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(RESEARCH ARTICLE)

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"Invasive group B *Streptococcus* infections in non-pregnant adults: Clinical features and antibiotic resistance at the Avicenne military hospital of Marrakesh (2020–2025)"

Rim Almaggoussi [1, 2, *], Yousra Boughalem [1, 2], Ahmed Abairrou [1, 2], Ayoub Aamer [1, 2], Youssef El Kamouni [1, 2], Lamiae Arsalane [1, 2] and Said Zouhair [1, 2]

[1] *Microbiology Laboratory of the Avicenna Military Hospital of Marrakesh, Morocco.*
[2] *Faculty of Medicine and Pharmacy of Marrakesh.*

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Abstract

Background: Group B *Streptococcus* (GBS) or *Streptococcus agalactiae* is a type of Gram-positive β-hemolytic coccus which is increasingly regarded as a cause of invasive infections in non-pregnant adults with. It is generally associated with neonatal disease but in recent decades its epidemiological profile has shifted towards adult patients.

Objective: To establish the clinical and antimicrobial susceptibility profiles of invasive GBS (iGBS) infections among non-pregnant adults at the Avicenna Military Hospital of Marrakech between January 2020 and May 2025.

Methods: A retrospective, descriptive study was conducted using laboratory records. Non-pregnant adult patients (≥18 years) with confirmed GBS isolates from sterile or clinically significant non-sterile sites were included. Bacterial identification was performed using. Resistance phenotypes were established by determining CMIs using the BD Phoenix™ M50 system or by using antibiotic disk diffusion method, following EUCAST guidelines.

Results: Over a period of 53 months, we observed 72 cases of invasive GBS with a striking predominance of males (90.2%). The most frequent clinical infections included urinary tract infections (56.8%), skin and soft tissue infections (27.0%), and pneumonia (8.1%). All the isolates were sensitive to penicillin G, vancomycin and linezolid. As for tetracycline a high resistance rate was noted (73.5%). Moderate resistance rates to erythromycin (24.2%) and clindamycin (22%) were observed.

Conclusion: GBS is an emerging cause of invasive infections in non-pregnant adults. It has different clinical manifestations ranging from urinary tract infections to bacteremia and meningitis. Although first-line antibiotics such as penicillin remain effective, the significant resistance rate to macrolides and tetracyclines highlights the need for a continuous epidemiological surveillance and cautious empirical treatment, particularly in patients with a penicillin allergy.

Keywords: Group B *Streptococcus*; Invasive GBS; Non-pregnant adults; Antibiotic resistance; Clindamycin resistance; Macrolide resistance; Morocco

1. Introduction

Group B *Streptococcus* (GBS), or *Streptococcus agalactiae*, is a Gram-positive B-hemolytic coccus initially differentiated from other Streptococci by Rebecca Lancefield in the 1933 and linked to bovine mastitis [1]. It is a colonizer of the

* Corresponding author: Rim Almaggoussi

gastrointestinal and genitourinary tracts in 10–30% of healthy adults [2], While rarely causing human disease before the 1960s [3], [4], GBS has since become a major pathogen, especially for neonates and adults with underlying conditions.

In non-pregnant adults, especially those over 65 or with comorbidities (e.g., diabetes, cancer, liver disease), GBS may cause bacteremia, skin and soft tissue infections, and other serious conditions such as meningitis, endocarditis, and pneumonia. [5]

To understand recent trends in GBS invasive infections and resistance to antibiotics in our hospital, a retrospective study was conducted at the microbiology laboratory of the Avicenna Military Hospital of Marrakech. The study assessed invasive GBS infection detection rates in non-pregnant adults and changes in antibiotic susceptibility.

2. Material and methods

2.1. Ethical Considerations

The study was carried out without any interaction with individuals, making informed consent unnecessary. Anonymity and confidentiality were respected for all personal data collected.

2.2. Study Population and Setting

Our study was a retrospective, descriptive study carried out at the Avicenna Military Hospital of Marrakech. The study period run from January 01 2020 to May 31st, 2025, covering a period of 53 months. We recruited during this time period all non-pregnant adult patients (over 18 years old) with a confirmed Group B *Streptococcus* infection. We excluded pregnant adults and patients under 18 years-old.

2.3. Case Definition

We defined a confirmed Group B *Streptococcus* infection as all isolates from a sterile site (e.g. cerebrospinal fluid, blood cultures, internal organs biopsy …) or non-sterile site (with no other bacterial etiology, e.g. superficial abscesses, respiratory tract infections…) with a positive culture (GBS growth on agar plates or on broth) or identified by RT-PCR.

