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Bacteriological profile of community peritonitis operated in a Moroccan Hospital

--Manuscript Draft--

Bacteriological profile of community peritonitis operated in a Moroccan Hospital

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Abstract

Introduction. Peritonitis is characterized by acute inflammation of the peritoneum, often resulting from digestive organ perforation or intra-abdominal septic focus. It may be either of infectious or noninfectious origin. The germs involved are those of the digestive flora (*Enterobacteriaceae* and Anaerobic), while gram-positive cocci and yeasts can be isolated in nosocomial infections. Our study aims to isolate and identify the germs involved in community-acquired peritonitis, in order to assess their susceptibility to the antibiotics available in our Country.

Methods. This is a retrospective study of bacteriological profile of community peritonitis in Rabat Morocco. A total of 150 adult patients with peritonitis, were admitted and samples were collected intraoperatively for bacteriological examination between July 1, 2022 and April 30, 2023.

Results. Among the 150 patients, 101 (67.8%) were males and 48 (32.2%) were females, with sex/ratio of 2.1. The mean age of the patients was 40.5 years +/- 20.12. The distribution of germs was dominated by *Escherichia coli* (44%). Overall, 70% of *Escherichia coli* isolated, had a resistance to Ampicillin but no resistance to Ampicillin has been reported by *Enterococcus*.

Discussion. In the present study, we were interested in the bacteriological profile of community peritonitis, in order to adapt the antibiotic therapy to our bacterial ecology.
Our findings indicate a concerning trend of increasing resistance among *Escherichia coli* to the commonly used Amoxicillin/Clavulanic Acid combination in our clinical setting.

Conclusion. Consequently, there is a need to reassess the empiric antibiotic prescribed for the management of community-acquired peritonitis.

Key words: Peritonitis, Community, Resistance, Antibiotic.

Data Summary

No data was generated during this research or is required for the work to be reproduced

Introduction

Peritonitis is an acute inflammation of the peritoneum, either of infectious or noninfectious origin. It is most often secondary to the perforation of a digestive tract and/or the dissemination of a septic focus within the intra-abdominal cavity. Peritonitis is considered generalized when it extends throughout the peritoneal cavity [1].

The microorganisms involved mainly belong to the digestive flora; however, Gram-positive cocci and yeasts can be isolated in nosocomial infections [2].

Previous reports indicate a predominance of *Escherichia coli*, accounting for 65%, mostly sensitive to Ceftriaxone, Amoxicillin-Clavulanic Acid combination, and Imipenem [3].

Peritonitis represents a therapeutic emergency as they can jeopardize the patient's prognosis. Treatment involves a combination of medical and surgical interventions [4].

In Morocco, few studies have focused on the microbiological profile of the microorganisms implicated in community peritonitis.

The main objective of this study is to isolate and identifies the responsible bacteria, and assess their antibiotic sensitivity profiles within our context.

Materials and methods

This is a retrospective study carried out at the microbiology laboratory of Military Hospital of Instruction Mohamed V, over a period of ten months from July 1, 2022 to the end of April 2023 including 150 adult patients of both sexes aged over 15 years operated for peritonitis confirmed intraoperatively. We excluded patients under the age of 15, patients who received pre-admission antibiotic treatment, and patients whose appendix was macroscopically healthy.

Different samples were taken, depending on the anatomical site reached, such as deep pus and peritoneal fluid. The samples received in the laboratory have benefited from a macroscopic examination, a microscopic examination after Gram staining. The cultures were carried out on Columbia agar with 5% blood (GS), on Polyvitex chocolate agar (GSC) and Sabouraud-Chloramphenicol agar (for yeast research). All these media were incubated at 37.8°C for 18 to 24 hours in atmospheres enriched with 5% to 10% CO2. Selective and specific media were used, such as ANC blood agar (Nalidixic Acid and Colistin) and Schaedler agar (for anaerobic bacteria) with anaerobic incubation for 48 hours. The isolated organisms were identified using conventional bacteriological methods. The study of antibiotic sensitivity was carried out by the Muller-Hinton agar diffusion technique according to the recommendations of the Antibiotic Susceptibility Committee of the French Society of Microbiology EUCAST 2022.V.1.0 [5].

Data from the study were analyzed software SPSS 20.0. Statistical analysis used the usual description criteria of numbers and percentages.

