Evaluation of antibiotic prescribing practices in surgical departments at the University Hospital Center-Yalgado Ouedraogo, Burkina Faso

Abstract

Introduction: Inappropriate use of antibiotics is one of the main causes of the emergence of antibiotic resistance in sub-Saharan Africa. To contribute to better antibiotic prescribing, the aim of thiswork was to evaluate prescribing in the surgery and surgical specialties department at the University Hospital CenterYalgado Ouedraogo (CHU-YO).

Methods: This was a prospective cross-sectional study from December 15 to 21, 2021. Patients hospitalized in the surgical department were included. Compliance guidelines were the recommendations of the SFAR and the guide to good antibiotic prescribing in Burkina Faso**.**

Results: A total of 162 patients were hospitalized during the study period, of whom 97 were included. The prevalence of antibiotic prescriptions was 59.9%. Curative antibiotic therapy accounted for 66% of prescriptions, whileall surgical patients received antibiotic prophylaxis. The β-lactam family was prescribed in 88.5% of cases for prophylaxis and 91.3% for curative treatment. Ceftriaxone was prescribed in 71.3% of cases for prophylaxis and 44.9% for curative antibiotic therapy. Overall compliance was 22.3% for antibiotic prophylaxis and 49.3% for antibiotic therapy. Non-compliance withantibiotic prophylaxis was linked to an inappropriate choice of antibiotic for prophylaxis, and to unjustified prescribing for antibiotic therapy.

Conclusion: Capacity-building for prescribers and the development of guidelines could help improve the appropriateness of antibiotic use at CHU-YO.

Key words: Non-compliance - antibiotic prophylaxis - antibiotic therapy - surgery

Introduction

Antibiotics revolutionized medicine by enabling the effective treatment of bacterial infections, thereby reducing the associated morbidity and mortality. Unfortunately, the success of antibiotics was short-lived. After just a few years, bacteria developed resistance to them[1]. Antimicrobial resistance (AMR) is a major public health problem. Indeed, it has become one of the ten leading causes of death worldwide, and countries in the West African region account for the highest number of cases[2].

The main cause of this worldwide plague is the unbridled use of antibiotics[3]. Incorrect diagnoses, followed by unnecessary antibiotic therapy, and sometimes self-medication, have

exacerbated the phenomenon. Severalstudies report this over-prescription of antibiotics worldwide[4].

In the surgical field, despite the evolution and improved knowledge of surgical techniques, infection remains a permanent risk, and pathogenic bacteria are found in more than 65.5% of surgical wounds during closure[5]**.**

In Burkina Faso, the incidence of surgical site infections was reported to be 23.35% at the University Hospital Center CHU-SS de Bobo Dioulasso in 2019[6]**.** It is, therefore, essential for all surgical procedures to prevent bacterial proliferation to reduce the risk of postoperative infection. This requires compliance with hygiene rules, with or without antibiotic prophylaxis, in line with recommendations.

In our context, due to the lack of studies on microbial ecology and the unavailability of certain antibiotics, antibiotic prophylaxis remains a headache for anesthetists, as does antibiotic therapy, particularly in surgical settings. Despite all these difficulties, the use of antibiotics remains frequent in this environment.

With the aim of optimizing antibiotic prescribing, this work evaluated antibiotic prescribing in the Department of surgery and surgical specialties at the University Hospital Center-Yalgado Ouedraogo(CHU-YO) from December 15 to 21, 2021.

Methods

The study took place in the Department of Surgery and Surgical Specialties at CHU-YO. It is one of the reference centers for adult surgical pathologies in the city of Burkina Faso, as well as in the surrounding localities and regions. The department comprises several departments: Urology, Orthopedics-Traumatology, Adult General and Digestive Surgery, Neurosurgery, Maxillofacial Surgery and Odontology, Ophthalmology, Otolaryngology. Each department includes an emergency unit. In addition to the surgical emergencies we deal with, we also carry out procedures as part of a set program.

