was detected in 14.3% ($n = 93$), AMRB in 3.5% [($n = 23$); MRSA: $n = 3$/ESBL: $n = 20$]. Significantly more colonization of AMRB/MSSA could be detected in women who had previously given birth compared to women who were nulliparous ($p < 0.05$). MSSA colonization was significantly associated with self-reported respiratory diseases during pregnancy ($p < 0.05$), but AMRB/MSSA colonization was not statistically associated with other types of infection.
Conclusion Our results demonstrate a low overall rate of colonization with AMRB/MSSA, as well as a low percentage of colonized pregnant women who developed infections. Multiparous women are at higher risk for colonization with MSSA/MRSA or ESBL. Because the prevalence of AMRB/MSSA is low, this study suggests that general screening of pregnant women without risk factors is not recommended.

ORIGINAL ARTICLE

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Characterization of multiple antibiotic resistant clinical strains of *Staphylococcus* isolated from pregnant women vagina

Bakwena Ashton Hetsa[1] · Ajay Kumar[1] · Collins Njie Ateba[1,2]

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Abstract
Vagina which is one of the important reservoirs for *Staphylococcus* and in pregnant women pathogenic strains may infect the child during the birth or by vertical transmission. A total of 68 presumptive *Staphylococcus* strains isolated from human vagina were found to be gram-positive cocci, and only 32 (47%) isolates were found beta-hemolytic. Matrix-assisted laser desorption/ionization time-of-flight mass-spectrometry (MALDI-TOF MS) results confirmed 33 isolates belonged to *Staphylococcus* which consisting of 6 species, i.e., *S. aureus* (14), *S. vitulinus* (7), *S. epidermidis* (4), *S cohnii* (3), *S. equorum* (3), and *S. succimus* (2). Further, the result of antibiotic susceptibility tests showed that large proportions (76%—100%) of the isolates were resistant to multiple antibiotics and more often resistant to penicillin (100%), ampicillin (100%), oxacillin (97%), oxytetracycline (97%), vancomycin (97%), rifampin (85%), erythromycin (82%), and streptomycin (76%). In the present study, only the *sec* enterotoxin gene was detected in four *S. aureus* strains. DNA fingerprints of the 33 isolates that were generated using random amplified polymorphic DNA (RAPD) and enterobacterial repetitive intergenic consensus (ERIC) PCR analysis revealed great genetic relatedness of isolates. High prevalence of vaginal colonization with multiple antibiotic-resistant staphylococci among pregnant women was observed which were emerged from the single respective species clones that underwent evolution. The vertical transmission of these multiple antibiotic-resistant *Staphylococcus* species to the infant is possible; therefore, the findings of this study emphasize the need for regular surveillance of antibiotic-resistant bacterial strains in pregnant women in this area.

The pregnancy microbiome

The Pregnancy Microbiome

Hadar Neuman, Omry Koren PMID: 28346919 DOI: 10.1159/000455207

Abstract

In recent years, microbiome research has revealed multiple essential roles of the microorganisms residing within the human body in host metabolism, immunity, and overall health. Numerous physiological and pathological states, including obesity and the metabolic syndrome, have been correlated with microbial changes, termed dysbiosis. Our microbiomes change in response to our environment, diet, weight, hormones, and other factors. It is, therefore, not surprising that there are also significant changes in the microbiome during pregnancy when dramatic weight gain and metabolic and immunological changes occur. In this review, we summarize the known changes in microbial composition throughout pregnancy at a variety of body sites, including the gut, vagina, oral cavity, and placenta, and we describe several studies that have linked pregnancy complications with microbial changes. Unlike the case of certain disease states, such as obesity, where dysbiosis is considered to have negative effects, we believe that the microbial alterations observed during pregnancy are vital for a healthy pregnancy. While more research in this field is required to reveal specific mechanisms and pathways regulating these alterations, the microbial changes during pregnancy are likely coordinated with the immune, endocrine, and metabolic states.

