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Serotypes and antibiotic susceptibility of *Streptococcus agalactiae strains* isolated from invasive neonatal infections

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Abstract

The purpose of the study: to determine the serotypes and antibiotic susceptibility of strains of *streptococcus agalactiae* isolated from invasive neonatal infections.

Material and methods: Fifty-five strains of *Streptococcus agalactiae* were selected isolated from invasive cerebrospinal fluid (CSF) and blood infections. The strains were confirmed by the Api 20Strep galleries and tested against the following antibiotics: penicillin G, ampicillin, erythromycin, clindamycin, tetracycline, ofloacin, levofloacin, gentamycin 500 µg, quinpristin-dalfopristin, chloramphenicol, vancomycin, interpretation was carried out according to the recommendations of the CLSI 2020 and kanamycin 1000 µg was interpreted according to the Ca-SFM standards. The serotyping of the strains was carried out according to the protocol of Monica Impéri

Results: All strains were sensitive to penicillin G and ampicillin as well as vancomycin and fluoroquinolone; 92.7% are resistant to tetracyclines, 34.5% to erythromycin, 32.7% to clindamycin, 27.3% to chloramphenicol and 25.5% to kanamycin. The distribution of serotypes was as follows: serotype III is the majority with 56.4% followed by serotype Ia with 21.8% then serotype V with 14.5%.

Conclusion: The strains of *Streptococcus agalactiae* remain sensitive to betalactamines, resistance to macrolides was around 35%, whereas that of aminoglycosides was 25%.Serotype III is the main serotype in invasive strains

Keywords: *Streptococcus agalactiae*; antibiotic resistance; serotype III; invasive strains

1. Introduction

Streptococcus b, known before the 1960s as an agent of mastitis, emerged as the bacterium responsible for neonatal infections. It is currently recognized and considered as the main agent responsible for these infections, which are known to manifest themselves mainly in the form of septicemia during the early syndromes and meningitis during the late syndromes (1).

About ten serotypes are currently described which have a particular worldwide distribution depending on the syndrome observed (2).

It is a bacterium which remains sensitive to the main families of antibiotics, in particular to betalactamines and glycopeptides, despite the presence of low-level resistance to aminoglycosides, the latter remaining active in association

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with betalactamines, especially during sepsis, the description of worldwide share of a few isolates with a high level of resistance restricts its use in invasive infections. (3).

The purpose of this study is to determine the serotypes and antibiotic susceptibility of strains of *Streptococcus agalactiae* isolated from invasive neonatal infections.

2. Material and methods

Fifty five strains of *Streptococcus agalactiae* have been selected and isolated from invasive infections from cerebrospinal fluid (CSF) and blood.

The strains were confirmed by the Api 20Strep gallery. In addition, antibiograms were carried out, according to CLSI recommendations, and the antibiotics tested include: penicillin G, ampicillin, erythromycin , clindamycin, Tetracycline , ofloacin , levofloacin , gentamycin 500 µg , quinpristin - dalfopristin , chloramphenicol, vancomycin . The latter were interpreted according to CLSI 2020 standards and kanamycin 1000 µg interpreted according to Ca-SFM standards (5)

chloroform technique , The serotyping of the strains was carried out according to monica 's ptotocol imperial (6)

3. Result

The research results indicate that; of all the strains tested: 92.7% are resistant to tetracyclines, 34.5% to erythromycin, 32.7% to clindamycin, 27.3% to chloramphenicol and 25.5% to kanamycin. Moreover; it has been concluded that 100% of strains are sensitive to penicillin G, ampicillin, fluoroquinolones and vancomycin.

