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Bacteriological profile of community peritonitis in adults at Mohammed VI university hospital

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Abstract

A good analysis of intraperitoneal bacteriological results constitutes the basis of therapeutic consideration. The objective of this work is to report the main epidemiological and bacteriological characteristics of community-acquired peritonitis in adults at the Mohammed VI University Hospital of Marrakech.

This is a retrospective descriptive study carried out in the microbiology laboratory of Arrazi hospital at Mohammed VI University Hospital in Marrakech over a period of seven years from January 1, 2017 to December 31, 2023 including all community peritonitis documented in our hospital. The cytobacteriological study was carried out according to conventional methods. During the study period (2017-2023), 503 documented peritonitis were collected, The profile of the incriminated germs was dominated by *Escherichia coli* (48.9%) followed by *Streptococci* (18.3%), 8% of *Pseudomonas aeruginosa* and 18.5% for other *Enterobacteria*.

Our results showed that *E coli* becomes increasingly resistant to the combination of amoxicillin acid clavulanic which is the antibiotic commonly used in our context, this leads us to review the antibiotics prescribed probabilistically in our context for the management of peritonitis community.

Keywords: Peritonitis; Community Peritonitis; Antibiotic Therapy; Epidemiology of Community Peritonitis

1. Introduction

Peritonitis corresponds to an acute inflammation of the peritoneum, the most frequent causes of which are infectious, most often by perforation of the digestive tract. We distinguish between extra-hospital infections and nosocomial infections, mainly postoperative. The germs involved are those of the digestive flora (enterobacteria and anaerobes), but gram-positive cocci and yeasts can be isolated in infections acquired in hospital. These conditions are a therapeutic emergency. The diagnosis is most often clinical, with the help of radiological examinations. Treatment is surgical and medical [1]. The bacteria responsible for community-acquired peritonitis mainly come from the intestinal flora. Given its great diversity, it is therefore fundamental to know it well as well as the factors that can influence its composition. Despite the significant progress made in the medical field, particularly in the effectiveness of antibiotic therapy and resuscitation techniques, postoperative intraabdominal infections remain a serious condition for humans [2]. Etiological treatment is based on surgery to identify and eliminate the cause of the infection, take microbiological samples, perform peritoneal cleansing and prevent recurrence. Medical treatment takes care of the consequences of infection through intraoperative resuscitation and antibiotic treatment directed against germs isolated from

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intraoperative samples. Antibiotic therapy that does not take into account all isolated germs and late treatment are factors in therapeutic failure, persistence of infection, and even death. Likewise, the condition remains burdened with high mortality when it occurs in an elderly person with underlying diseases who is operated on late, particularly when it involves a postoperative infection. The duration of treatment is around 7 to 10 days, or even less in the case of infection treated early and in patients without failure [1]. It is certain that the progress made in surgical techniques, the discovery of aseptic methods and then antibiotics have dramatically improved the prognosis of peritonitis. To achieve this result, careful multidisciplinary care is essential, involving: surgeons, anesthetists-intensivists, microbiologists and radiologists. It is therefore necessary to urgently compensate for the hemodynamic, respiratory and biological changes that the patient presents. As soon as the diagnosis is made, probabilistic antibiotic therapy must be started which will, possibly, be adapted to the bacteriological results of the peritoneal samples taken during the intervention. This antibiotic therapy will depend on the direct examination of peritoneal samples, but also on the bacterial ecology of the department, and the level of the leak responsible for peritonitis. Furthermore, the establishment of microbial mapping is the pillar of any probabilistic antibiotic therapy, hence the role of surgeons during interventions in taking samples from intra-abdominal infectious sites, taking into consideration the types of germs frequently associated in these types of infection, and which will then be researched by microbiologists, and test their sensitivities in relation to the different families of antibiotics [3].

This study aimed to isolate and identify the germs involved in acute peritonitis in order to evaluate their sensitivity to available antibiotics and to propose effective therapeutic regimens for the management of community-acquired peritonitis in the general and digestive surgery department at the Mohamed VI University Hospital of Marrakech. With this in mind, the objective of this work is to report the main epidemiological and bacteriological characteristics of community peritonitis in adults at the Mohammed VI University Hospital of Marrakech.