Administration of antibiotics

- **Administration of antibiotics during pregnancy leads to changes in the vaginal microbial ecology before birth**, with potential for morbidity, and **long-term effects on the early microbial colonization of the newborn.**

- Women who received **oral antibiotics during any trimester of pregnancy** had an **increased rate of colonization with staphylococcal species** in **vaginal samples,** compared with samples obtained from women without antibiotic treatment during pregnancy.

- Oral antibiotic administration **for urinary tract infections** in the **third trimester** was also associated with increased colonization by ***Staphylococcus* species**.

- **Women treated in the third trimester for respiratory tract infection -** were more often **colonized with *Escherichia coli*** than women without antibiotic treatment.

- Significant changes in vaginal colonization with ***Streptococcus agalactiae* (group B streptococcus)** following antibiotic treatment during pregnancy were not observed.(Stokholm 2014, CMI)

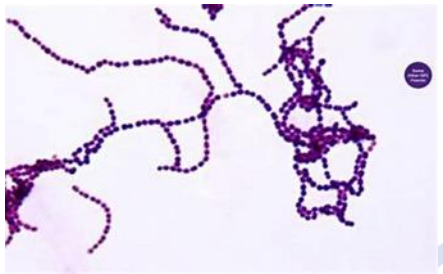
Conclusions

❑ **Regarding GNB:**

- **Low incidence of resistant strains with clinical significance**:
  - **UTI** with **1 ESBL-*E.coli***
  - **SSI** with **2 CASE -*Klebsiella* sp.**
  - **Peritonitis** with **1 CR-*Acinetobacter baumannii***
- **The high incidence of *E. coli* strains in cervical secretions** was noted,
  - but taking into account the clinical significance of the presence of this strain in the cervix (**considered colonization**)
  - as well as the **low antimicrobial resistance** (they are community strains),
  - it can be appreciated that **treatment in these cases - is necessary only if the clinical condition of the patients requires such an approach**
  - **but their resistance pattern must be known in the case of detecting early infections in newborns**!

Conclusions

- What is noteworthy is the fact that **GPC registered high frequencies**, and the isolated strains **show resistance to antimicrobials** that describe resistance phenotypes that pose therapeutic problems.
  - **Group B streptococcus** registers high frequencies in pregnant women and those hospitalized for full-term birth (35.08%) but also in those hospitalized for premature birth (19.04%),
  - Colonization with ***S.aureus*** should also be mentioned, as long as most of the strains were of the MRSA type or associated multiple resistance mechanisms
- so **adequate supervision and treatment due to the potential for illness in newborns** is required.



Conclusions

- Empiric and definitive antimicrobial **treatment in early and late onset infections in newborns:**
  - **Infections with MDR pathogens**, especially those caused by ESBL/CRE *Enterobacterales* or MRSA are **associated with increased risk of morbidity and mortality**
  - **Treatment options for these infections are limited,**
  - **Efficacy and safety of novel antibiotics are currently extrapolated from adult data**
  - **Dose optimization - required**
    - **There are clinical trials for**: Ceftazidime/avibactam, Meropenem/vaborbactam, Imipenem/cilastatin/relebactam, cefiderocol.

Future Directions

- The acquisition and implementation of the **new automatic microbiological sample processing line purchased on the project will help in:**
  - **shortening times by using advanced technology** (by 1,5 days),
  - allowing to **increase vigilance on infection surveillance** in pregnant or infertile women and newborns,
  - **improving patients' health, bringing cost efficiency** in material and human resources (much more is done with less expense),
  - **providing safety in terms of contamination of medical personnel,**
  - ensuring **automatic standardized microbial culturing**,
  - increasing the performance of microbial isolation on culture media, which leads to a **faster identification of microorganisms, reducing to zero the risk of false negative results.**

Thank you for your attention!

Name:

Monica Licker[1,2], Corina Musuroi[1,2], Delia Muntean[1,2]

Institution:

1. Clinical Laboratory, Emergency County Clinical Hospital Pius Brînzeu Timișoara;
2. Multidisciplinary Center for Antibiotic Resistance Research (MULTI-REZ), University of Medicine and Pharmacy V.Babeș Timișoara

Email address: licker.monica@umft.ro

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