Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 9, August 2021: 2371-2378

Bacterial infections and antibiotic resistance profile in an outhospital environment

Hicham Chemsi[1,&],Farida Hilali[1], Abdelilah Laraqui[1], Tahar Bajjou[1], Yassine Sekhsokh[1]

[1] Laboratory of Research and Biosafety, HMIMV, Faculty of Medicine and Pharmacy of Rabat, MohammedV-Souissi University, Morocco
[&] Corresponding author : Dr Hicham Chemsi : chemsi.h2@gmail.com

Introduction Bacterial infections are a real public health problem ; they are common in both hospitals and community settings. The objective of our work is to describe the epidemiological situation, and the profile of the sensitivity of bacteria to antibiotics in the extrahospital environment.

Material and Methods It is a prospective study of descriptive type. It was carried out at the 3 medical analysis laboratories of Meknes city over a period of eight months. Inclusion criteria were all positive specimens: urinary examination, vaginal swab, urethral swab, pus, sputum, sperm. The exclusion criteria concerned patients with negative examinations and other microorganisms. An antibiogram is performed for the study of resistance. The exploitation of the data was performed and analyzed statistically.

Results We collected a total of 762 samples, 675 strains of Gram-negative bacilli (88.6%), 83 of Gram-positive cocci (10.9%), and 10 Gram-negative cocci (0.5%). The most frequent bacteria are *Escherichia coli* (69.5%), *Klebsiella pneumoniae* (12.7%), *Staphylococcus sp.* (4.6%). Urinary cytobacteriological examinations are the most frequent (90.7%), followed by vaginal samples (3.8%), and urethral samples (1.8%). The elderly population is the most affected with a female predominance (66%). The sensitivity of Enterobacteriaceae is reduced for Amoxicillin (25.6%), and Ampicillin (22.8%). On the other hand, the highest sensitivities were observed for Imipenem (100%), Amikacin (94.1%) and Colistin (96.6%).

Conclusion The etiological profile of bacterial infections and that of the sensitivity of bacteria to antibiotics are likely to vary in space and time, which requires action at all levels of society to reduce the impact and limit the propagation of resistance.

Keywords : sensitivity, community infections, antibiotics, bacteria, prevention

Introduction

Antibiotic resistance is now reaching dangerously high levels in all regions of the world, according to the World Health Organisation (WHO). New resistance mechanisms are emerging and spreading around the world, compromising our ability to treat common infectious diseases. It viewed antibiotic resistance as a serious threat to human health and modern medicine, a public health problem that is

growing exponentially for some bacteria and in some countries. When it comes to human prescriptions, it's generally accepted that 20% are related to hospital use, with the remaining 80% representing prescriptions in the community [1]. In cities, the growth of antimicrobial resistance of this germ during community infections is also considered a worrying phenomenon since resistance rates remain very high. In Morocco, This study was carried out in a few cities, notably in Rabat, Salé, El jadida, Settat-Berrechid... But given the importance of the subject, we were led to undertake this study which has the following objectives : evaluate the frequency of community bacterial infection with the different bacteria isolated, establish a sensitivity profile to antibiotics at the level of private laboratories in outhospital environment.

Materials and methods

This is a prospective, descriptive study. It was conducted in an outpatient setting in city laboratories of medical biological analyses. This study was conducted on a population comprising all age and gender categories. It spanned a period of 6 months. The inclusion criteria applied to all isolated strains responsible for human bacterial infections from different types of samples. The isolation of these different strains was carried out on the following samples : Urinary cytobacteriological examination (UCB), vaginal sampling (PV), pus, sputum, semen, urethral sampling (PU)... The exclusion criteria were for patients with negative examinations and other microorganisms (viruses, fungi and parasites). The data was collected using a fact sheet containing the following information (Age, Sex, Nature of Sampling, Bacterial Identification, Results and Antibiotics). An antibiotic is performed on positive identifications according to EUCAST. Antibiotics used in this study are : Amoxicillin (AMX), Ampicillin (AMP), Ticarcillin (TIC), Amoxicillin + clavulanic acid (AMC), Cefalotin (KF), Cefotaxim (CTX), Ceftriaxon (CRO), Cefixime (CFM), Cefuroxim (CXM), Ceftazidim (CAZ), Nalidixic acid (NA), Ofloxacine (OFX), Ciprofloxacin (CIP), Netilmicin (NT), Gentamicin (GM), Amikacin (AN), Doxycyclin (DO), Erythromycin (E), Imipenem (IMP), Tetracyclin (TET), Colistin (CT), Furans (FUR), Chloramphenicol (CHL), Sulfamethoxazole-trimethoprim (SXT). The data was collected using an operating sheet that contains information : age and gender of the patient, nature of sampling, bacterial species. The data was used on Excel and a statistical analysis on the SPSS version 20 software.