This was a cross-sectional study,and data collection took place from December 15 to 21, 2021. The study involved all inpatients, whether underwent surgery(all types of surgical procedures)or not, in the various departments of the department. Thus, our sampling was exhaustive, considering the following inclusion criteria: all patients hospitalized during the study period for whom antibiotic therapy or antibiotic prophylaxis was prescribed by oral, parenteral, rectal or inhalation route; present before or at 8 a.m. and with a usable medical record. All patients hospitalized after 8 a.m. on the day of the survey, whose treatment started

after 8 a.m. or completed before 8 a.m. were excluded(inspired by the WHO Point Prevalence Survey). Data was collected on one day per department.

Antibiotic use was assessed according to the guide of good antibiotic prescribing in Burkina Faso[7]and the recommendations of the SociétéFrançaised'Anesthésie et de Réanimation (SFAR), updated in 2018[8]**.** Thus, it was justified if the pathology justified antibiotic administration and judged adequate according to its indication if the antibiotic prescribed appears on the list of antibiotics recommended in this indication. It was compliant if the dosage, route of administration and duration of treatment were in line with recommendations.

Data were collected through a review of patient records, operative reports, anesthesia charts and hospitalization registers, entered theKobo-Collecttoolboxand analyzed with EPI info software version 7.2.4.0.

Anonymity and confidentiality of personal data were preserved during data collection. Authorization for data collection was obtained from the management of CHU-YO, and we obtained the agreement of the various department heads.

Results

Socio-demographic characteristics

During the study period, 162 patients were hospitalized in the surgical department. Of these, 105 (64.8%) were prescribed antibiotics and 97 (59.9%) patients were included in thestudy (**Figure 1**). There were mainly 71 (73.2%) males, giving a sex ratio of 2.7. The mean age was 39.3 ± 17.4 years, with a minimum of 3 years and a maximum of 80 years.

Antibiotic prescription frequency

Eighty-one (83.5%) patients underwent surgery, and all(100%), received antibiotic prophylaxis. The β-lactam family was the most prescribed (90.4%). Among β-lactams, ceftriaxone was prescribed in 72.3% of cases. According to prescription frequency, the orthopedic-traumatology department used amoxicillin/clavulanic acid for prophylaxis in 50% of cases. In the other departments - general and digestive surgery, urology, neurosurgery and maxillofacial surgery - ceftriaxone was used as prophylaxis in 37.1%, 21%, 9.6% and 8.1%,respectively (**Table 1**).

The frequency of prescription of curative antibiotic therapy was 43.5%. Of the patients who received antibiotic therapy, 25 (17%) received bi-antibiotic therapy, 4 (2.7%) tri-antibiotic therapy and 2 (1.3%) patients had a monotherapy.

The most frequently prescribed antibiotics were ceftriaxone (45.3%) and amoxicillin + clavulanic acid (35.9%). Ceftriaxone was prescribed more frequently in the adult general and

digestive surgery department (50%). Amoxicillin + clavulanic acid was the most prescribed medicine in orthopedic traumatology (52.6%) and ophthalmology (50%). In Urology, ceftriaxone was the most prescribed (40%), followed by ceftriaxone + sulbactam (30%).

Evaluation of antibiotic prescribing

Among patients who received antibiotic prophylaxis, 72 (88.8%) prescriptions were justified, and this varied according to the type of surgery (**Table 2).** Overall compliance with antibiotic prophylaxis recommendations was 23.4%**.** The delay in administration was non-compliant in 44.1%: early in 10 (29.4%) cases and late in 5 (14.7%) cases (**Table 3)**.

Sixty-four prescriptions for antibiotic therapy were filled, of which 65.2% were justified (**Table 2)**. Overall compliance with antibiotic therapy was 49.3%. Dosage was non-compliant in 15.9% of cases, as was the duration of treatment in 18.4%. In all cases (100%), antibiotic therapy was not compliant, particularly in children.

Discussion

This study aimedto assess antibiotic use in the Department of Surgery and Surgical Specialties at CHU-YO. Any interpretation of our results must consider the cross-sectional nature of the study, which concerns a population at a given time. This makes it impossible to conclude onthe evolution and outcome of patients according tothe antibiotic regimens used.

