Bacteriology and Antibiotic susceptibility of community-acquired peritonitis in Hôpital Régional de Ségou (Mali).

Beye S.A., Traoré A.M., Camara B.

ABSTRACT

Objective

The objective of this study was to determine the susceptibility of bacterial pathogens isolated specimens collected from community-acquired peritonitis, in order to provide guidance to hospital practitioners on adequacy of antibiotic therapy.

Patients and Methods

A cross sectorial prospective study of bacterial pathogen was carried out on a total of 98 patients who were operated for community-acquired peritonitis at Hôpital Régional de Ségou (HRS) from March, 2016 to February 2017. All pathogens were identified by standard microbiologic methods and their antibiotic susceptibility testing was performed using disk diffusion method.

Results

A total of 98 patients were operated with a diagnosis community acquired-peritonitis. The mean age was 26 ± 17,5. Men were more represented with a sex ratio of 2,5. Specimens were collected systematically during the surgical procedure (laparotomy) by the surgeon using aspiration via a syringe, On macroscopic examination, collected specimens were: purulent (61 cases), faecaloid (16 cases), bilious (8 cases) and seropurulent (8 cases). Out of 98 cultures specimens, 78 were positive (79.6%). Average time for culture results was 3.7 ± 1.7 days. In 87.2% of positive results, cultures were mono-microbial with 79 bacterial strains identified. Gram-negative bacilli accounted for 71.2% of isolated bacteria versus 28.8% for Gram-positive Cocci. Escherichia Coli accounted for 71.2% of the strains, followed by Citrobacter Koseri. Staphylococcus aureus was the most frequent Gram-positive cocci strain. Escherichia coli was of diminished susceptibility to Amoxicillin/Clavulanic acid (AMX/CLV), and susceptibility to Third Generation of Cephalosporin (3GC) and second-generation quinolones. Staphylococcal strains were susceptible to aminoglycosides and quinolones but resistant to oxacillin in 91.6% of cases.

Conclusion

Probabilistic antibiotic therapy in community peritonitis in Ségou could be performed by C3Gs and aminoglycosides.

Index terms: peritonitis, susceptibility, antibiotic, Ségou, Mali

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INTRODUCTION

Peritonitis is a serious intra-abdominal infection requiring both a quality surgical intervention and an effective and adapted antibiotic regimen. Antibiotic therapy remains problematic in low- and middle-income countries (LMICs) [1], because of many limitations and constraints: long waiting time for the results of microbiology examinations could be a poor prognosis for patients contributing to poorly adapted antibiotic therapy [2].

This situation could contribute to the occurrence of bacterial antibiotic resistance (ABR). The emergence and diffusion of ABR poses a major threat to global public health. Antibiotic therapy in community-acquired peritonitis was the subject of a French consensus conference recommending the use of either monotherapy or combinations depending on the existence of severity and others in particular the species usually encountered, the risk of emergence of strains resistant to fluoroquinolones, the lack of direct information on the susceptibility of bacteria isolated in peritonitis, etc.. [3]. these updated recommendations advocate first-line use of one of the following antibiotic regimens: (1) AMX/CLV + gentamicin; (2) cefotaxime or ceftriaxone + imidazole during intra-abdominal infections [4]. Recent data show changes in ABR prevalence amongst microbes responsible for community-acquired peritonitis [5].

In Mali, few updated data exist on the susceptibility of bacteria to antibiotics in community-acquired peritonitis in general and in particular). We conducted this study to determine antibiotic susceptibility of pathogens in HRS (4th administrative region of Mali) with the goal of providing recommendations and guidance for probabilistic antibiotic therapy in community-acquired peritonitis.

