ORIGINAL RESEARCH

The current status of prophylactic antibiotic use in gastrointestinal surgery patients at Hai Phong International Hospital in 2023

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ABSTRACT

Background: Surgical site infection is considered a very common hospital infection today, leading to severe complications, prolonged hospital stays, increased treatment costs, and even death. Gastrointestinal surgical procedures often carry a high risk of surgical site infections. Prophylactic antibiotics have been used for a long time to reduce the rate of surgical site infections at Hai Phong International Hospital, but there have not been any specific reports related to the use of antibiotics in surgical patients at the hospital. On that basis, recognizing the urgency of evaluating the situation of using prophylactic antibiotics in surgery at the hospital's surgery department, this study was conducted to describe the current status of prophylactic antibiotic use in gastrointestinal surgery patients at Hai Phong International hospital 2023. ***Method:*** Cross-sectional descriptive study through the retrospective review of medical records of surgery patients in the gastrointestinal department at Hai Phong International Hospital, Vietnam from January 1st to December 31st, 2023. ***Results:*** The median age of patient in this study was 51. The most common surgical sites were the anus and appendix, with rates of 55,6% and 22,64%, respectively. The predominant type of surgery was clean-contaminated, accounting for 63.81%. The most used antibiotics were Metronidazole (66.75%), Ampicillin/sulbactam (56.46%), Cefotaxime (23.21%), and Cefazolin (10.53%). The proportions of patients receiving appropriate prophylactic antibiotics with timing of drug administration, antibiotic selected, and doses were 98.56%, 63.87% and 60.77%, respectively. The overall appropriate prophylactic antibiotic was 3.35%. ***Conclusion:*** The overall appropriateness of prophylactic antibiotic use is relatively low (3,35%), the main reason is the inappropriate duration of administration (96,65%). In addition, the inappropriate selection and use of antibiotics contributed to the inappropriate antibiotic. Therefore, it is essential to develop guidelines for prophylactic antibiotic use to improve treatment outcomes.

Keywords: *prophylactic antibiotic, surgical site infections, gastrointestinal surgery.*

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INTRODUCTION

Surgical site infections (SSIs) are a common and serious complication in postoperative patients, significantly impacting patient health, increasing mortality rates, prolonging hospital stays, and raising treatment costs [1]. In Vietnam,

the rate of surgical site infection recorded in a study at some hospitals in the Northern provinces in 2008 was 10.5% [2]. At Bach Mai Hospital, research shows that the SSI rate is 8.7%, ranking third among healthcare-associated area infections [3]. The use of prophylactic antibiotics (PAP) in surgery is considered an effective measure for controlling surgical site infections (SSIs), with an estimated 50% of SSIs being preventable if PAP is administered appropriately [4].

However, inappropriate antibiotic use is very common. According to a study by Arriba-Fernandez et al. (2022) demonstrated that improper antibiotic use, such as extending the duration beyond the recommended guidelines and failure in proper indication, not only fails to improve outcomes but also contributes to the development of antibiotic resistance [5]. This highlights inconsistencies in clinical practice, which can lead to serious consequences such as increased rates of surgical site infections and prolonged hospital stays.

At Hai Phong International Hospital, gastrointestinal surgical procedures are primarily classified as clean or clean-contaminated procedures, making the use of prophylactic antibiotics (PAP) crucial. Currently, patients undergoing surgery in the department receive PAP; however, antibiotic use remains inconsistent, and there have not been any specific reports related to the use of antibiotics in gastrointestinal surgical patients at the hospital.Therefore, evaluating the current state of prophylactic antibiotic use in gastrointestinal surgery is essential to enhance treatment quality and ensure patient safety.

METHODS

Research Subject

Medical records of all patients indicated gastrointestinal surgery at the Department of Gastrointestinal Surgery, Hai Phong International Hospital in 2023.

Inclusion criteria: Medical records of patients with discharge time from January 1st to December 31st, 2023. The records pertain to patients who received systemic antibiotic therapy.

Exclusion criteria: Medical records of patients not related to indications for gastrointestinal surgery.

Research methodology

Research design: A descriptive cross-sectional, non-interventional study conducted through a retrospective review of medical records.

Evaluation standards: The NNIS score was used to evaluate the risk stratification of surgical site infection. The appropriateness of indications, dosage, route and administration, and duration of prophylactic antibiotic treatment were assessed according to to Clinical Practice Guideline on Surgical Antimicrobial Prophylaxis (ASHP) 2013 [6], WHO 2018 global guidelines for preventing surgical site infections [1], and the guidelines for antibiotic use of the Vietnam Ministry of Health in 2015 [7].

Data analysis

Process and analyze data using Excel 2016.

