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STUDY ABOUT ANTIBIOTIC RESISTANCE IN SERRATIA SPP. ISOLATED FROM HOSPITALIZED PATIENTS

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Abstract: *The retrospective study included 96 Serratia strains isolated from the patients hospitalized in the Clinical County Emergency Hospital Braşov during 2013. The objectives consisted in the evaluation of frequency and distribution of Serratia species in the hospital departments, in analysing the infections in which this germs were implicated and determination of antimicrobial resistance of the isolated strains. Most frequently Serratia spp. has been implicated in urinary infections (47.9%) followed by respiratory tract infections (14.6%) and varicose ulcer infections (13.5%). The resistance of Serratia strains to β-lactams was high, excepting imipenem (12%). For aminoglycosides, the resistance was higher in the case of gentamicin (90%).*

Key words*: Serratia spp., antimicrobial resistance, infections.*

1. Introduction

Serratia genre includes Gram negative rod-shape bacteria, aerobe facultative anaerobe and chemo-oganotrophic with low nutrional requirements. According to Bergey's Manual of Systematic Bacteriology, Serratia genre belongs to the Enterobacteriaceae family and includes 12 species [2], [20].

Serratia spp. is ubiquitous in the natural environment, being isolated from soil, water and different plants (vegetables, mushrooms, grasses, mosses, trees) [2], [8], [20].

These micro organisms are components of the intestinal flora in animals and humans. Serratia are opportunistic pathogens, healthy humans' infections being rare [2], [8].

S. marcescens was long time considered a non-pathogenic bacterial species (being used for military experiments about the spread of germs over large areas in USA) but today is considered an important human pathogen in hospitals [8], [11], [13].

In present S. marcescens is recognized as a significant agent of nosocomial infections with different severities. [8], [10], [15], [16]

This bacterial species causes outbreaks in various hospital wards, more frequently in the Neonatal Intensive Care Unit, Neuro-surgery and Neurology [1], [5], [7], [10].

In hospitalized patients Serratia could be isolated from gut, throat, hands and skin. [8] They produce especially urinary tract infections [3] but also low respiratory tract infections, septicemia, wounds infections, endocarditis, osteomyelitis, meningitidis, arthritis, ocular infections, intraabdominal infections, skin infections, brain abccesses [8], [11], [12], [14], [15], [16].

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Risk factors for the colonization and the emergence of hospital-acquired infections can be immunocompromised conditions (e.g. diabetes mellitus, malignancy), antibiotic treatment, urinary, artherial or intravenous catetherization, oro-tracheal or naso-gastric intubation, pre-damaged skin [1], [12].

The species Serratia rubidaea and Serratia liquefaciens could be isolated from hospital environment, but their pathogenic role is not fully confirmed [2], [5], [8], [14], [16].

Natural or acquired resistance to various antibiotics of Serratia strains isolated from hospitalized patients could create difficulties in the therapy of the nosocomial infections [6], [11], [15], [16], [17]. Often, there have been reported high levels of resistance including to cephalosporins, aztreonam, carbapenems, drugs being usually active in the infections produced by germ of the Enterobacteriaceae family, especially for the ESBL (Extended Spectrum β Lactamases) strains [18], [19].

2. Material and methods

The performed study was retrospective of type descriptive. There have been analyzed 96 strains of Serratia spp. isolated during 2013 from the biological samples of the patients hospitalized in the Clinical County Emergence Hospital Braşov.

The isolation of Serratia strains has been performed on Columbia Blood Agar, Mac Conkey Agar and UTI Agar (Urinary Tract Infections Agar) and the identification was based on classical biochemical tests. The species confirmation was made using the VITEK 2 COMPACT automated system.

For all isolated strains, antibiogram was performed according to CLSI 2013 (Clinical Laboratory Standard Institute).

The identification of Serratia ESBL strains was based by the sinergy test.

For the statistical processing of the data there, Microsoft Excel has been used in order to calculate the relative and absolute frequency.

3. Results and discussions

During the study, there have been initially analyzed the frequency of isolation of the Serratia spp. strains from various biological products from patients hospitalized in 2013.

Table 1 illustrates the involvement in the pathology of the Enterobacteriaceae genre in the studied timeframe.

Table 1

Germs	Number of strains
Escherichia coli	1291
Klebsiella spp.	543
Proteus spp.	198
Enterobacter spp.	150
Serratia spp.	96
Total	**2278**

Figure 1 shows the share of total Serratia strains from the total of Enterobacteriaceae family germs isolated during 2013.