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PATIENTS AND METHODS

A cross sectorial prospective study of bacterial pathogen was carried out on a total of 98 patients that were operated by laparotomy with a diagnosis of community acquired-peritonitis at HRS from March, 2016 to February 2017. All bacteria were identified by standard microbiologic methods. Antibiotic susceptibility testing was performed using disk diffusion method. Ségou region is located in the centre of Mali and has a population of 3.7 million inhabitants. HRS is a secondary level of care structure according to the Malian national denomination. Inclusion criteria were: patients admitted to the emergency room with a working diagnosis of community-acquired peritonitis and transferred to the General Surgery Department. Sampling was performed using syringe aspiration after laparotomy. Isolation and identification of bacterial strains were performed in HRS' medical biology laboratory - bacteriology unit. Morphological traits, direct examination, isolation on adapted media, and biochemical identification galleries were used to identify bacterial strains. Mueller-Hinton agar (MH) and horse-blood MH broth supplemented with β-NAD (MH-F broth) were used in Agar diffusion method for non-slow-growing bacteria. Sampling and culture methods did not allow for anaerobic pathogen identification. Standard Kirby-Bauer (KB) antibiotic testing using antibiotic-containing discs in Agar medium were used to obtain antibiograms. For each antibiotic standard sized zones of inhibition were used to determine susceptibility. Readings were performed at 24h after incubation and results were reported as sensitive, intermediate, or resistant, based on the size of the zone of inhibition. Different antibiotics have been tested using KB testing: amoxicillin (AMX), ticarcillin, amoxicillin-clavulanic acid (AMX/CLV), cefazoline, cefotaxime, cefixime, ceftazidime, aztreonam, imipenem, amikacin, gentamycin, tobramycin, chloramphenicol, cotrimoxazole, colistin and ciprofloxacin.

Data were analysed using Epi Info software version 3.5. Studied variables included sociodemographic data (age, sex, occupation, residence), medical history (consultation period, time to take charge, pathway first), bacteriological (isolated germ, antibiotic susceptibility) and outcome.

Consent for intra-operative sampling was obtained for all patients and data was processed anonymously.

RESULTS

EPIDEMIOLOGICAL ASPECTS

During the study period, 98 patients were included in 104 admitted for community-acquired peritonitis, a frequency of 94.2%. The average age was 26.9 (17.5 years [5-85 years]. The sex ratio (H/F) was equal to 2.5. age distribution showed a peak incidence between the ages of 16 to 30-years with 43.9%. Average consultation time was 8.4 (6.9 days. Frequent occupations were: cultivator (33.7%), housewife and non-schooled child with each 17.3%. The majority of patients were referred by peripheral health structures (64.3% of cases). Antibiotic therapy was introduced before the reference in 53 patients or 54.1% of the studied population

sample. The use of the traditional practitioner before admission to hospital was 25.5%.

CLINICAL AETIOLOGIES

All analysed patients presented to the ER with clinical signs of generalised. They all underwent laparotomy: upper and lower midline incision (90 cases), right para rectal (7 cases) and a right subcostal (1). Intraoperative exploration showed intra-peritoneal suppuration (61 cases), faecaloid matter (16 cases), bilious liquid (8 cases), and sero-purulent (8 cases). Etiologies were: appendicular peritonitis (52%), ileal and colic perforation in 18.3%, gastric perforation (16.5%), pelvi-peritonitis (7.1%) and others (6.1% including duodenal perforation: 1 case and biliary: 5 cases).

BACTERIOLOGICAL CHARACTERISTICS:

Microbial culture was contributory in 78 cases or 79.6% bacteriological growth. Average time to bacterial culture results was 3.7 (1.7 days with extremes of 2 to 10 days.). Sixty-eight cultures were monomicrobial (87.2% of the cases). In 10 cases there were polymicrobial (two-germs) cultures (12.8% of the cases. A total of 79 bacterial strains were identified. Enterobacteria are reported on table I according to their classification. These enterobacteria accounted for 52 cases (65.8%) among isolated bacterial strains. Escherichia coli was the most prevalent bacterial species with 37 cases (71.2%) enterobacteria, followed by Citrobacter koseri (7 cases), Proteus mirabilis and Enterobacter cloacae with 2 cases each. Enterobacteria are followed by Gram-positive cocci with 27 cases or 34.2% of isolated bacteria. In the cocci group, Staphylococcus aureus was the most prevalent with 13 cases (50%), followed by coagulase-negative Staphylococcus with 11 cases (42.3%). Table II shows the susceptibilities of germs to antibiotics. Strains of E. coli were susceptible to aminoglycosides in 56.7% of cases, third generation cephalosporins (C3G) (59.4%), quinolones (59.4%), and AMX/CLV (21.6%). Citrobacter koseri were sensitive to C3G in 71.4% of cases. The two isolates of Enterobacter cloacae were resistant to C3G, sensitive to aminoglycosides and quinolones with 50%, respectively. Staphylococcus aureus were sensitive to aminoglycosides (83.3% of isolates), quinolones (58.3% of isolates). Staphylococcal strains were resistant to oxacillin in 91.6% of isolates.