2.4. Bacterial Isolates

All redundant isolates were excluded. The bacterial strains were grown on defibrinated sheep blood agar plates and incubated at 37 °C in 5% CO_2. Identification of colonies as GBS was done through automatic identification by BD Phoenix M50 (BECTON DICKINSON), or when unavailable by latex agglutination test (Oxoid Streptococcal Grouping Kit)

2.5. Antimicrobial Susceptibility Testing and Macrolide Resistance Phenotype

Susceptibility testing was performed by automated CMI testing by BD Phoenix M50 (BECTON DICKINSON) and/or qualitative disk diffusion according to the European Committee on Antimicrobial Susceptibility Testing (EUCAST) (http://www.eucast.org, last access on «1st June 2025). All the isolates were tested for susceptibility to benzyl penicillin (PEN G), high-level gentamycin resistance (HLGR) using the recently proposed clinical cut-off (CMI> 128mg/L) erythromycin (ERY), clindamycin (CLI), tetracycline (TET), and fluoroquinolones (CIP, LEV). The macrolide resistance phenotypes were determined by a double-disk test or by comparing the clindamycin CMI levels with and without erythromycin present according to the EUCAST guidelines. The isolates were classified as expressing the M-phenotype when they were resistant to macrolides only, or to the MLS_B phenotype when showing cross-resistance to macrolides and lincosamides, either constitutive ($cMLS_B$) or inducible ($iMLS_B$)

3. Results

A total of 72 patients were identified as invasive GBS (iGBS) infection during the 4 years and a half study period. Out of all the patients included, 65 were male (90.2%)while only 7 were female patients. (FIGURE 1)

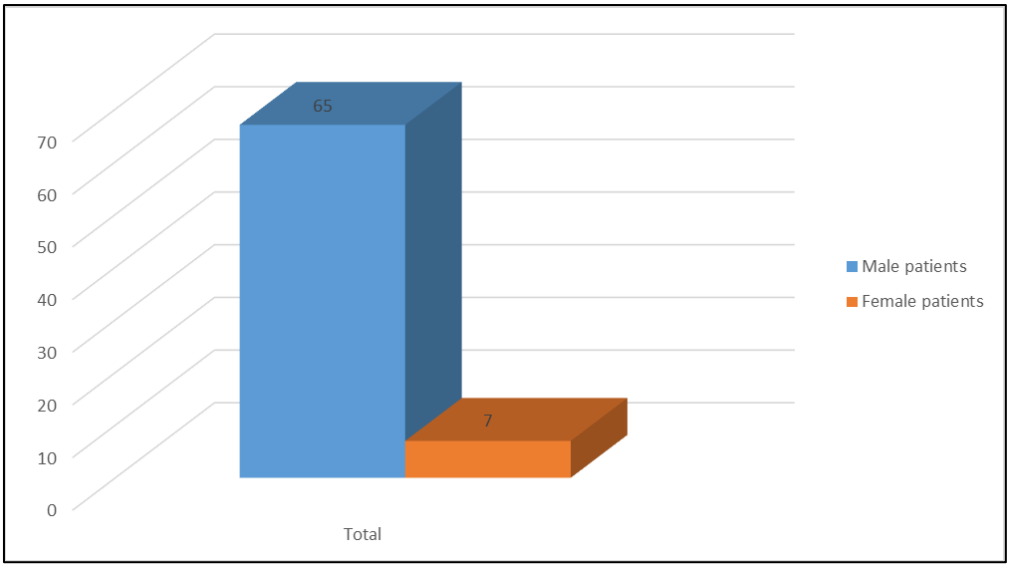

Figure 1 Repartition of Cases by Gender

The three most common clinical manifestations of iGBS infection were invasive urinary tract infection ((56.8%), skin and soft tissue infection (27.0%) and pneumonia (8.1%) Other manifestations included, bacteremia without focus (4.05%), intra-abdominal infection (1.35%), meningitis (1.35%) and deep tissue biopsy (1.35%). (figure 2)