Results

During our study, 251 samples have been received including 150 patients, of which, 162 were positive with a positivity rate of 65%. 101 (67.8%) were male and 48 (32.2%) female, the sex ratio (M/F) was 2.1. The mean age of the population was 40,5 years+/- 20.12 with extremes ranging from 15 to 94 years. **(Figure 1)**

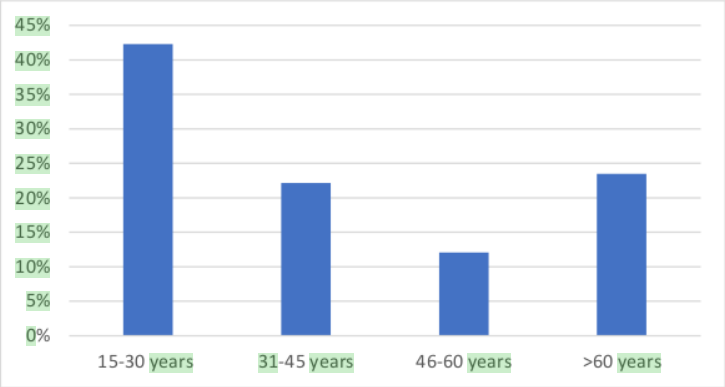
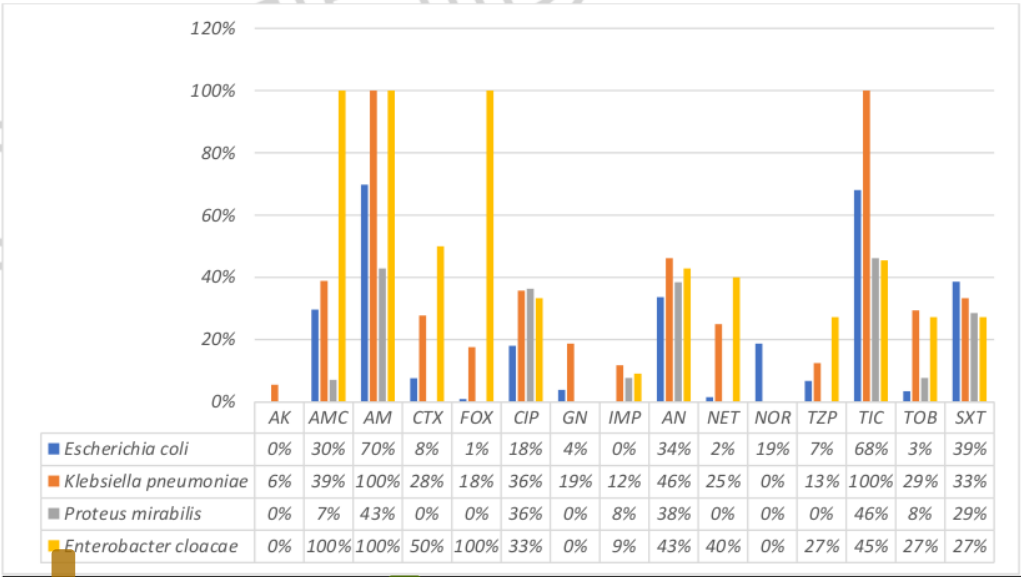


Figure 1: The distribution of the study population by age group.

The distribution of germs showed a predominance of *Escherichia coli* with a prevalence rate of 44%, followed by *Enterococcus faecalis* at 11%, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, both presenting a rate of 7%.

In terms of antibiotic sensitivity, *Escherichia coli* isolates showed a resistance rate of 70% to Ampicillin, 30% to Amoxicillin-Clavulanic Acid, 1% to Cefoxitin, 18% to Ciprofloxacin, 4% to Gentamicin, 0% to Amikacin, 30% to Trimethoprim/Sulfamethoxazole and 0% to Imipenem. **(Figure 2)**



	AK	AMC	AM	CTX	FOX	CIP	GN	IMP	AN	NET	NOR	TZP	TIC	TOB	SXT
Escherichia coli	0%	30%	70%	8%	1%	18%	4%	0%	34%	2%	19%	7%	68%	3%	39%
Klebsiella pneumoniae	6%	39%	100%	28%	18%	36%	19%	12%	46%	25%	0%	13%	100%	29%	33%
Proteus mirabilis	0%	7%	43%	0%	0%	36%	0%	8%	38%	0%	0%	0%	46%	8%	29%
Enterobacter cloacae	0%	100%	100%	50%	100%	33%	0%	9%	43%	40%	0%	27%	45%	27%	27%

AK: Amikacin, AMC: Amoxicillin + clavulanic acid, AMP: Ampicillin, FEP: Cefepime, CTX: Cefotaxime, FOX: Cefoxitin, CIP: Ciprofloxacin, CN: Gentamicin, IMP: Imipenem, NA: Nalidixic acid, NET: Netilmicin, NOR: Norfloxacin, TZP: Piperacillin + tazobactam, TIC: Ticarcillin, TM: Tobramycin, SXT: Trimethoprim / sulfamethoxazole.

Figure 2: Sensitivity profile of isolated germs to antibiotics

As for *Enterococcus faecalis* isolates, no resistance was observed to Ampicillin, Gentamicin, Teicoplanin or Vancomycin **(Figure 3)**.