Results

We collected a total of 762 samples, 675 strains of Gram-negative bacilli (88.6%), 83 of Gram-positive cocci (10.9%), and 10 Gram-negative cocci (0.5%) Figure 1. A female predominance was noted with 502 women, a frequency of 66%, and 260 samples come from males with a frequency of 34%. The F / M sex ratio is 1.93. The most affected age group is that of patients aged 60 and over with a frequency of 30%, followed by patients aged between 20 and 40 years with a frequency of 28%, followed by patients between 40 and 60 years with a frequency of 25% and finally the least affected age group was between 0 and 20 years with a frequency of 17% Figure 2. According to the global distribution of 762 isolates according to the type of sample note that 91% of samples are urine cytobacteriological examinations, followed by vaginal samples with 4%, urethral samples with 2%, pus with 1%, and sperm cultures with 1% Figure 3. The overall distribution of bacteria was *Escherichia coli* 530 (69.5%) followed by *Klebsiella pneumoniae* 97 (12.7%), *Staphylococcus sp.* 35 (4.6%), *Enterococcus sp.*, *Streptococcus sp.* with 24 (3.1%), *Enterobacter cloacae* 21 (2.8%), *Pseudomonas sp*. 13 (1.7%) and

Proteus mirabilis 11 (1.4%) Figure 4. The distribution of enterobacteria according to the nature of the samples showed a predominance of urine cytobacteriological examinations with 633 (95.6%), followed by samples vaginals with 15 (2.3%), vulvar swab with 5 (0.8%) Figure 5. The resistance rates of Enterobacteriaceae to AMX and AMP were 74.43% and 77.16%. Their sensitivity to AMC is 72%, to Ceftriaxone is 80.9%, to Cefixime is 82%, to Ceftazidine 80.9%. Their susceptibility profiles to quinolones are low compared to cephalosporins. Their sensitivity to Ciprofloxacin was 62.2%, Ofloxacin with 59.4%, Norflocaxine with 44%. The lowest sensitivities were observed for Erythromycin with 1.8% Figure 6. Regarding Gram-positive Coccis, the distribution of bacteria according to the nature of the samples showed a dominance of urinary examinations with 46 (55.4%), followed by vaginal samples with 14 (16.9%), followed by samples urethral with 7 (8.4%), followed by pus samples with 6 (7.2%) Figure 7. The highest sensitivities were observed for Ceftazidime with 90.9% followed by Gentamicin with 78,8% and the Trimethoprim-Sulfamethoxazole combination with 78.1%. The rate of strains sensitive to AMP, Cefotaxime, Cefuroxime is reduced to 65.4%. For other antibiotics, the sensitivity rate is very low Figure 8.

Discussion

Global distribution of results by sex

The results obtained showed a female predominance (66%) with an F / M sex ratio of 1.93. This female susceptibility is due to urinary tract infections which are also reported by various studies. At the national level, the sex ratio F/M is 1.7 in a study in Sale city [2], 2.3 in a study carried out in Rabat city [3], 3.3 in a study in El Jadida city [4], and F/M sex ratio is 1.7 in Settat city [5]. Internationally, the study carried out in Algeria confirms the female predominance with a frequency 80% [6]. In France, the frequency is 79% [7]. The frequency of urinary tract infections in women is explained by the short, wide, straight urethra ; frequency of sexual intercourse ; during menopause, the decrease in estrogen impregnation leads to a reduction in lactobacilli and an increase in pH responsible for vaginal colonization. In men, this infection is mainly represented by prostate involvement except in the case of anatomical or functional abnormalities of the urinary tract. The risk of developing a urinary tract infection is therefore higher in women than in men.