2. Patients and methods

This is a retrospective descriptive study carried out in the microbiology laboratory of the Arrazi hospital at the Mohammed VI University Hospital of Marrakech over a period of seven years ranging from January 1, 2017 to December 31, 2023 including all community peritonitis documented in patients aged over fifteen treated in the visceral surgery department.

The cytobacteriological study was carried out according to conventional methods with direct examination and culturing on enriched and selective media. Bacterial identification was carried out by the BD PHOENIX100 automated system from 2017 to 2019 and since 2020 by mass spectrometry on a MALDI BiotyperTM automated system. The study of antibiotic sensitivity was carried out by the BD Phoenix M50 automated system and the interpretation was made according to the standards of the antibiogram committee of the French Society of Microbiology EUCAST. The data collected focused on age, sex, isolated germs and antibiotic resistance profiles. Data processing was carried out using Excel software.

3. Results

During the study period (2017-2023), 503 documented peritonitis were collected, representing a prevalence of 37.2%. The average age of the patients was 52.4 with extremes ranging from 15 years to 93 years. A male predominance with a M/F sex ratio of 1.7 was observed.

The profile of the incriminated germs was dominated by *Escherichia coli* (48.9%) followed by *Streptococci* (18.3%), 8% of *Pseudomonas aeruginosa* and 18.5% for other *Enterobacteria*.

For peritonitis associating two germs, an association of *E.coli* with Streptococci was found in 35% of these peritonitis (including 20% with *Enterococcus*) and 10.2% with *Pseudomonas aeruginosa*. Strains of *E. coli* showed a sensitivity of 12.7% to amoxicillin, 14% to amoxicillin–clavulanic acid, 86.9% to ceftriaxone and ceftazidime, 86.9% to piperacillin tazobactam, 97% to imipenem, 83% with gentamicin 98% with amikacin 85% to ciprofloxacin and 75% to trimethoprim-sulfamethoxazole. 7% of the isolates presented resistance to third generation cephalosporins by production of an extended spectrum beta-lactamase (13%).

Klebsiella pneumoniae strains showed 71.5% susceptibility to amoxicillin- clavulanic acid, 71.5% sensitivity to third generation cephalosporins, 81.3% sensitivity to ciprofloxain and 80% to trimethoprim-sulfamethoxazole. All *Klebsiella pneumoniae* strains were susceptible to imipenem and amikacin

Pseudomonas aeruginosae strains showed a sensitivity of 98.1% to ceftazidime.

Evolution of resistance among all *E.coli* isolates increased from 60% to 75% for Amoxicillin clavulanic acid and from 12% to 20% for C3G.

E.coli is the main bacterial strain involved in community-acquired peritonitis; there is an increase in isolates of 10% between 2017 and 2023.

During the study period, there was an increase in *E.coli* strains with reduced sensitivity to carbapenems of 12.5%.

Table 1 Percentage of antibiotic resistance in *E. coli* strains isolated from adult peritonitis over 7 years at Marrakech University Hospital (n = 213)

	Resistance %	**Nombre**
AMOXICILLINE	87.3	186
AMOXICILLINE ACIDE CLAVULANIQUE	75	162
CEFTAZIDIME	13.1	28
CeFOTAXIME	12.1	26
CEFEPIME	11.7	25
PIPERACILLIN-TAZOBACTAM	13.1	28
CIPROFLOXACINE	14.5	31
ERTAPENEME	7	15
IMPENEME	2.3	05
GENTAMICINE	16.4	35
AMIKACINE	1.9	04
TRIMETHOPRIM-SULFAMETHOXAZOLE	25	54

Table 2 Percentage and number of bacteria isolated in adult peritonitis over 07 years at Marrakech University Hospital (n =436)

	Nombre	**%**
Polymicrobial infection	67	13.3%
Monomicrobial infection	436	86.7%
Enterobacteria	294	67.4%
E.coli	213	48.9%
Klebsiella spp	32	10.8%
Enterobacter	20	6.8%
Citrobacter *Seratia marcesens* *Morganella sp* *Proteus sp*	15 01 06 08	5.1% 0.3% 1.3% 2.7%
Non-fermentative BGN	41	9.3%
Pseudomonas aeruginosa	35	8.0%
Acinetobacter baumanii	06	1.3%

