Evaluation of the practice of antibiotic prophylaxis in a surgical setting in Mbujimayi, Democratic Republic of the Congo

Hervé Tshikomba Mbuyamba (hervembuyamba8@gmail.com)
Université Officielle de Mbujimayi

Crispin Mukendi Muamba
Université Officielle de Mbujimayi

Séraphin Katulondi Binene
Université Officielle de Mbujimayi

Séverin Akinja Uwonda
Université Officielle de Mbujimayi

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Abstract

Background: Antibiotic prophylaxis is helpful to prevent patients from developping surgical site infections. In Mbujimayi, the issue is not documented at all. The known study on the subject was conducted more than five years ago. This study aims to assess the compliance of the practice of antibiotic prophylaxis in the surgery and gyneco-obstetrics departments of the Bonzola General Reference Hospital compared to the international standard.

Methods: We conducted a prospective observational study from March 2020 to March 2021 of operated patients who had been subjected to antibiotic prophylaxis.

Results: Three hundred and twenty-four patients were selected for this study. Compliance for each of the criteria was 87.35% for the indication ; 0.31% for the choice of molecule ; 3.65% for the time of the first administration ; nil for the duration of antibiotic prophylaxis. So overall compliance was nil.This study shows a significant gap between the recommendations of international societies and the actual practice in Mbujimayi. It is therefore necessary to conduct further studies to identify the determinants in order to reverse the trend.

Conclusion: Compliance of the practice of antibiotic prophylaxis in Mbujimayi is zero. It is therefore important to take steps to improve antibiotic prophylaxis practice to maximize harms for the benefits of patients and practitioners.

Background

Antibiotic prophylaxis is the administration of the antibiotic before potential bacterial contamination due to a risky situation during a surgical procedure [1, 2].

This procedure does not spare the patient from the risk of developing an infection of the surgical site in particular and of the whole organism in general, due to the presence of certain predisposing factors, including non-compliance with hygiene and dietary measures., asepsis and antisepsis. This leads to a high risk of non-compliance with infection-promoting factors on the one hand and, on the other hand, to the excessive prescription of antibiotics in hospitals without testing the sensitivity of germs, thus promoting resistance.

Many studies have been carried out around the world, in Africa and in the Democratic Republic of Congo.

In the USA and Europe, 2% of surgical procedures are complicated by an infection of the surgical site [3].

In Africa, there is a frequency of 8.6% of surgical site infections in Ivory Coast against 13.4% in Bamako (Mali) [4]

In the Democratic Republic of Congo, N'sinabau et al, in a study on the evaluation of antibiotic prophylaxis at the general reference hospital of N'djili, reported an overall compliance of antibiotic

prophylaxis estimated at 33%, i.e. patients in whom the indication, duration and dose of administration have been respected [5]. During the same year 2020, another study was conducted in Butembo by Bunduki et al; they reported an antibiotic prophylaxis compliance rate of 18.1% [6].

In Kasai Oriental, Mukenga et al conducted a similar study from January 1 to June 30, 2014 at Dipumba General Hospital in the town of Mbujimayi; they found that the practice of antibiotic prophylaxis did not comply with international recommendations with 4.8% compliance [7].

Despite advances in asepsis, surgical site infections remain a public health problem even in developed countries. For example, the incidence rate of SSI varies between 3.6–4.2% in Belgium and 2.8% in France [8].

Any surgical procedure carries a risk of SSI which must be as low as possible, but which will never be zero since the skin barrier has been crossed [9]. Germs also find a favorable environment for their proliferation due to favorable factors such as ischemia, hematoma... SSI is the first cause of morbidity and mortality in clean surgery. It complicates 15.9% of interventions in African countries against 2% in developed countries [10]. SSIs are an obsession for any surgeon. They are the most feared by surgeons because they jeopardize the surgical procedure [3]. Thus the use of antibiotics in prophylaxis leads to the reduction of SSIs. However, it obeys very specific indications and appropriate doses.