RESULTS

General characteristics of study patients

The characteristics of patients are described in Table 1. The study included 583 patients with a nearly equal distribution of males (51.29%) and females (48.71%), with a mean age of 51 years. Comorbidities were presented in 33.96% of patients, the most common being hypertension (12.69%) and type 2 diabetes (6.69%). The median hospital stay was 11 days. Risk factors for surgical site infections included preoperative infections (28.64%), obesity (16.81%), and an ASA grade ≥3 (7.89%). According to the Altemeier classification, clean-contaminated surgeries made up the largest proportion (63.98%), followed by contaminated surgeries (28.13%). The common surgeries were anal surgery and appendectomy with rates of 52.66% and 22.64%, respectively. There was one patient with a superficial SSI (0.17%) and one with an organ/space infection (0.17%); no patients developed deep SSIs

Table 1. *General characteristics of study patients*

Patient characteristics		**Total %** (n=583)
Male		299 (51,29)
Female		284 (48,71)
Mean age, years		51
Comorbidity		198 (33,96)
Type of comorbidity	Hypertension	74 (12,69)
	Diabetes type 2	39 (6,69)
	Hepatitis B/ Hepatitis C	8 (1,37)
	Other comorbidities	77 (13,21)
History of antibiotic allergy		6 (1,03)
Hospital stay before surgery, days		5 (0-15)
Hospital stay after surgery, days		8 (3-6)
Length of hospital stay, days		11 (3-27)
Risk factors for surgical site infections, n (%)		
Preoperative infections		167 (28,64)
Obesity (BMI≥ 25kg/m2)		98 (16,81)
ASA grade ≥ 3		46 (7,89)
Diabetes		39 (6,69)
Malnutrition		23 (3,95)
Hospitalized for more than 14 days pre-operative.		1 (0,17)
Surgical wound classification, n (%)		45 (7,72)
Clean		373 (63,98)
Clean-Contaminated		164 (28,13)

Contaminated	1 (0.17)
Dirty	
Type of surgery, n (%)	
Anus	307 (52,66)
Appendix	132 (22,64)
Biliary	72 (12,35)
Abdominal wall	43 (7,38)
Colon	9 (1,54)
Stomach	5 (0,86)
Liver	5 (0,86)
Pancreas	1 (0,17)
Small intestine	1 (0,17)
Other	4 (1,37)
Post-operative infection, n (%)	
Superficial incisional	1 (0,17)
Deep incisional	0 (0)
Organ/space	1 (0,17)
Systemic inflammatory response syndrome	1 (0,17)
No diagnosed but signs of infection	9 (1,54)

Status of prophylactic antibiotic use

The study analyzed prophylactic antibiotics use in 418 patients, who underwent clean or clean-contaminated surgery, of which 412 patients received prophylactic antibiotics prior to the skin incision, in line with WHO recommendations. The proportions of appropriateness indication of prophylactic antibiotics corresponding to each surgical group are presented in Table 2. The most commonly used prophylactic antibiotics across various surgical groups were Beta-lactamase inhibitors and 5-Nitroimidazoles, primarily Ampicillin/sulbactam and Metronidazole, followed by first-generation Cephalosporins like Cefazolin. In colorectal and anal surgery (N = 238), 141 patients were appropriately prescribed prophylactic antibiotics, the most commonly appropriateness prophylactic antibiotic regimen was Ampicillin/sulbactam plus Metronidazole (accounting for 53.36%), while appendectomy procedures (N = 68) had 55 patients, Ampicillin/sulbactam plus Metronidazole was used in 60.29% of cases. Cefazolin is a commonly used antibiotic in biliary surgery (N=60) and hernia (N=39) with rates of 36.67%, 46.15%, respectively. The overall appropriate antibiotics selection rate according to ASHP (2013), Sanford Guide (2024), and Ministry of Health guidelines (2015) was 64.81%.

Table 2. *Rate of antibiotic use by each surgical type*

Antibiotics (n=412)	**Number (%)**
Colorectal and anal surgery(n=238)	

Ampicillin/Sulbactam	10 (4,20)
Ampicillin/sulbactam + Metronidazole	127 (53,36)
Ciprofloxacine + Metronidazole	2 (0,84)
Ertapenem	2 (0,84)
Appendix surgery (n = 68)	
Ampicillin/sulbactam + Metronidazole	41 (60,29)
Ampicillin/Sulbactam	12 (17,65)
Ampicillin/Sulbactam + Cefotaxime	1 (1,47)
Biliary (n = 60)	
Cefazolin	22 (36,67)
Ampicillin/Sulbactam	16 (26,67)
Ampicillin/sulbactam + Metronidazole	9 (15)
Cefazolin + Metronidazole	2 (3,33)
Hernia surgery (n = 39)	
Cefazolin	18 (46,15)
Liver surgery (n = 4)	
Cefazolin	2 (50)
Ampicillin/sulbactam + Metronidazole	1 (25)
Stomach and intestinal surgery (n= 3)	
Ciprofloxacin	1 (33,33)
Appropriate selection rate according to ASHP, Sanford guide and Ministry of Health guidance (n = 412)	**267 (64,81)**