Streptococci	82	18.3%
Entérocoque	40	9.1%
Streptocoque spp	42	9.2%
Staphylococci	09	2.1%
MRSA	*03*	*0.7%*
MSSA	06	1.4%
Candida	10	2.3%

Table 2 Percentage of antibiotic resistance in gram negative bacteria isolated from adult peritonitis over 07 years at Marrakech University Hospital result expressed in %

ATB **Micro organism**	**AMX**	**AMC**	**FOX**	**CAZ**	**CTX**	**FEP**	**PTZ**	**CIP**	**ERT**	**IMP**	**G**	**AK**	**SXT**
E.coli(n =213)	87.3	75	12.1	13.1	16	11.7	13.1	33	7	2.3	16.4	1.9	25
Kp(n =32)	100	28.5	28.5	28.5	28.5	23	18.7	18.7	0	0	20	0	20
Enterobacter(n =20)	100	100	70	35	35	35	30	29.3	30	30	0	0	19.8
Citrobacter (n =15)	100	100	0	8.6	8.6	0	0	20	0	0	0	0	0
Pseudomonas aeroginosa(n =35)	100	100	-	7.9	100	-	7.9	7.9	100	7.9	8	-	100

Table 3 Percentage of antibiotic resistance in *Staphylococci* isolated from adult peritonitis over 7 years at Marrakech University Hospital result expressed in %

	AMX	**AMC**	**C1G**	**FOX**	**CRO**	**CXT**	**FEP**	**CIP**	**SXT**	**G**	**AK**
Staphylocoque(n=9)	100	25	25	25	25	25	25	50	50	33	0

4. Discussion

Peritonitis corresponds to an acute inflammation of the peritoneum, the most frequent causes of which are infectious, most often by perforation of the digestive tract. A distinction is made between extra-hospital infections and nosocomial infections, mainly postoperative [1]. Community peritonitis, which is the subject of this work, is defined by its acquisition outside a hospital structure. [4] The species isolated during community peritonitis come from the commensal digestive flora which colonize the peritoneal fluid. The samples are most often poly microbials around 2 to 4 different species [5] involving aerobic germs (enterobacteria, streptococci and enterococci) and anaerobic germs [6]

The eradication of the infectious source must be systematic, as an emergency, carried out by a complete peritoneal cleansing whatever the surgical technique (laparotomy or laparoscopy) implemented; under no circumstances should the initiation of antiinfectives be delayed for take peritoneal microbiological samples [7] The data in the literature do not allow us to recommend one antibiotic therapy over another.

However, it is fundamental as first intention to choose an antibiotic active on Gram-negative bacilli and anaerobic germs such as the amoxicillin/clavulanic acid or piperacillin/tazobactam combination. Knowledge of the local bacterial ecology of Escherichia coli (resistance to amox/ac.clav) could guide this choice. [15]

The most frequently found microbial species in this series was *Escherichia coli* in 48.9% cases. This trend was noticed in most series with a few variations from one series to another. Indeed, a study carried out in Marrakech found a rate of 57% [8], other retrospective studies carried out in Burkina Fasso showed rates between 33.3% and 47% [9] [10]. A

recent study conducted in China showed a rate of 20.96% [9] This proportion of *E. coli* in community peritonitis was 43% in a multicenter observational study conducted in 68 establishments worldwide [12]

This study revealed 20.1% of gram-positive cocci including 19.9% of *Streptococcus spp* and 7.1% of *Enterococci.* Generally speaking, the literature is divided on the pathogenic role of *enterococcus*, witness to or responsible for the severity of peritonitis. Some studies show an increase in mortality associated with the presence of *enterococcus* [18,19], while others only find an increase in morbidity [20-21]. Experts from the French Society of Anesthesia and Intensive Care SFAR [22] recommend not taking *enterococci* into account in the probabilistic treatment of community-acquired peritonitis without signs of shock. However, *Enterococcus* must be targeted if ongoing antibiotic therapy, hepatobiliary pathology, liver transplantation. Faced with the controversial pathogenic role of enterococci, additional clinical studies must be carried out in order to clarify the place of antibiotics active on enterococci in the therapeutic arsenal of secondary community peritonitis. [23]