THERAPEUTIC AND OUTCOME ASPECTS

The Protocol of probabilistic antibiotic therapy instituted was based on the Association of ampicillin + metronidazole + gentamycin (94 cases) and ceftriaxone + metronidazole (4 cases). Following the result of antibiotic susceptibility, a therapeutic adaptation was performed in 64.3% of cases with the following regimens: ciprofloxacin + metronidazole and ceftriaxone + metronidazole. Outcomes were favourable in 54 patients. Unfavourable outcomes with complications occurred in 36 patients with parietal suppuration (30 cases) and evisceration (5 cases). Death occurred in 8 cases.

DISCUSSION

Peritonitis is a common cause of acute abdomen. The study of the susceptibility profile is of paramount importance. It is a quality approach to providing sentinel and therapeutic epidemiological data for rapid decision-making.

Epidemiological aspects:

Peritonitis is a common cause of acute abdomens in an African care environment with high mortality and morbidity. It remains a pathology of the young adult as is reported in many series [1, 2, 6, 7]. Male predominance is reported in the African series [1, 6, 7] as was the case in our study. The majority of our patients lived in rural areas with frequent use of complementary and alternative medicine or traditional practitioners. These two factors could explain the observed delays to hospital consultation, which consequently could result in poorer prognosis as previously shown [8]. Lack of resuscitation and intensive care services in peripheral structures is a frequent referral motive to the regional hospital.

CLINICAL ETIOLOGIES

Ileal perforations use to be the first cause of peritonitis in African series, followed by appendicular perforation [6.7]. However as shown in our data, eradication programs against certain diseases, such as typhoid fever with the improvement of hygiene and sanitation, vaccination and case treatment, have led to a decrease in its prevalence o as a cause for peritonitis.

BACTERIOLOGICAL PROFILES

The microbial ecology of community peritonitis has evolved little over time [9-11]. E. coli remains the most frequently isolated aerobic species of enterobacteria [1.8]. In the majority of cases, it is described a constant Association of aerobic and anaerobic germs [3, 5, 8] with a flora stackable to the normal digestive flora. Polymicrobial infections are reported in several series [1, 3, 5, 9]; however, our results showed a low prevalence of polymicrobial cultures with only ten positive (two-germs) cultures. The conditions for transferring microbiological samples and waiting time at the laboratory level can influence the amount of anaerobic flora. Other isolated enterobacteria were Citrobacter koseri (7 cases) and Enterobacter SP.

Although reported with a significant prevalence in some series, nonfermenting gram-negative bacilli were not found in our study [1.12]. [12.13]. We found similar proportions of Gram-positive cocci as is reported by other authors [1.14]. Staphylococcal disease was predominant with 13 cases. Streptococcus was not isolated in our study, as was the case in other studies [1, 13, 14].