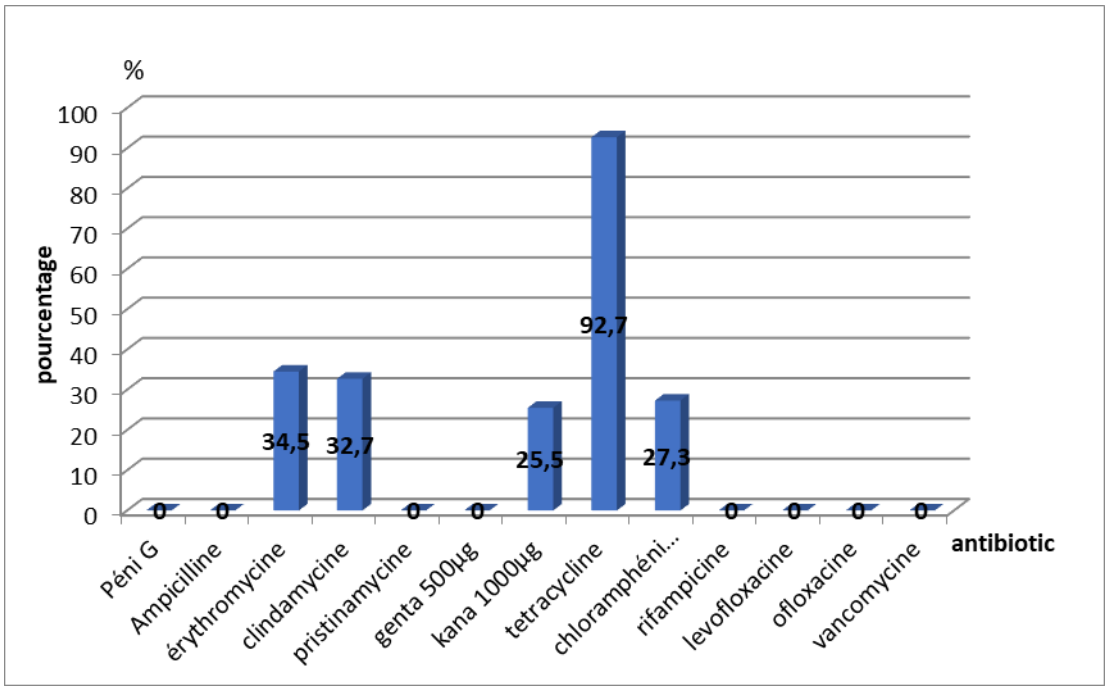


Figure 1 Antibiotic resistance of invasive strains

Based on the distribution of the strains according to the early or late syndromes; it was found that 33 strains or 63.46% isolated from early syndrome and 19 strains or (36.53) isolated from late syndrome, for 3 strains the data were missing.

The distribution of serotypes was as follows:

Serotype III is the majority with 56.4% followed by serotype Ia with 21.8% then serotype V with 14.5%.

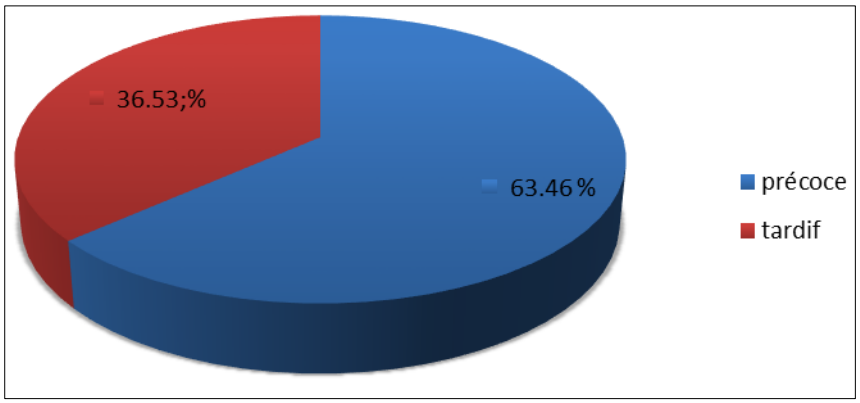


Figure 2 Distribution of invasive strains according to syndrome

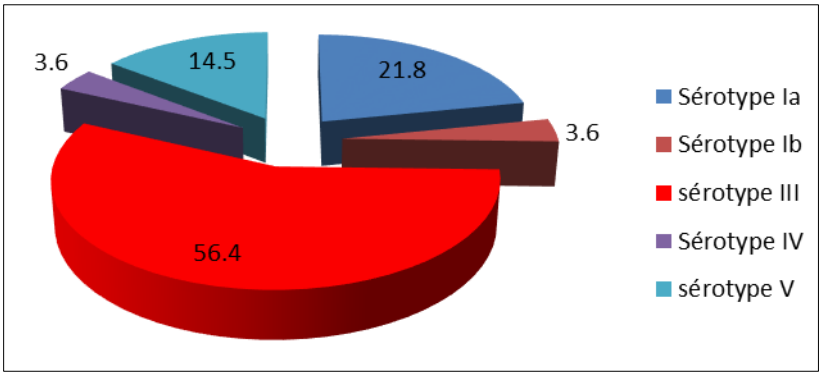
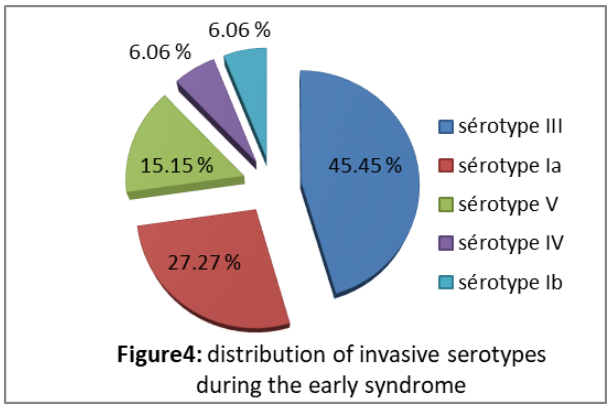


Figure 3 Distribution of invasive strain serotypes



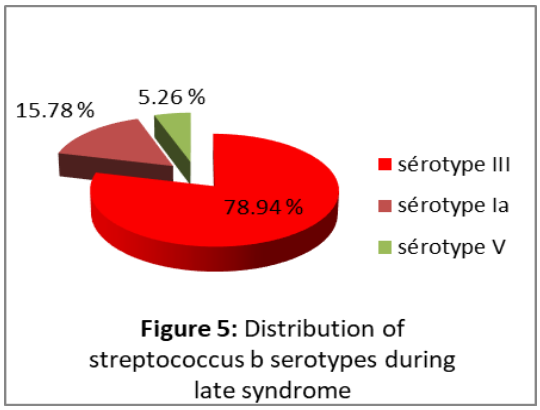


Figure 4 Distribution of invasive serotypes during the early syndrome

Figure 5 Distribution of streptococcus b serotypes during late syndrome

Among the 33 strains isolated from early neonatal infections we noted:

A predominance of serotype III at 45.45% followed by serotype Ia in 27.27% then serotype V in 15.15% of cases, serotype Ib and IV were each found in 6 % of cases, while number of serotypes found during late neonatal infections is limited, indeed only 3 serotypes were found namely serotype III, serotype Ia and V.