The prevalence of antibiotic prescription was 59.9% in our study. Mthombeni et al. in South Africaand Ebongue C. et al. in Cameroon, respectively, found a prevalence of antibiotic prescriptionsof 32.5% and 87.8%[9,10]**.** This high prevalence of antibiotic prescribing could be due to the high prevalence of infectious pathologies in our context and/or misuse and/or overuse of antibiotics in certain departments. On the other hand, the high incidence of surgical site infections in sub-Saharan Africa could explain these results[11].

The male predominance (73.2%) of our patients is comparable to the studyof Ouedraogo A. et al. in Bobo Dioulasso, who found a male predominance of 73.7%[6]. This could be explained by the high frequency of traffic accidents and urinary tract pathologies amongmen.

Relevance and compliance of antibiotic prophylaxis

All patients who underwent surgery (81) in thisstudy received antibiotic prophylaxis. Ouedraogo A. et al. and Prevostet al. in France reported frequencies of 78.9% and 64 %, respectively[6,12]. Osteoarticular (35.8%) and gastrointestinal (30.9%) pathologies were the main indications for antibiotic prophylaxis in thisstudy. Mbuyamba et al. in Democratic Republic of the Congo found 27.2% and 5.2% for abdominal surgery and traumatology procedures, respectively. El Hassan et *al*. reported gastroduodenal/biliary 41.6%,

orthopedic 10.8%[13]. The predominance of these pathologies for antibiotic prophylaxis is because they are at high risk of infection**,** hence the need for antibiotic prophylaxis, according to the SFAR[8,14]**.** In our context, the most usedmeans of transport is the motorcycle, which exposes us to numerous accidents on public highways, resulting in the high frequency of osteoarticular pathologies in our study.

The β-lactam family was the most prescribed (90.4%), with ceftriaxone accounting for 72.3%. Ouedraogo A. et al. at CHU-SS found ceftriaxone prescribed in 68.5% of cases[6,8]**.** First-generation cephalosporins such as Cefamandole and, above all, Cefazolin are the molecules most recommended for antibiotic prophylaxis in surgery**.** However, these molecules have not been used due to their unavailability and the easy accessibility and affordable cost of ceftriaxone. Moreover, without studies on the microbial ecology of surgical site infections, surgeons use broad-spectrum antibiotics such as ceftriaxone. It therefore seems important to involve pharmacy staff, via the hospital therapeutic committee, in the development of antibiotic prophylaxis protocols for surgery to ensure the availability of the molecules needed to provide better care for our patients.

The study highlighted the gap between the recommendations issued by learned societies and observed practices. In fact, only 23.4% of antibiotic prophylaxis complied with recommendations. The compliance rate in our study was low compared with the literature. Indeed, Mbuyamba et al., Prevost et al., and Harbi et al. described compliance of antibiotic prophylaxis with the local protocol in 87.3%, 64% and 33.3%,respectively[12,15,16]**.** The least compliant criteria were, respectively, a waiting time of less than two hours and the prescription of antibiotics with a broader spectrum than those recommended in the guidelines. This results in considerable additional financial costs, as well as a non-negligible risk of the emergence of antibiotic-resistant bacterial strains[16].

Of the prescriptions that were justified and appropriate, the route of administration complied with recommendations in 100% of cases and the dosage in 31 (91.2%) cases. The reasons for non-conformity of dosage were, in most cases, due to a unit dose lower than the recommended dose**.** The timing of the first dose was correct in 55.9% of cases. Prevost et al. reported in their study that the administration time was compliant in 77.6% of cases[12]. In our study, non-compliance with the administration time was early administration in 29.4% and late administration in 14.7% of cases. These deviations from the recommended interval could be minimized by implementing the WHO checklist for patient safety in the operating theatre, which has been the subject of a national directive from the Burkina Faso Ministry of Health, and one of whose items concerns the correct administration of antibiotic

prophylaxis[7].Finally, improving practitioners' knowledge could improve the quality of antibiotic prophylaxis.