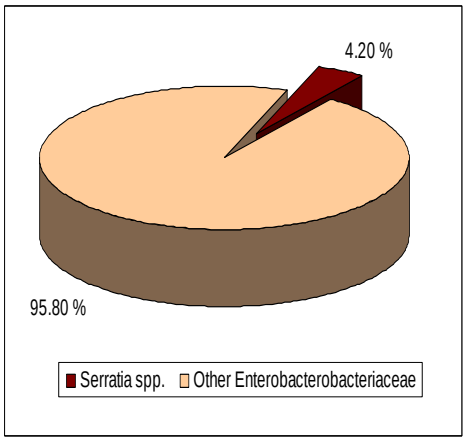

Fig. 1. *Share of Serratia spp. from the total of Enterobacteriaceae strains*

The distribution of Serratia spp. strains in the hospital departments during the studied period was another objective of the study (Table 2).

Figure 2 illustrates the distribution of the Serratia strains in the medical and surgical departments.

It can be observed the wide distribution of Serratia species in different hospital wards, of both medical and surgical profile, a higher frequency (34.4%) being recorded in Urology.

Table 2

Hospital department	Number of strains
Urology	33
Surgery	17
Intensive Care Unit	17
Dermatology	12
Internal medicine	6
Ortopedy	4
Nefrology	2
Hematology	2
Gastrology	1
Neurology	1
Reumatology	1
Total	**96**

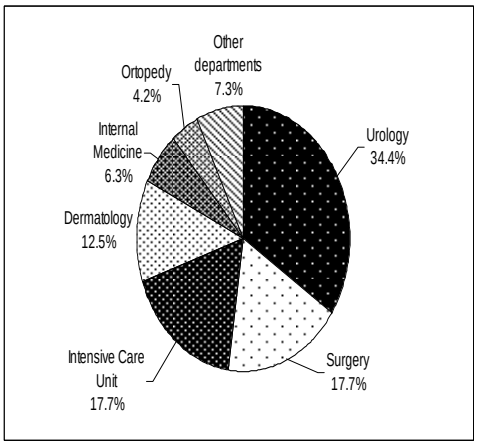

Fig. 2. *The distribution of Serratia strains in hospital departments*

We have also analyzed the pathological samples from which there have been isolated Serratia strains in the time frame of the study (Table 3).

The germs from Serratia genre were more frequently etiological involved in urinary tract infections, followed by the infections of lower respiratory tract, varicose ulcers, soft tissues and wounds. Rarely, Serratia spp. was isolated from peritoneal, pleural and joint fluids.

Table 3

Pathological products	Number of strains
Urine	46
Respiratory secretions	14
Varicose ulcers	13
Pus	8
Wound secretions	7
Peritoneal fluid	4
Pleural fluid	2
Joint fluid	2
Total	**96**

Figure 3 illustrates the localizations in the body of the infections produced by Serratia species.

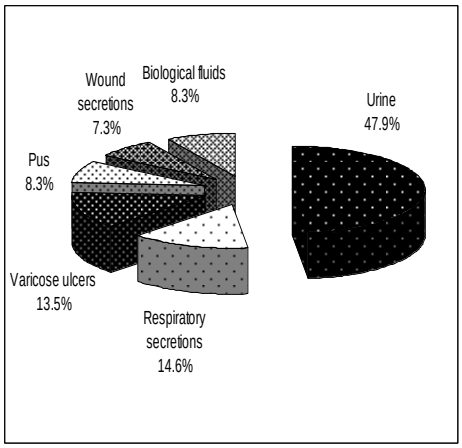

Fig. 3. *The spectrum of infections produced by Serratia spp.*

During the study, there have being tested different antimicrobials by the antibiogram: beta-lactams (ampicillin – Amp; amoxicillin – clavulanic acid – Amc; ceftriaxone – Cro; ceftazidime – Caz; imipenem – Ipm) and two aminoglycosides (gentamicin – G and amikacin - Ak).

Figure 4 illustrates the percentages of the resistant Serratia strains for each of the tested antibiotics.