Global breakdown of results according to the type of sampling

It was 90.7% of samples were urine examinations. Followed by vaginal swabs (3.8%), urethral swabs (1.8%), put (1.2%). Our results join those found in Sale city 66.5% [2] Rabat city 69.7% [3] and in El jadida city 88.9% [4]. Urinary tract infection is one of the main reasons for consultation, microbiological testing and prescription of antibiotics, with the economic consequences of treatment and the development of bacterial resistance.

Global distribution of results according to the causal agent

Gram negative bacilli predominate with 88.6% compared to Gram positive cocci 10.9% and Gram negative cocci 0.5%. These results represented with a clear predominance of *Escherichia coli* (69.5%), followed by *Klebsiella pneumoniae* (12.7%) and *Staphylococcus sp.* (4.6%). In Sale, a clear predominance of *Escherichia coli* 76.6%, followed by *Klebsiella pneumoniae* 12% [2]. In Rabat, *E. coli* was found at the head of the wire with a frequency 47.1% followed by *K. pneumoniae* 12.4% [3]. In El-Jadida, *E. coli* and *K. pneumoniae* with 67.6% and 21.8% respectively, *Proteus mirabilis* 3.7%

and *Enterobacter cloacae* 3.6% [4]. In Algeria, the predominance is represented by *E. coli* 53.3% followed by *Proteus mirabilis* 10%, *K. pneumoniae* 10% and *Streptococcus sp* [6]. In France, *E. coli* 74%, followed by *Klebsiella sp., Proteus sp., Enterococcus sp.* and *Citrobacter sp.* 8.0%, 5.1%, 4.3% and 3.0% respectively [7]. From these studies, *E. coli* remains the most predominant causative agent responsible for bacterial infections, especially urinary tract infections.

Antibiotic susceptibility profile of *Escherichia coli* to antibiotics

The resistance rate of Enterobacteriaceae to AMX is 74.4%, to AMC 72%, to Ceftriaxon 80.9%. Their sensitivity to Ciprofloxacin 62.2%, Ofloxacin 59.4%, Norflocaxine 44%. The lowest sensitivities were observed for Erythromycin 1.8%. *E. coli* is the main species involved in community infections in adults in women, regardless of age. In Rabat, the sensitivity is 17.4% to AMX, 80.3% to Ceftriaxone [3]. In Algeria, the resistance rate of *E. coli* to AMX 75%. The AMC maintains a sensitivity rate of 70.3%. 84.9% of strains are sensitive to Gentamicin while 37.5% of strains were resistant to Sale city [2] and 10% in Algeria [8]. *E. coli* showed a sensitivity of 59% to Ciprofloxacin. In Algeria, resistance to Ciprofloxacin was 18% [8].

Antibiotic susceptibility profile of *Klebsiella pneumoniae* to antibiotics

K. pneumoniae is naturally resistant to AMX and TIC. Low sensitivities were observed for SXT 61.3% followed by AMC 78%. The sensitivity to Ciprofloxacin is reduced by 71.7%. The other antibiotics keep good activity. In Sale city, the marked resistance rate for AMC 65.6%, The resistance rate to Ciprofloxacin 25.8% [2]. In Rabat city, the lowest sensitivities were observed for AMC 42% and SXT 43% [3]. In Guelma, 45% of the strains were resistant to AMC, 27% to Ciprofloxacin [8].

Susceptibility profile of *Staphylococcus sp*. to antibiotics

The highest sensitivities were observed for Gentamicin 78.8% and SXT 78%. The rate of AMP sensitive strains 65.4%. In Sale, the lowest resistance was noted for SXT 7.1%, 7.7% for Cefalotin and 15.4% for Tobramycin [2]. In Settat-Berrechid cities, the most alarming resistance was recorded for Peni G 82.2% [5]. In Guelma, resistance was noted 20% to OXA and 4% to Gentamicin [8].