Appropriateness and compliance withantibiotic therapy

The prevalence of antibiotic therapy was 43.5%. Talaam et al. found a prevalence of 43.7%[17]. All these prescriptions were made according to a probabilistic logic (100% empirical). These results are comparable to those reported by Ouedraogo A. et al. and et al.,who noted 100% and 98.9% empirical prescribing, respectively[6,18]. Diagnostic uncertainty, lack of familiarity with microbiological diagnostic tools and the long delay in reporting bacteriology results could be the root of these empirical prescriptions.

In our series, 33 (51.6%) antibiotic prescriptions were deemed to be non-compliant. The reasons were dominated by unjustified antibiotic prescriptions (34.4%) and incorrect dosage (15.9%). In their study, Talaam et al. reported a 33.4% proportion of inappropriate antibiotic prescriptions for treatment purposes, and the most frequent reason for inappropriate antibiotic prescribing was duration of treatment[17].

In the analysis of compliance criteria, the proportion of antibiotic therapy justified was 65.6%. Pollmann et al. in Canada reported 78%[19]. In fact, antibiotic therapy was over-prescribed in certain situations where it was not necessary. According to recommendations, antibiotic prophylaxis can exceptionally last 48 hours (even when drains or catheters remain in place). However, several"precautionary" prescriptions have been noted.

Dosage and duration were correct in more than ¾ of cases. Dosage compliance errors were generally excessive dosing in children aged 0 to 5, in whom it should be calculated according to weight. Talaam et al. in Kenya also reported inadequate duration (45.9%) as the main reason[17]. This situation seems to be linked to the diversity of referral protocols. Indeed, in our hospital, several surgeons trained in different schools with different approaches are used. Due to the lack of convincing data, there is almost no specific therapeutic protocol for antibiotic therapy. We, therefore, need to set up a multidisciplinary committee to produce a standardized protocol according to the microbial ecology and level of resistance in the various departments, or failing that, to comply with national and international recommendations.

Conclusion

This study, which looked at the state of antibiotic prescribing in the surgical environment, revealed the prevalence of antibiotic prescribing was significant. However, there is a considerable gap between observed practices and the recommendations of learned societies.

Ongoing training of medical staff in the proper use of antibiotics and the development of local guidelines for antibiotic therapy could help improve compliance with antibiotic use at the Yalgado Ouedraogo University Hospital.

CONSENT AND ETHICAL APPROVAL

This study was conducted with the approval of the local Health Research Ethics Committee (CERS) by deliberation n°2021-12-291 and the authorities of the University Hospital of Yalgado Ouedraogo.It was carried out in compliance with current ethical standards. Informed consent was obtained from all included patients. Confidentiality was maintained throughout the data collection and analysis phase.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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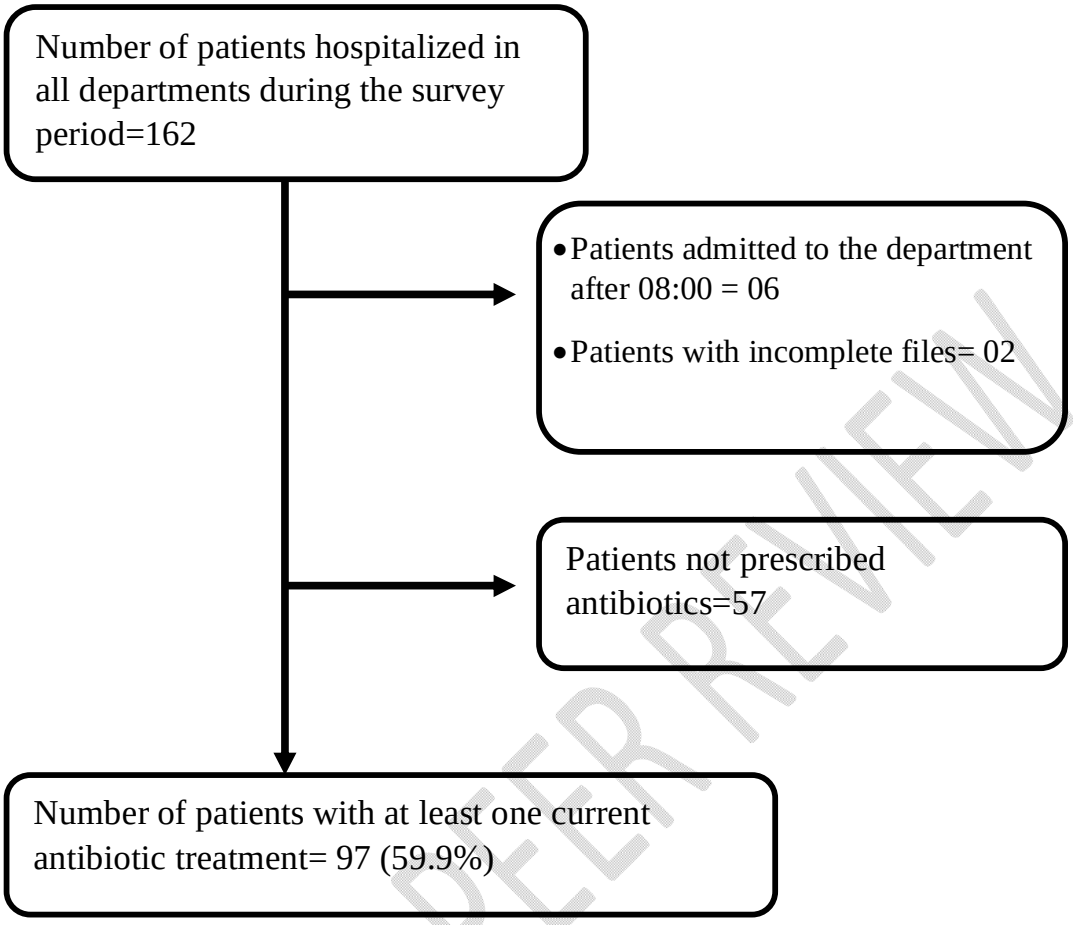