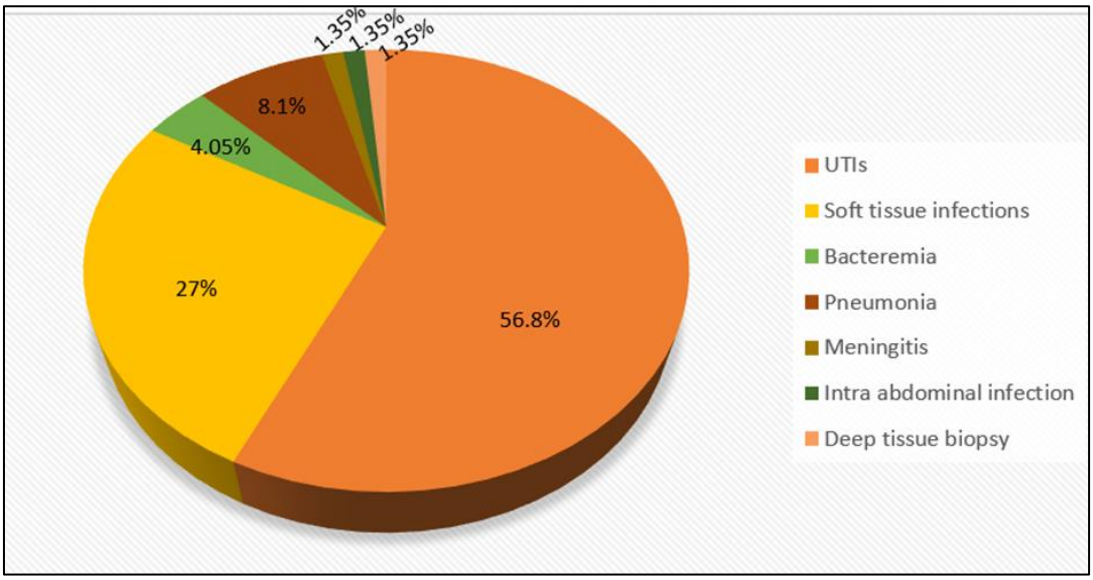

Figure 2 Repartition Of Cases By Site

3.1. GBS antibiotic susceptibility profiles from 2020 to 2025

Over the study period, the GBS isolates were collected and examined for antibiotic susceptibility. Among these isolates, the antibiotic sensitivity of penicillin G, Gentamicin, erythromycin, clindamycin, tetracycline, levofloxacin, moxifloxacin vancomycin and linezolid were predominantly examined. All isolates in our study remained susceptible to penicillin G, vancomycin, and linezolid, but expressed a high resistance to tetracycline, followed by moderate resistance to erythromycin, clindamycin, and lower rates of resistance to levofloxacin, moxifloxacin and gentamicin. The total resistance rate to tetracycline was 73.5%, to erythromycin was 24.2% and to clindamycin was 22%. The resistance rate to gentamicin was 10%, while the resistance rate to levofloxacin and moxifloxacin was relatively low with 8.7% and 5.5% respectively. (figure 3)

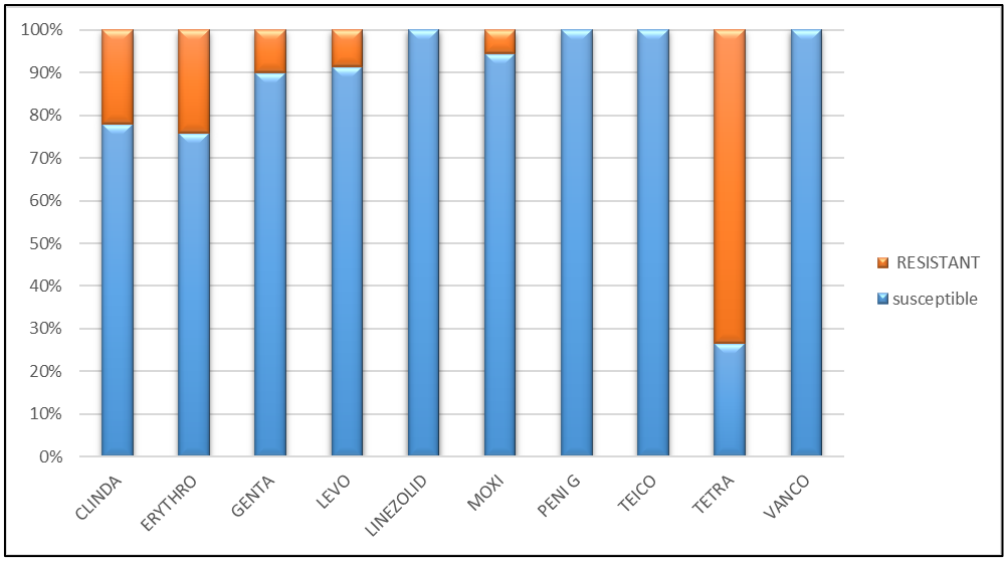

Figure 3 GBS Isolates Antibiotic Sensitivity from 2020 To 2025

4. Discussion

4.1. Demographic and Clinical Findings

Our study presents an overview of the clinical and microbiological profile of invasive Group B *Streptococcus* (iGBS) infections among non-pregnant adults over a 53-month period at the Avicenna Military Hospital in Marrakech.