Susceptibility profile of *Streptococcus sp*. to antibiotics

The lowest sensitivities were observed for Doxycycline 22.7% and Erythromycin 7.8%. The sensitivity to SXT 63.2% [9]. A good level of activity for Ceftriaxon 89.5%, Cefuroxim 87.5% and Cefotaxime 100%. Beta-lactams are the standard antibiotics for treating strep infections [10], AMX 80% and AMC 90.9% [11]. The parietal structure of streptococci does not oppose the diffusion of beta-lactams. The resistance mechanism is due to mutation of targets to inhibit bacterial multiplication [10].

Conclusion

Antibiotic resistance has become a global concern and a major public health problem. Indeed, in recent years, we have witnessed a dramatic increase in resistance to antibiotics. This resistance can delay and hinder treatment, and ultimately lead to complications or even death. It is important to note that resistance rates have reached alarming levels. It would therefore be important to undertake awareness-raising action on the proper use of these drugs with national and international recommendations for

standardizing therapeutic regimens and controlling the spread of resistance, which is one of the major challenges of the new millennium.

Conflicts of interest

The authors do not declare any conflict of interest

Références

[1] Tebano G, Pulcini C. Correct use of antibiotics in health establishments: how to move forward ? Journal of Anti-infectives 2016; (18): 98-105

[2] Hadeq S. Bacteria sensitivity profile in non-hospital settings at the level of the city of Sale city. Doctoral thesis in pharmacy. Rabat: University Mohammed V Faculty of Medicine and Pharmacy of Rabat 2016

[3] El Bakili Z. Bacteria sensitivity profile in non-hospital settings at the level of the city of Rabat city. Doctoral thesis in pharmacy. Rabat: University Mohammed V Faculty of Medicine and Pharmacy of Rabat 2016

[4] Nadmia H, Elotmani F, Talmi M, Zerouali K, Perrier-Gros-Claude J.D, Timinouni M. Antibiotic resistance profile of community uropathogenic enterobacteriaceae in El Jadida (Morocco). Medicine and Infectious Diseases 2010; 40: 303–5

[5] Serragui S, Derraji S, Mahassine F, Cherrah Y. Bacterial resistance: states of places in Morocco. Morocco Medical. 2013; volume 35 n ° 3: 199-205

[6] Baba Ahmed-KaziTani Z, Arlet G. News of antibiotic resistance in Gram-negative bacilli in Algeria. PATBIO-3117 ; No. of Pages 10

[7] Jehla F, Twizeyimanaa E. Sensitivity of bacteria to antibiotics: MICs are complementary to the antibiogram. Francophone Laboratories Review 2015 - n ° 476

[8] Bentroki A, Gouri A, Yakhlef A, Touaref A, Gueroudj A, Bensouilah T. Resistance to antibiotics from strains isolated from community urinary infections between 2007 and 2011 in Guelma (Algeria). Annales de Biologie Clinique 2012; 70 (6): 666-8

[9] El Bakkouri J, Belabbes H, Zerouali K, Belaiche A, Messaouidi D, Perrier J, Claude G, El Mdaghri N. Resistance to Antibiotics of Community Uropathogenic *Escherichia coli* and Consumption of Antibiotics in Casablanca (Morocco). European Journal of Scientific Research 2009

[10] Drancourt M. Bacterial Infections. Antiquity of antibiotic resistance. Journal of Anti-infectives. 2016. ANTINF-151, No. of Pages 5

[11] Lavigne Jean-Philippe, Sotto Albert, Merle Corinne, Jourdan Jacques, Soussy Claude-James, Sirot Danielle. Enzymatic resistance of Escherichia coli to beta-lactams and clinical prevalence. PatholBiol 2002; 50: 388-93