Work on antibiotic prophylaxis in Mbujimayi hospitals is very rare. The known study on this subject dates back to 2014 [7]. It is therefore important to update the practice of antibiotic prophylaxis in surgical settings in Mbujimayi in order to assess its compliance with the international standard.

Methods

Design and Setting of study

This is a prospective and observational study carried out from March 2020 to March 2021 in the surgery and gyneco-obstetrics departments at the Bonzola General Reference Hospital, located in the city of Mbujimayi, province of Kasai Oriental, in the Democratic Republic of Congo. It is a tertiary level hospital which has approximately the capacity of 150 beds for the surgical department and 100 beds for the gyneco-obstetrics department. It is under the management of the Bakwanga mining company (MIBA).

Target population

All patients operated in the surgical and gyneco-obstetrics departments during the study period constituted our study population.

Selection criteria

All patients classified as Altémeier I and II and having undergone antibiotic prophylaxis were included in this study.

Were excluded from this study, all the operated patients whose medical file was incomplete, operated elsewhere but referred to the Bonzola general reference hospital for postoperative follow-up, operated on following postoperative outpatient care and those whose surgical act corresponded to classes III and IV of Altémeier.

Sample size and data collection

The sample size was 324 operated patients who fulfilled the selection criteria (Figure 1).

Figure 1. Breakdown of patients by departments

The data was collected using a pre-established form. The important data were taken from the medical files of the patients (consultation form, anesthetic form and protocol and operating protocol). We collected the general and main data relating to antibiotic prophylaxis: indication of antibiotic prophylaxis, choice of antibiotic, time (schedule) of administration of the first dose and route of administration, dosage of the first dose and the duration of antibiotic prophylaxis. The general variables were sex, age, Altémeier class, preoperative diagnosis, nature of the surgical intervention (urgent or scheduled), duration of the surgical operation, ASA score, duration of hospitalization and antecedents.

Antibiotic prophylaxis compliance was assessed considering adapted criteria developed by the National Institute for Health and Care Excellence (NICE) [11] and Stanford Health Care (SHC) [12].

Operational Definitions

The six variables relating to the practice of antibiotic prophylaxis in surgery were evaluated. Interventions were assessed as “compliant” if all the variables individually complied with the criteria for antibiotic prophylaxis use. If one or more variables did not comply with the prescription criteria, the intervention was then considered “non-compliant” [13, 14].

Surgical wounds have been classified into four types according to Altémeier as recommended by CDC: clean wound, clean contaminated wound, contaminated wound and dirty wound [15].

Data Analysis

The data was encoded in Excel 2010 software and then analyzed using Epi Info version 7 software. We calculated the frequency, percentage and average. The results are presented in the form of tables and figures.

Results

General Characteristics

Demographic Characteristics

The female sex was much more represented in this study with 269 out of 324 patients or 83.03%.

Patients whose age group was between 20 and 30 years were the most represented with 129 out of 324 patients or 39.81%. The average age of the patients was 40 years with extremes of 17 and 84 years excluded (Table 1).

Table 1
Distribution of patients according to patient age

Age (years)	Frequence (n = 324)	%
< 20	46	14.20
20–30	129	39.81
31–40	74	22.84
41–50	26	8.02
> 50	49	15.12

Characteristics of surgical interventions

The Altemeier II class was the most represented with 273 patients out of 324, or 84.26%. One hundred and sixty-nine operations were carried out in emergency out of the 169 surgical operations, or 52.16%. The duration of the intervention was less than 60 minutes in 64.81% of patients (Table 2).

Table 2. Distribution of patients according to the characteristics of the surgical procedures

Characteristics of procedures	Frequence (n=324)	%
Classe of Altemeier		
I	51	15.74
II	273	84.26
Character of surgical procedure		
Emergency	169	52.16
Elective	155	47.84
Duration of the intervention (minutes)		
<60	210	64.81
>120	12	3.70
60-120	102	31.48

Seventy-seven point five percent of the patients were classified as ASA I. The majority of operated; 70.68%; had spent between 7 and 14 days in hospital (Table 3).