Figure 1 : Patient flow diagram

Table *1* :Antibiotics used for prophylaxis by department (n=83)

Service	**AAC n(%)**	**Ceftriaxone n(%)**	**Ciprofloxacin n(%)**	**Metronidazole n(%)**	**Total n(%)**
Visceral	1(6,7)	23(37,1)	0	4(66,6)	28(33,7)
S/CMF	0	5(8,1)	0	0	5(6)
Neurosurgery	0	6(9,6)	0	0	6(7,2)
Orthopedics	14(93,3)	13(21)	0	1(16,7)	28(33,7)
Urology	0	13(21)	2(100)	1(16,7)	16(19,3)
Ophthalmology	0	0	0	0	0
ORL	0	0	0	0	0
Total	**15(100)**	**60(100)**	**2(100)**	**6(100)**	**83**

AAC : Amoxicillin acid clavulanic ORL: Oto Rhino-laryngology

S/CMF: Maxillo-facial surgery department

Table 2 Distribution of justification for antibiotic prophylaxis and antibiotic therapy by surgery and infections

	Antibiotic prophylaxis (n=81)		**Antibiotic therapy (n=64)**	
Surgery/infection	**Justified indication**		**Justified indication**	
	Yes	**No**	**Yes**	**No**
Cerebro-meningeal	5(71,4)	2(28,6)	3(60)	2(40)
Mucocutaneous	4(100)	0	3(100)	0
Digestive	22(88)	3(12)	16(76,2)	5(23,8)
Osteoarticular	27(93,1)	2(6,9)	12(63,1)	7(36,8)
Urogenital	14(87,5)	2(12,5)	4(40)	6(60)
Eye	0	0	2(50)	2(50)
ORL	0	0	2(100)	0
Total	**72(88,9)**	**9(11,1)**	**42(65,6)**	**22(34,4)**

Table 3 Antibioticprophylaxiscompliance

	Yes	No
Compliance criteria	**n (%)**	**n (%)**
Antibiotic prophylaxis (n=34)		
Route of administration	34(100)	0
Dosage	31(91,2)	3(8,8)
Administration time	19(55,9)	15(44,1)
Antibiotic therapy (n=38)		
Route of administration	38(100)	0
Dosage	32(84,2)	6(15,9)
Duration	31(81,5)	7(18,4)