Characteristics of dosage and route of administration

Among the 267 patients with appropriate antibiotic selection, only 254 patients (95.13%) received the correct antibiotic dosage according to the recommendations of the ASHP, Sanford Guide, and the Ministry of Health. These patients were from the colorectal, appendectomy, hernia, biliary, and gastrointestinal surgery groups. Of the remaining 13 patients with inappropriate antibiotic dosing, 11 patients (4.12%) were prescribed Ampicillin/Sulbactam at a lower dose of 1.5g (Ampicillin 1g/Sulbactam 0.5g) compared to the recommended dose of 3g (Ampicillin 2g/Sulbactam 1g). Additionally, 2 patients (0.75%) received Cefazolin at a dose of 1g, lower than the recommended 2g (or 3g if body weight ≥ 120kg). No patients were prescribed doses higher than the recommended guidelines. All 267 patients with appropriate antibiotic selection received antibiotics via intravenous infusion, ensuring a 100% compliance rate for the administration route. The proportion of patients receiving prophylactic antibiotics corresponding to each specific dosage of administration was presented in Table 3.

Table 3*. Characteristics of dosage of antibiotic administration*

Antibiotics	**Dosage once as indicated**	**Number (%) (N = 267)**

Ampicillin/sulbactam Metronidazole	Ampicillin/sulbactam 3g (ampicilin 2g/ sulbactam 1g) Metronidazol 500 mg/100 ml	**121 (45,32)**
Ampicillin/sulbactam Metronidazole	Ampicillin/sulbactam 1,5g (ampicilin 1 g/sulbactam 0,5 g) Metronidazol 500 mg/100 ml	6 (2,25)
Ampicillin/Sulbactam	Ampicillin/sulbactam 3 g	**85 (31,84)**
Ampicillin/Sulbactam	Ampicillin/sulbactam 1,5 g	5 (1,87)
Cefazolin	Cefazolin 2 g	**42 (15,73)**
Cefazolin	Cefazolin 1 g	2 (0,75)
Ciprofloxacin + Metronidazole	Ciprofloxacin 400 mg/200 ml Metronidazol 500 mg/100 ml	**3 (1,12)**
Ertapenem	Ertapenem 1g	**2 (0,75)**
Ciprofloxacin	Ciprofloxacin 400 mg/200 ml	**1 (0,37)**

Duration of prophylactic antibiotics

The majority of patients continued using antibiotics until discharge, with only 26 patients (6.22%) out of 418 in the clean and clean-contaminated surgery group not using antibiotics within 24 hours after surgery. Among 254 patients who received appropriate indication, dosing and administration of prophylactic antibiotics, 14 patients stopped antibiotics within 24 hours after surgery. In the study sample of 418 patients using prophylactic antibiotics, 14 patients (accounting for 3.35%) fully met all criteria for prophylactic antibiotic use, based on the information that has been collected and assessed.

The overall rate of appropriateness of prophylactic antibiotic in this study is presented in Figure 1.