Table 3. Distribution of patients according to ASA score and length of hospitalization

Variables	Frequence	%
ASA Score		
ASA I	250	77.5
ASA II	54	16.6
ASA III	18	5.56
ASA IV	2	0.62
Duration (days)		
<7	10	3.09
>35	16	4.94
15 to 25	52	16.05
26 to 35	17	5.25
7 to 14	229	70.68

N=324

Antibiotic prophylaxis data

The indication of antibiotic prophylaxis was compliant in 87.35% of prescriptions. The antibiotic was administered to the patient after surgery in 96.50% of cases at once the usual dose (99.07%). Prophylactic antibiotics had lasted more than 48 hours in 100% of operated patients (Table 4).

Table 4. Distribution of operated patients according to the practice of antibiotic prophylaxis

Practice of antibiotic prophylaxis	Frequence (n=324)	%
Indication		
Compliant	283	87.35
Non compliant	41	12.65
Time		
After the procedure	312	96.50
At the beginning of the procedure	12	3.50
Posology		
Usual dosis	321	99.07
Twice usual dosis	3	0.93
Duration (hours)		
>48	324	100.0

Ceftriaxone was the most prescribed antibiotic, often in combination with gentamycin, metronidazole and ampicillin (Table 5).

Table 5. Distribution of operated patients according to antibiotics received for prophylaxis

Antibiotics	Frequence (n=324)	%
Ceftriaxone	113	34.88
Métronidazole+Ceftriaxone	110	34.1
Metronodazole+Ampicilline+Gentamycine	74	22.94
Metronidazole+Ceftriaxone+Gentamycine	7	2.17
Metronidazole+Ampicilline	6	1.86
Ampicilline+Gentamycine	5	1.55
Metronidazole+Gentamycine+Ampicilline	5	1.55
Ciprofloxacine+Metronidazole	2	0.62
Co-amoxyclav	1	0.31
Ampicilline	1	0.31

Overall assessment of antibiotic prophylaxis

The overall assessment of the practice of antibiotic prophylaxis was nil because all the assessment criteria were not respected in any operated (Table 6).

Table 6. Distribution of operated patients according to the overall assessment of the practice of antibiotic prophylaxis

Variables	Appréciation	
	Compliant n(%)	Non compliant n(%)
Indication	283(87.35)	41(12.65)
Time of administration	12(3.50)	312(96.50)
Posology	3(0.93)	321(99.07)
Duration of antibiotic prophylaxis	0(0.00)	324(100)
Choice of molecule	1(0.31)	323(99.69)

Total=324

Discussion

General Characteristics

Demographic Characteristics

Women operated on were much more represented with 269 cases out of 324, or 83.03%. These results are similar to those found respectively by Mukenga [7] in Mbujimayi in 2017 which had reported 66.1% of operated cases and Nsinabau [5] in Kinshasa in 2019 which had reported 83.1% of operated cases. This could be explained by the fact that many patients were admitted to the gyneco-obstetrics department in our series.

Those operated on whose age group was between 20 and 30 years old were the most represented with 39.81%. The average age in our series was 40 years old with extremes of 17 and 84 years excluded. These results are close to those found by Mukenga according to which 62 operated on had the average age of 35 years with 18 and 80 years [7].

Characteristics of surgical interventions

Those operated on whose surgical wound was classified as Altermeier II were the most represented with 84.26%, while in Diakara's series [16], this rate was 58.7%. Our rate is far higher than that mentioned in Diakara's series. This would be explained by the fact that we have in our series many gyneco-obstetric patients who are mostly of the Altemeier II class. It should be noted, however, that most of the surgeries were performed urgently in our series, up to 52.16%. The urgent nature of surgical operations is a factor favoring the occurrence of surgical site infection according to some authors [17-19].