Figures

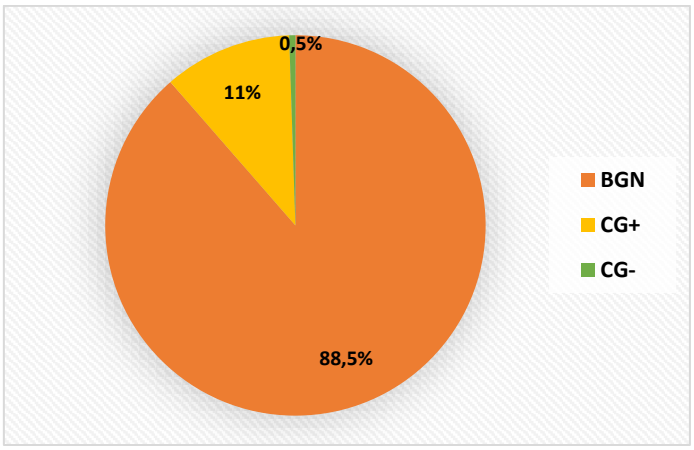

Figure 1 Diagram of the global distribution of isolates

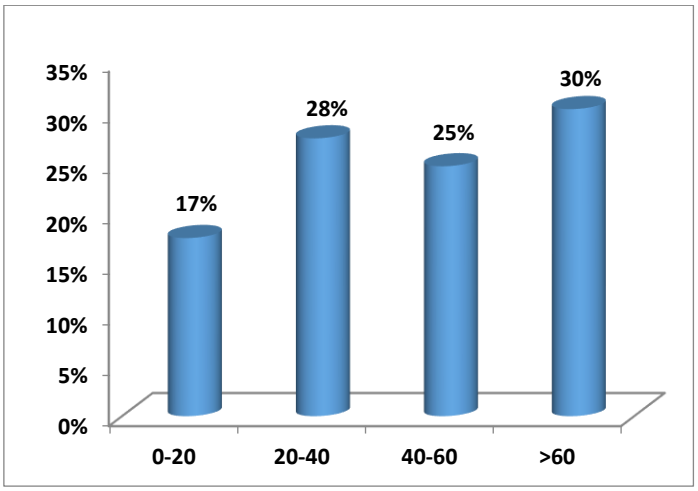

Figure 2 Global distribution by age

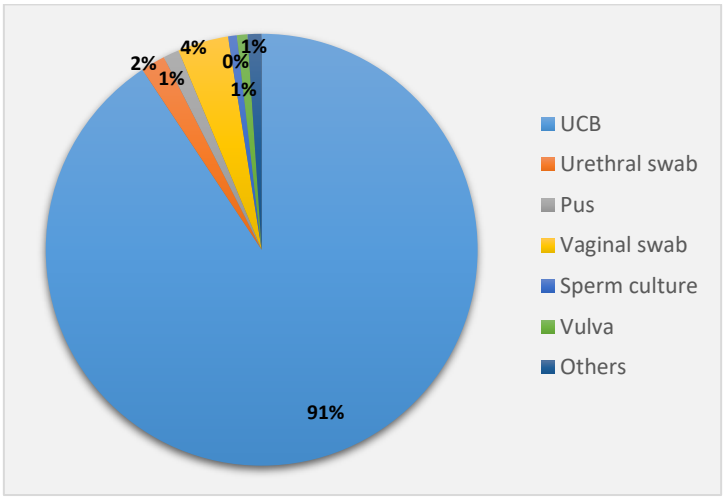