Staphylococcus aureus represented a rate of 2.1% with two strains resistant to methicillin. According to a prospective study carried out on seventy-two patients in the second university hospital in Burkina Faso; staphylococcus represented a 12% portion with 28% *MRSA* [10]. Antibiotic therapy for more than 48 hours in the preceding 15 days is sufficient to promote the emergence of Multi resistant bacteria [24]

We noted 8 % of *Pseudomonas aeruginosa* in community peritonitis in this series. The pathogenicity of *Pseudomonas* has never been demonstrated; its presence is often associated with other bacteria [22]. The risk of *Pseudomonas* and *Enterobacter* infection is described in patients with a risk of modified bacterial ecology (living in an institution, prior antibiotic therapy). In work carried out on 234 community infections, *P. aeruginosa* was not detected found only in 5% of samples and *Enterobacterspp* in 13% of cases [26]. Even if *Pseudomonas* and *Enterobacter* were not taken into account in probabilistic antibiotic therapy, the recovery of microbiological results made it possible to include antibiotics active on these germs.

This study revealed 2.3% *Candida spp*; a French observational study revealed an average yeast percentage of 4% [25] while it was around 7.7% in a previous study carried out in South Africa [9]. *Candida* are saprophytic hosts of the normal digestive tract, their pathogenic value remains debated, leading to limiting antifungal treatments to severe infections. SFAR experts do not recommend initiating antifungal treatment in community-acquired peritonitis except in immunocompromised patients. , transplanted or suffering from an inflammatory disease.[22]

This synthesis made over the last 7 years, made it possible to report that the local microbiological profile of community peritonitis at the Marrakech University Hospital is consistent with the literature data with the predominance of *E.coli* and the involvement of *Enterococcus* and *Pseudomonas aeroginosa*. In the present study the search for anaerobic germs was not carried out; however their associations with aerobic germs has been confirmed in several studies; the difficulty in transporting anaerobes to the laboratory explains their low proportions even though they are clearly present [27,28] and several studies discuss the need to systematically search for strictly anaerobic bacteria in peritoneal fluid [23].

This study also reports a high percentage of resistance to amoxicillin–clavulanic acid and C3G in *E.coli* strains which increased from 60% in 2017 to 75% in 2023 for amoxicillin–clavulanic acid and with an increase in resistance of 09% for C3G. The emergence of strains with reduced sensitivity to carbapenems represented 12% during the period of our study.

New probabilistic antibiotic therapy protocols have been proposed to treat these potentially serious infections. French experts have proposed for the probabilistic treatment of community acquired peritonitis to target aerobic and anaerobe Gram-negative bacilli using a combination of amoxicillin/clavulanic acid + gentamicin or cefotaxime (or ceftriaxone) + metronidazole. In case of severe infection, the presence of *enterococci* should be targeted by the use of piperacillintazobactam + gentamicin. Probabilistic antifungal treatment is recommended if yeast is observed on direct examination, or in cases of severe infection [29].

5. Conclusion

Community-acquired peritonitis represents an emergency that requires surgical intervention and rapid initiation of probabilistic antibiotic therapy. Knowledge of the ecology of the service and the establishment is an effective way to optimize probabilistic antibiotic therapy and improve coverage of all germs involved. This monitoring of the microbial ecology of community-acquired peritonitis in adults over the last 7 years highlights the increasing involvement of *E.coli* strains resistant to C3G, which exposes the risk of therapeutic failure and a duration of Longer hospitalization. The

drafting of a local consensus must be put in place to adapt the medical treatment of community peritonitis. This probabilistic treatment will be secondarily oriented according to the results of the antibiogram.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest

Statement of ethical approval

All the data has been collected anonymously following patient confidentiality

Statement of informed consent

Informed consent was obtained from all individual participants included in the study..

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