Most patients were operated for less than 60 minutes in 64.81% of cases. This would be explained by the often urgent nature of the surgical interventions which, for the most part, were performed in the gyneco-obstetrics department. The impact of the duration of surgery on the occurrence of surgical site infection has been mentioned by some authors [20-22]. The risk would be particularly increased for surgical operations lasting more than two hours [23].

Operated patients were classified as ASA II in 77.5% in our series, whereas Charlotte reported 66.1% of patients classified as ASA I in her series [23]. The postoperative hospital stay varied between 7 and 14 days in 70.68% of cases in our study. Which is close to Charlotte's result on this.

Antibiotic prophylaxis data

The indication for antibiotic prophylaxis was considered to comply with the recommendations of the French Society of Anesthesia and Resuscitation (SFAR) in 87.35% of cases in our series. This rate is significantly higher than those reported by Mukenga (53.2%) and Rachdi (65.67%) [7.24]. As for Arquès and Majjad, they reported the result similar to ours [25,26]. However, the SFAR recommendations do not cover all clinical situations. Many acts have not been subject to scientific evaluation. In the absence of recommendations for a specific subject, practitioners may or may not choose to prescribe prophylactic antibiotics by getting as close as possible to similar pathologies and techniques [27].

The administration of the first dose was made after the surgical intervention in 96.35% of the surgical operations of our series. This result is similar to that of Mukenga [7] who reported 82.3% administration of the 1st dose after surgery. This would be explained by the urgency of the surgical operations which predominates, but also the socio-economic level of the surgical population of our environment.

In our study, 99.7% of patients had received a non-compliant dosage. The same observation was made by Mukenga who reported 85.5% [7]. According to studies conducted elsewhere on the same subject, the dosage was correct in 63.64% of operations in the Rachdi series [24], 99% in that of Naija [28], 89% in that of Van Kasteren [29] and 100% in that of Vaisbrud [30]. The lack of knowledge on the practice of antibiotic prophylaxis in our environment could be the reason for this high percentage of non-compliance with the dosage.

The duration of antibiotic prophylaxis exceeded 48 hours in 100% of cases, whereas Mukenga had reported 62.9% in his series [7]. Vaisbrud had found that the duration of antibiotic prophylaxis was less than 24 hours in 91% of his series [30] while Arquès had reported a shorter duration in 78.5% of antibiotic prophylaxis [25]. The precarious aseptic conditions in our environment could explain the continuation of the antibiotic until beyond the recommended time. This delay in antibiotic prophylaxis would be the basis of the emergence of bacterial resistance [7].

The choice of antibiotic was consistent with the standard in 0.31% of cases in our study. This choice was outside the scope of recommended molecules, especially in terms of broadening the spectrum. However, it is recommended that the antibiotic prescribed must include in its spectrum of action the bacteria most

frequently responsible for infection of the surgical site [31,32]. In our series, gentamicin, ampicillin and ceftriaxone were used more, and especially in combination. However, Naija, Rachdi and Arquès had reported a compliance rate of the choice of antibiotic clearly higher than ours, respectively 64%; 65.45% and 89.8% [24,25,28]. A study conducted in Australia, based on the Australian consensus, reports a compliance rate of 53.3% [33]. According to SFAR recommendations, aminopenicillins can be used, but in combination with a beta-lactamase inhibitor [27]. The prescription of 3rd generation cephalosporins is not suitable for antibiotic prophylaxis because these drugs are expensive and their use leads to the emergence of mutants resistant to these useful drugs for curative treatment [24]. Lack of knowledge of the recommendations on the choice of antibiotics to be used as first-line treatment in our setting would justify this non-compliance.

This study was conducted exclusively at the Bonzola General Reference Hospital because of its importance in the surgical management of patients in the city of Mbujimayi. Extending this study to other hospitals could provide increasingly reliable data on the practice of antibiotic prophylaxis in Mbujimayi. It is also necessary to conduct a further study on the determinants of non-compliance with antibiotic prophylaxis in the city of Mbujimayi.