Serotype III is the majority: 78.94% followed by far by serotype Ia in 15.78% and only 5.26% of serotype V,

4. Discussion

All invasive strains of *Streptococcus agalactiae* have been shown to be sensitive to beta-lactams

Similar results have been reported by different authors who found 100% sensitivity to beta-lactams (3.7–10)

However, other authors have reported resistance rates of the order of 2 to 4% vis-à-vis beta- lactams (11-13) , hence the need to monitor the development of this resistance, especially after post made by *KIMURA* on the support of resistance which would be related to a modification of PLP. (12)

All our strains are sensitive to vancomycin, rifampicin and ofloxacin; invasive strains are sensitive to gentamicin ; Resistance to fluoroquinolones remains low or even exceptional worldwide. (7.14) the invasive strains showed resistance at variable rates against erythromycin, clindamycin, tetracycline, chloramphenicol and kanamycin.

Resistance to aminoglycosides remains low according to the authors (3) , only in our series we note that resistance to kanamycin is much higher than to gentamicin, this would be due to the frequent use of amikacin in hospital practice. given its ease of administration, which would favor the emergence of resistance to this molecule.

Hraoui in Tunisia found among these strains 1.3% resistance to gentamicin and 3.1% to streptomycin. (3)

Resistance to macrolides fluctuates around 32% for invasive strains, similar rates are reported by various authors (15,16) this can be explained by their widespread use in therapy, especially during respiratory infections, other authors find much higher rates as in the study by *Suhaimi* and *Wang* who speak of a resistance of around 80% (11.17) while others speak of a low rate of resistance such as *Del Pilar* who advances a rate of 10% (7,13,18) . As for tetracyclines, all the authors agree on a very high resistance rate of around 80%. (3,11,13,19)

Resistance to chloramphenicol is variable: *Hraoui* finds only 3.1% of resistant strains , *Suhaimi* does not describe any strain resistant to this molecule (3.11) . Our collection of invasive strains is composed of 63.46% of strains isolated from early syndrome and 36.54% isolates from late syndrome; for the distribution of serotypes of invasive strains, we note a predominance of serotype III (56.4%) which is recognized as being the most invasive serotype , followed by serotype Ia which is found mainly during the early syndrome, then serotype V and last serotype Ib and serotype IV.

When we analyze this distribution according to the syndrome: we notice this predominance of serotype III during the early syndrome (45.4%) followed by serotype Ia (27.27%), serotype V (15.15%) and further behind serotypes Ib and IV (6.06%), this result correlates with those published by *Tazi* which takes up the review made by *Edmond* which reports a predominance of serotype III in 50% of cases followed by serotype Ia (18 %) then serotype V and finally found serotype II (5%) which was not found during our study (20)

Similar results are reported by different authors (21–23) *Anne six* , taking the results of the CNR for streptococci between 2007 and 2012, finds during the early syndrome a clear predominance of serotype III followed by serotype Ia, then serotype V, serotype II and Ib (24) .

During the late syndromes, we note the clear predominance of serotype III (78.94%) followed by serotype Ia (15.78%) and finally serotype V (5.26%); *Six* also reports a predominance of serotype III (80%) followed by serotype Ia, V, Ib and II (24) , the same findings have been reported by several authors (25–28) .

According to *Ait* in 2003 in Constantine, the distribution of the serotypes of the invasive strains is as follows: during the early syndrome, a predominance of serotype III followed by serotype Ia then serotype II then Ib ; during the late syndrome, serotypes Ia and III are found equally, followed by serotypes II then Ib ; the author does not mention other serotypes such as V and IV which are present in our study, this is due to the technique used for serotyping and which does not make it possible to detect the other serotypes and which is currently abandoned (29) . There is a significant difference in the distribution of serotype III between the early syndromes and the late syndromes, the latter is strongly associated with late meningeal forms and the authors have already reached the same conclusions. (24,26,28)

Florindo confirms during his study this variability in the distribution of serotypes, he notes the predominance of serotypes III, Ia, and V during the period from 2005 to 2011 and notes the decline in serotypes II and V in favor of serotypes IV and Ib during the period 2011-2012 (30) .

Sadeh in Iran notes the predominance of serotype III followed by II, Ia, V and Ib (27) .

5. Conclusion

The strains of *Streptococcus agalactiae* remain sensitive to betalactamines, resistance to macrolides was around 35%, whereas that of aminoglycosides was 25%.

Serotype III is the main serotype in invasive strains.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest

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