The predominance of male patients (90.2%) in our cohort is notable and differs from other studies where the gender distribution tends to be more balanced or with slight predominance for one the genders like the studies done in England [14] and Beijing [11] where female patients were slightly predominant (54.4% and 54.9%). Other studies conducted in Italy [9], France [10] and Brussels, Belgium[13] noted a male predominance (63.1%, 52%, 58.1%) but none noted the almost exclusive male predominance like we did in our study. This discrepancy could be attributed to the military hospital setting, which serves a predominantly male population, or could suggest gender-related differences in susceptibility. Further multicenter studies would be required to validate whether this trend is context-specific or of broader relevance.

Regarding clinical manifestations, invasive urinary tract infections was the most common site of isolation of GBS (56.8%) this represents a is higher percentage than typically reported in the literature, where skin and soft tissue infections and bacteremia without focus are more frequently cited as was reported in the studies of Imperi M and al [9] and Xavier et al [10] where blood culture represented the first isolation site of GBS (89.4% and 52%). Other studies like Li Yand al [11] and Phoompoung P [12] and al reported the predominance of Skin and soft tissue infections (42% and 30.8%). This discrepancy may reflect local diagnostic practices or patient demographics. Skin and soft tissue infections was the second most predominant site (27%) which is in accordance to the data reported in the literature Graux E and al [13] (21%), Xavier et al [10] (15. 3%).The least common manifestation in our study was meningitis with ascites (1.35% each), the literature also reports multiple rare manifestations such as meningitis in brussels (0.3%), osteomyelitis (2.5%) and pneumonia in Italy (1%)

4.2. Microbiological and Resistance Patterns

The antibiotic susceptibility profile observed in our study provides reassuring confirmation of the continued effectiveness of penicillin G, vancomycin, and linezolid, which remained active against all GBS isolates throughout the study period, this is in accordance to multiple other studies where all GBS isolates remained sensitive to penicillin G, vancomycin, and linezolid [13], [11], [10],[9].This reinforces current clinical guidelines recommending penicillin as the drug of choice for treatment of GBS infections.(EUCAST CLSI)

However, resistance to tetracycline was notably high (73.5%), consistent with global reports suggesting widespread tetracycline resistance among GBS strains due to the presence of the *tet(M)* gene [10], [9]. Although tetracycline is not

typically used in the treatment of invasive GBS infections, this resistance remains important epidemiologically and may impact certain treatment contexts.

We noted a moderate resistance to erythromycin (24.2%) and clindamycin (22%) as was the case in the studies performed in France [10], Italy [9] and Brussels [13] with erythromycin resistance rate respectively as follow: (32.7%), '24.1%) and (27.8%) and clindamycin resistance rates as follow: Italy [9] (26.8%) and Brussels [13] (21.7%). This poses a more significant clinical challenge, particularly for patients with beta-lactam allergies, in whom macrolides or lincosamides are often prescribed.

Finally, we noted a low but present resistance to fluoroquinolones (levofloxacin 8.7%, moxifloxacin 5.5%) and gentamicin (10%). While these agents are not first-line therapies, they may be used in combination or in patients with contraindications to standard treatments. This has also been the case in some studies such as the study of Imperi and al [9] where they reported a low resistance rate to gentamicin (5.5%) while the studies of Xavier and al [10] and Greaux and al [13] reported low resistance rates to levofloxacin (2.7%) and (6.6%).

5. Conclusion

In conclusion, invasive GBS infections are an important and possibly overlooked cause of morbidity among non-pregnant adults, especially those with underlying conditions. Although first-line antibiotics like B-lactamins remain effective, the rise of resistance to several antibiotics mainly macrolides and tetracycline in our context warrants continued surveillance efforts. Further multicenter and prospective studies, including molecular analysis and patient-level clinical outcomes, are needed to fully understand the evolving epidemiology of GBS in the adult population.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Anonymity and confidentiality were respected for all personal data collected.

Statement of informed consent

The study was carried out without any interaction with individuals, making informed consent unnecessary.

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