Conclusion

The overall compliance of antibiotic prophylaxis in Mbujimayi is nil because no operated patient has benefited from antibiotic prophylaxis in accordance with ANAES criteria. It is therefore necessary to take measures to improve the practice of antibiotic prophylaxis in order to maximize the advantages and minimize the disadvantages for the benefit of patients and practitioners.

These measures are:

-Training of medical staff on hospital hygiene;

-Training in antibiotics, antibiotic therapy and antibiotic prevention in particular;

-The concerted implementation of a local antibiotic prophylaxis protocol based on validated criteria and according to written procedures taking into account the realities of our environment and its popularization;

-Make available the antibiotics recommended for antibiotic prophylaxis.-

Abbreviations

ANAES	:	Agence Nationale d'Accréditation et d'Evaluation en Santé
ASA	:	American Society of Anaestesiologists
BEBUC	:	Bourse d'Excellence Bringmann aux Universités Congolaises
CDC	:	Center of Diseases Control
MIBA	:	Minière de Bakwanga
NICE	:	National Institute for Health and Care Excellence
SFAR	:	Société Française d'Anesthésie et Réanimation
SHC	:	Stanford Health Care
SSI	:	Surgical Site Infections
USA	:	United States of America

Declarations

Ethics approval and consent for publication

All methods were carried out in accordance with the relevant guidelines and regulation. All protocols were approved by committee of the Faculty of Medicine of the Université Officielle de Mbujimayi (UOM), which were subsequently approved by the human resources department of the Bakwanga mining company (MIBA) with responsibility for the Bonzola General Reference Hospital. The informed consent was obtained from all subjects and/or their legal guardian (s). The participant consented to publish.

Availability of data and materials

All data generated or analysed during the study are included in this published article.

Competing interests

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Authors' contributions

H.T.M. stepped in the design of the study. He wrote the main manuscript text, prepared figure and tables.

C.M.M. participated in the design of the study, the data analysis and interpretation of the results.

S.K.B. participated in the data collection at the Bonzola General Reference Hospital and the data analysis.

S.A.U. ensured the design of the study, the data analysis and interpretation of the results. He supervised the study.

All authors reviewed the manuscript.

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Figures

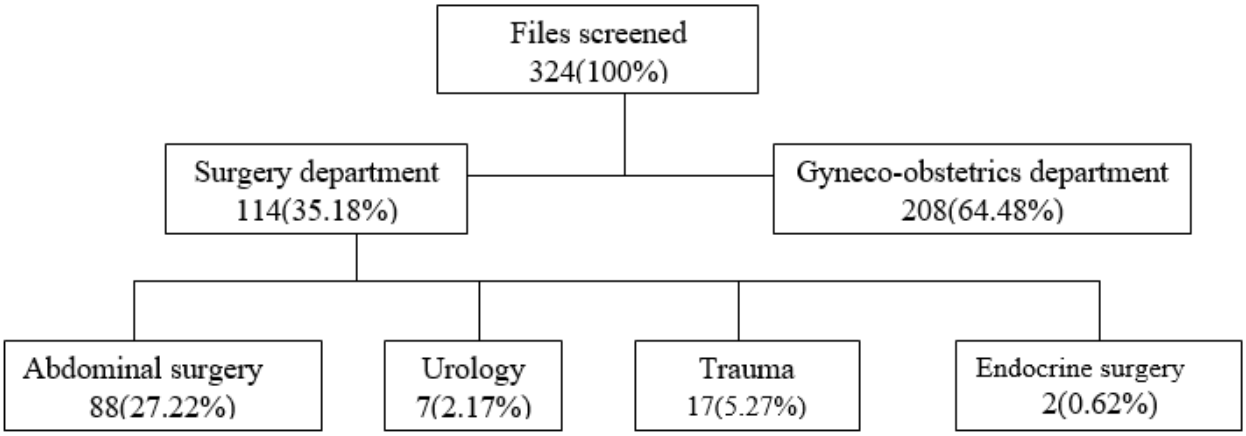

Figure 1

Breakdown of patients by departments