Figure 3 Global distribution of isolates according to the nature of the sample

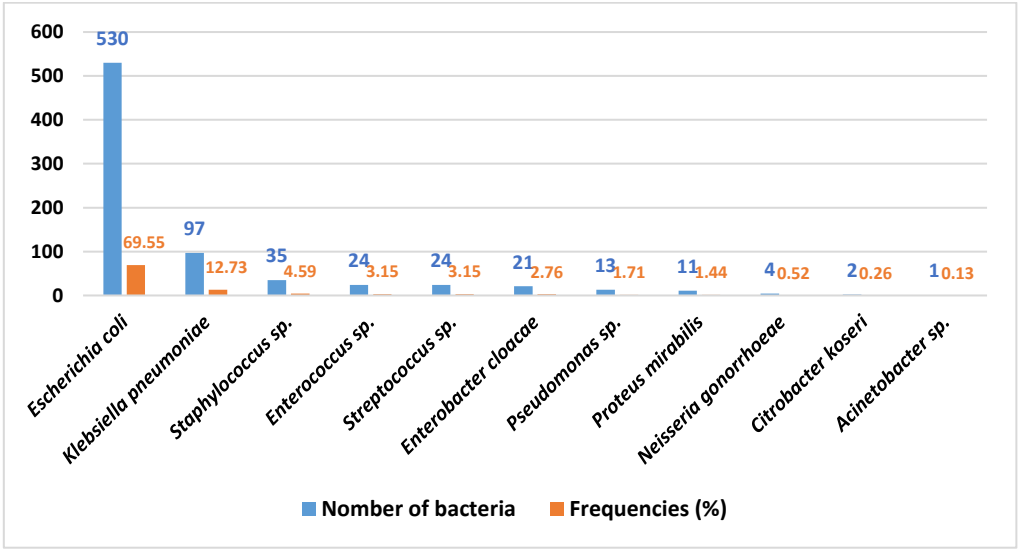

Figure 4 Global distribution of isolated bacteria

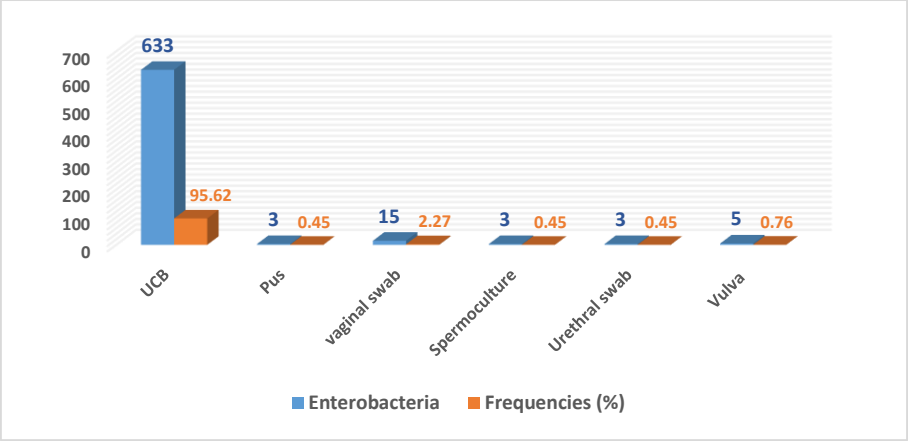

Figure 5 Distribution of Enterobacteriaceae according to the nature of the sample