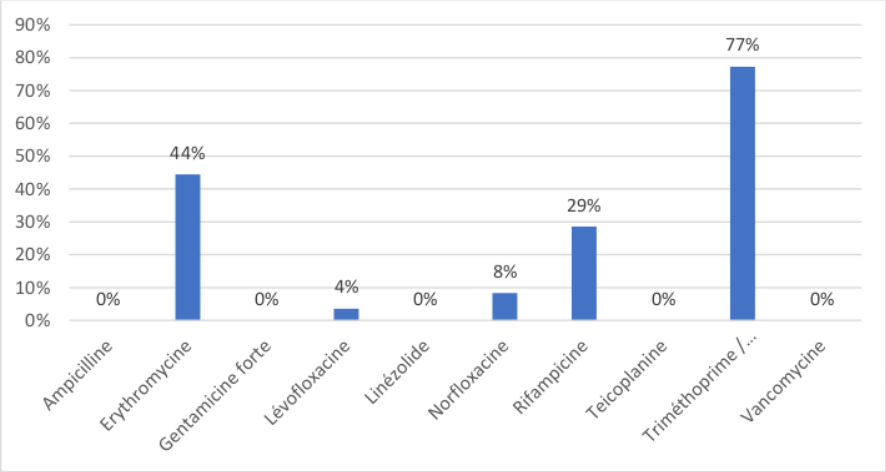


Figure 3: Sensitivity profile of *Enterococcus faecalis*.

Discussion

Peritonitis is an inflammation of the double peritoneal membrane, caused in the majority of cases by bacterial infections [6]. In developing countries, bacterial peritonitis is associated with a high risk of mortality. Effective microbiological diagnosis followed by appropriate antibiotic therapy improves treatment outcomes.

The average age of our patients, 40.5 years, does not differ from that found in the literature [7]. This could be explained by the precarious hygienic conditions in our developing countries, which contribute to the occurrence of the condition.

In our study, we found a male predominance. This finding has also been reported by other authors [7,8].

The diagnosis of peritonitis is based essentially on data from the interview and clinical examination, supplemented by paraclinical examinations and confirmed at laparotomy [4].

The microbiology of peritonitis is derived from intestinal flora [9]. It often involves polymicrobial infections, but only a small number have been proven to play a pathogenic role. Enterobacteriaceae, especially *Escherichia coli*, contribute to early mortality, while Anarerobes are implicated in abscess formation [10]. These are the germes to be systematically consider in community-acquired peritonitis.

The most frequent microbial agents found in our study were *Escherichia coli* (44%), *Enterococcus faecalis* (11%), *Klebsiella pneumoniae* (7%) and *Pseudomonas aeruginosa* (7%). Our data are close to those reported in France by Dupont et al and Sotto et al who has found a predominance of enterobacteria, particularly *Escherichia coli*, with prevalences of 33% and 25% respectively. In contrast, Solomkin and colleagues in the USA found a predominance of *Bacteroides sp*, with a prevalence of 27%, but in less severe peritonitis. In another study conducted in the United States *Escherichia coli* represented 17%, *Bacteroides sp* (27%) in

peritonitis. On the other hand, *Klebsiella pneumoniae, Enterobacter sp, Aerobacter sp* and Anaerobes were isolated in peptic ulcer perforation peritonitis [11-13].

Several treatment protocols have been proposed since the early 1960s [3], and numerous publications have examined the resistance profile of *Escherichia* coli in peritonitis [10,14]. The combination of Amoxicillin/Clavulanic Acid combination was the antibiotic of choice recommended by several French authors in the 1990s [4]. However, as early as 2000, the French consensus conference recommended combining Amoxicillin/Clavulanic acid with an Aminosid [15]. In our study, *Escherichia coli* strains showed a resistance rate to Amoxicillin-Clavulanic Acid of 30%. This rate is similar to those reported at the national level [3,12].

In an adult study conducted in 2009, 26% of *Escherichia coli* were resistant to the combination of Amoxicillin and Clavulanic Acid [15] revealing a 10% increase in this rate compared with a similar study conducted in 2006.

We believe that this rate of resistance in our context could be linked to the overuse of antibiotics, especially Amoxicillin-Clavulanic Acid, often self-medicated for respiratory, digestive and urinary tract infections. This could lead to an increase in the rate of resistant strains.

New protocols for probabilistic antibiotic therapy have been proposed to treat these potentially serious infections. A triple combination of Ceftriaxone, Metronidazole and Gentamicin is effective against *Escherichia* coli and Anaerobes or Ertapenem monotherapy is also effective. The use of other antimicrobials such as Impenem, Cefepime, Aztreonam and Tigecycline must be limited to avoid the emergence of multi-resistant strains [14-16].

Conclusion

Our study reviewed the resistance profile of *Escherichia coli* during community-acquired peritonitis across the Rabat region of Morocco. Our results showed that this germ is becoming increasingly resistant to the Amoxicillin/Clavulanic Acid combination, which is the antibiotic commonly used in our context. Particular attention needs to be paid to reducing the inappropriate use of antibiotics and banning self-medication. Other studies need to be carried out to monitor changes in the bacteriological profile of the germs responsible for peritonitis and to guide probabilistic antibiotic therapy.

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Author contributions

S.B. contributed to the initial drafting of the manuscript, while F.Z, EL.B, L.L, Y.B and M.C. revised it M.EL provided final approval for the version to be published.

Conflicts of interest:

The authors declare that there are no conflicts of interest.

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