The purpose of antibiotic therapy is to control the bacterium and the spread of infection [1]. In this context the regimen proposed by the consensus conference in 2001 was AMX/CLV and gentamycin incubating the enterobacteria particularly E. coli and S. aureus. A decrease in the susceptibility of enterobacteria to AMX was noted. It was

52% of the enterobacterial strains resistant to AMX/CLV in a series in Burkina Faso [1]. In our series 21.6% of E. coli strains were susceptible to AMX/CLV. Prior exposure to AMX remains the only risk factor for AMX/CLV -resistant E. coli [15]. In the context of Mali, the practice of self-medication with antibiotics is common because of the illicit sale to the market and the free purchase in pharmacies. The clinical impact of inadequate antibiotic therapy is well established in terms of promotion of ABR which can lead to therapeutic impasse. ABR is an increasingly worrying global problem and very few new antibiotics have been introduced in recent years. Therapeutic failures are already being observed in community-acquired infections such as pyelonephritis and peritonitis [16]. Methicillin-resistant Staphylococcus aureus (MRSA) has long remained the prototype of the nosocomial pathogen, which allowed for the maintenance of beta-lactams in the treatment of community diseases [17]. Nowadays their frequency increases in the community. In our series 91.6% of Staphylococcus aureus were MRSA. Susceptibility was maintained for second-group aminoglycosides and quinolones. Thus, antibiotic therapy should take into account the level of resistance of germs. We performed therapeutic adjustment with a C3G and an imidazole. Enterobacteria showed high levels of susceptibility to C3Gs whereas Staphylococcus strains were more often resistant. The addition of an aminoglycoside would probably palliate that. In the SMART study, 8% of the strains of E. coli were secretory of extended spectrum beta lactamase (ESBL) between 2005 and 2007 [18]. [1] Its proportion was 12% in the Burkinabé series. The occurrence of infectious complications is observed if the initial antibiotic therapy at the time of the surgical procedure is inadequate [19]. Another study would be needed to monitor the evolution of this resistance and evaluate the secretory enterobacteria of ESBL in our region.

Limitations

The main limitation of our study is the absence of specific anaerobic bacteria collection and culture means which might have impacted our results.

The conditions for transferring microbiological samples and waiting time at the laboratory could also have influenced the amount of anaerobic flora.

CONCLUSION

Despite its limitations, our study allowed to produce a snapshot of the microbial ecology of community-acquired peritonitis in HRS. This study allowed us to show that most isolated pathogens maintain a good susceptibility to antibiotics. C3Gs and aminoglycosides in particular showed a better efficacy profile on bacteria that have been isolated. C3Gs and aminoglycosides seem to be reasonable options for empiric antibiotic therapy in community-acquired peritonitis. Nonetheless therapeutic readjustment should be done following culture and antibiotic susceptibility testing. The authors recommend continuous monitoring of bacterial pathogens at HRS and further development of lab testing means including anaerobic culture.

In addition, antibiotic stewardship and rational use of antibiotics are paramount to guarantee effectiveness of therapy while minimising ABR.

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No conflicts of interest

TABLE 2
SUSCEPTIBILITY OF BACTERIA PATHOGENS TO ANTIBIOTICS

Bacteria pathogens	*Antibiotics tested*									
	AM	AMCA	CRO	CTX	CIP	GM	VA	PG	OX	IMP
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n(%)	n (%)
E. coli	2(5,4)	8 (21 ,6)	22(59,4)	10(27)	22(59,4)	21(56,7)	0	1(2,7)	0	37(100)
E. cloacae	0	0	0	0	1(50)	1(50)	-	-	-	2(100)
C. koseri	0	3(42,8)	5(71,4)	3(42,8)	3(42,8)	0	-	-	-	7(100)
S. aureus	0	1	4(30,7)	-	7(58,3)	10 (76,9)	12(92,3)		1	1

AM= amoxicillin AMCA= amoxicillin- clavulanic acid. CRO= ceftriaxon. CTX= cefotaxim. CIP= ciprofloxacine. GM= gentamycin. VA= Vancomycin PG= pénicillin G. OX= oxacillin. IMP= imipenem

TABLE 1
BACTERIA PATHOGENS

Table1: Bacteria pathogens

Groups	Bacteria pathogens	Effective
0	*Proteus mirabilis*	2
1	*Escherichia coli*	37
2	*Citrobacter koseri*	7
3	*Enterobacter cloacae*	2
	Enterobacter aerogenes	2
	Citrobacter freundii	1
4	*Serratia liquefaciens*	1

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