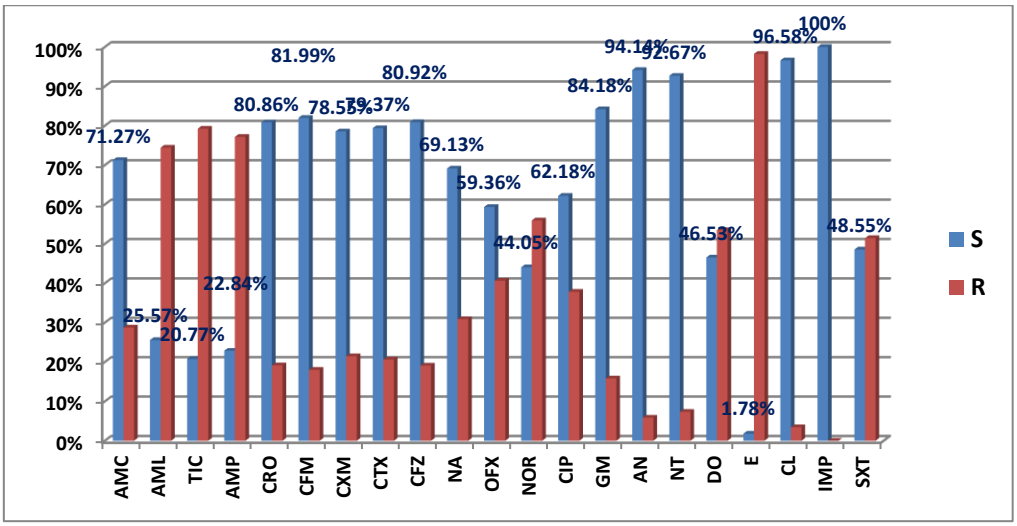

Figure 6 General susceptibility profile of Enterobacteriaceae to antibiotics

Amoxicillin (AMX), Ampicillin (AMP), Ticarcillin (TIC), Amoxicillin + clavulanic acid (AMC), Cefalotin (KF), Cefotaxim (CTX), Ceftriaxon (CRO), Cefixime (CFM), Cefuroxim (CXM), Ceftazidim (CAZ), Nalidixic acid (NA), Ofloxacine (OFX), Ciprofloxacin (CIP), Netilmicin (NT), Gentamicin (GM), Amikacin (AN), Doxycyclin (DO), Erythromycin (E), Imipenem (IMP), Tetracyclin (TET), Colistin (CT), Furans (FUR), Chloramphenicol (CHL), Sulfamethoxazole-trimethoprim (SXT).

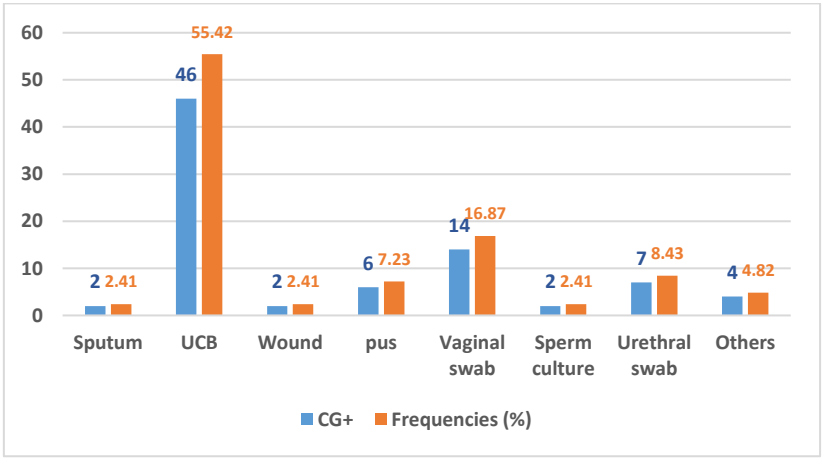

Figure 7 Distribution of Gram positive cocci according to the type of sample

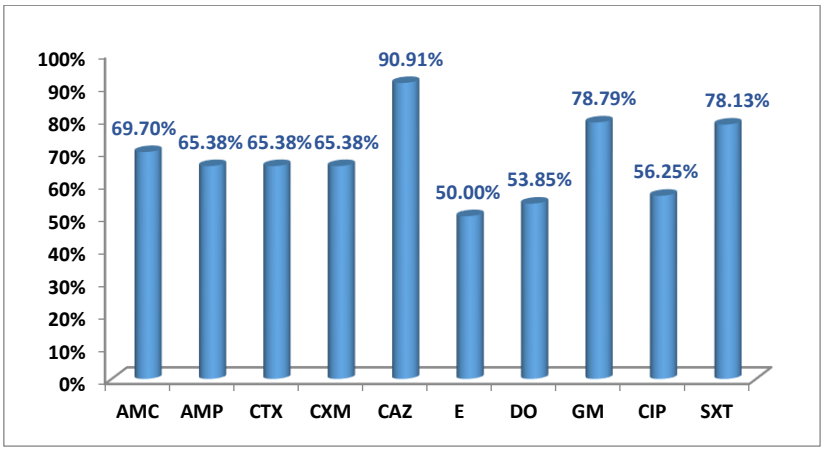

Figure 8 Profile of sensitivity of Staphylococcus sp. to antibiotics