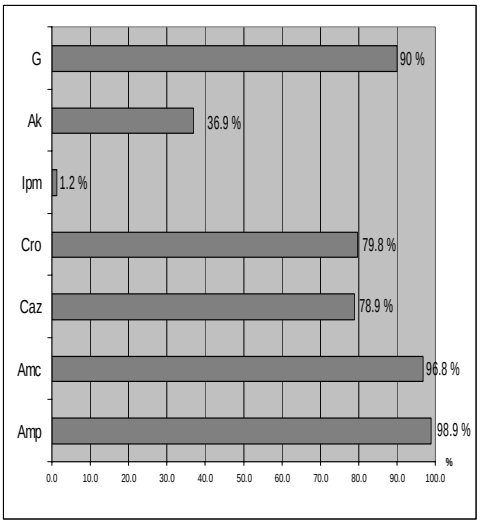

Fig. 4. *The resistance to beta-lactams of Serratia strains*

The Serratia species strains isolated from urine were also tested to norfloxacin (Nor), nalidixic acid (Na) and trimethoprim-sulfa-metoxazol (Sxt), as shown in Figure 5.

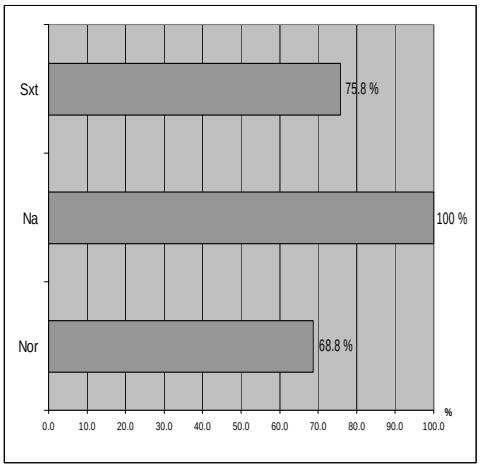

Fig. 5. *Resistance to other antimicrobials of Serratia spp. isolated from urine*

It has been also analyzed the share of multiresistant Serratia strains. In the study group, the percentage of Serratia ESBL producing strains was very high (61.5%) as shown in Figure 6.

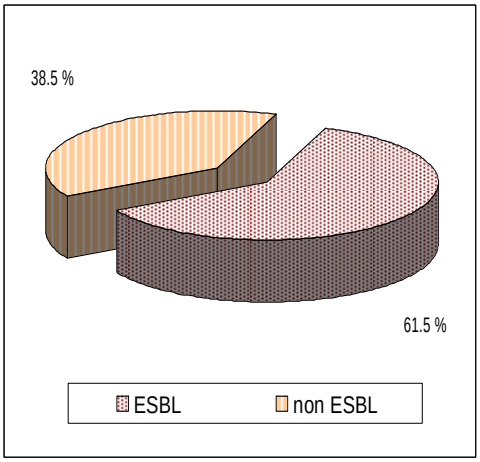

Fig. 6. *Share of Serratia ESBL producing strains*

The share of the Serratia species strains in 2013 was reduced compared to that of other Enterobacteriaceae species but illustrates the involvement of these bacteria in nosocomial infections, this aspect being different from previously conducted studies in the same medical unit [4],[9].

The wide distribution of Serratia strains in different hospital wards illustrated by this study as also the various localizations of the infections produced by these germs are in accordance with other published results of similar studies [3], [5], [7], [10], [15], [16].

Like in the case of other multidisciplinary hospitals, there have been found different levels of resistance to various antibiotics (β-lactams antibiotics, aminoglycozides, fluoro-quinolones), the most active antibiotic being imipenem [11], [15], [16].

The share of ESBL producing Serratia strains was very high, especially in Urology and Intensive Care Unit wards [6], [16], [19].

4. Conclusions

1. Serratia strains could be isolated from diverse wards, especially from Urology (34.4%), Surgery (17.7%) and Intensive Care Unit (17.7%).
2. Most frequently Serratia species has been implicated in urinary infections (47.9%) followed by respiratory tract infections (14.6%) and varicose ulcer infections (13.5%).
3. The resistance of Serratia strains to β-lactams antibiotics was high, excepting imipenem (12%) that proved to be a reserve antimicrobial for the infections with these germs.
4. For aminoglycosides, the resistance was higher in the case of gentamicin (90%) but there were also been found strains resistant to amikacin (36.9%).
5. For all antimicrobials currently used in the treatment of urinary infections the percentages of resistant Serratia strains were high.
6. The share of Serratia ESBL strains was wery high.
7. The obtained results indicate the importance of identifying Serratia spp. as an significant agent of nosocomial infections and of the detection of the ESBL producing strains that could cause therapeutic difficulties.

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