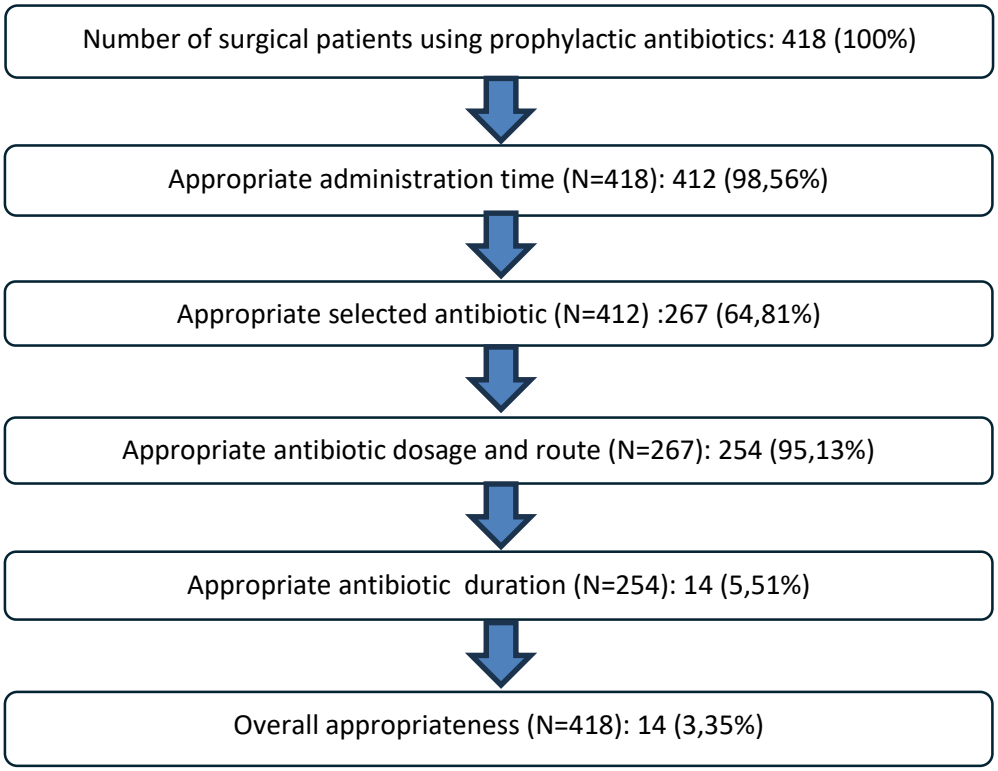

Figure 1. *Rate of appropriateness of prophylactic antibiotic use*

DISCUSSIONS

Patient Characteristics: The study found that 60.55% of patients were aged between 40 and 93 years. Patients over the age of 40 were at a higher risk of developing surgical site infections (SSI) compared to those younger than 40 (OR = 1.24; 95% CI: 1.07 - 1.44) [8]. Numerous systematic reviews have highlighted the connection between extended surgical duration and increased SSI risk [9-11]. In several surgical groups, it was observed that patients who developed SSIs typically underwent surgeries lasting approximately 30 minutes longer than those without SSIs [9]. A Vietnamese study investigating risk factors for SSI in hepatobiliary, pancreatic, and gastrointestinal surgeries revealed that procedures exceeding 120 minutes were a significant risk factor for SSI [12]. In the sample, 71.6% of the surgeries were classified as clean and clean-contaminated, categories where surgical antibiotic prophylaxis (SAP) is typically indicated. A high-risk group for SSI, identified by an ASA score ≥ 3, comprised 7.89% of the patients. Additionally, 16.81% of patients were obese, and 6.69% had diabetes. In Kaye et al.'s 2005 study of 144,485 patients, those with an ASA score of 3 or higher had a significantly increased risk of SSI compared to patients with an ASA score of 1-2 (OR = 3.0; 95% CI = 2.6) [13]. Diabetes is an independent risk factor for increased SSI rates [14], while obesity (BMI > 25 kg/m²) can raise the SSI risk by 60% in Asian populations [15]. Prolonged hospital stays also increase the likelihood of exposure to multidrug-resistant bacteria. Post-operation only one patient (0.17%) experienced superficial SSI, another (0.17%) developed organ/space SSI, and a third (0.17%) presented with systemic inflammatory response syndrome (SIRS) after surgery. These figures are lower than those reported by Phạm Văn Tân in 2016, where the SSI rate for gastrointestinal surgeries at Bạch Mai Hospital from 2011-2013 was 3.6%, with hepatobiliary and pancreatic surgeries showing an SSI rate of 4.4% [16]. The discrepancy could be due to differences in study periods, sample sizes, and patient demographics. Moreover, this study only tracked patients during their hospital stay, without assessing SSI occurrence within 30 days post-surgery, limiting the comprehensiveness of SSI detection.

Prophylactic antibiotics: A total of 98.56% of patients in the clean and clean-contaminated surgery group received the initial antibiotic dose at the appropriate time, adhering to current SSI prevention guidelines, which recommend administering prophylactic antibiotics (SAP) within 120 minutes before skin incision [1]. Among these patients, 69.17% were prescribed a combination of two antibiotics, while only 30.83% were given a single antibiotic. However, according to ASHP (2013) and the Ministry of Health (2015), combining antibiotics for hernia surgery is not recommended [6]. The most frequently used antibiotics were Metronidazole and Ampicillin/sulbactam in colorectal, appendix, and biliary surgeries. Metronidazole was often combined with other antibiotics such as Ampicillin/sulbactam, Cefotaxime, Ceftazidime, or Cefoperazone While ASHP (2013) recommends combining Metronidazole with 1st or 2nd generation cephalosporins, the Ministry of Health does not recommend its use in all types of surgeries [7]. Thus, combining Metronidazole with a 3rd generation

cephalosporin, as seen in this study, is inappropriate and should be reconsidered by using 1st or 2nd generation cephalosporins instead. The use of some antibiotics was outside ASHP recommendations, and the high rate of combination regimens indicates inappropriate antibiotic selection. In this study, 267 patients (64.81%) had appropriate SAP, a higher rate than in Nguyen Thi Thu Ha's study at Bach Mai Hospital, where the rate was 48.0% [17]. The explanation given is that at Bach Mai Hospital, cefoxitin monotherapy was the only regimen evaluated as being in line with the surgical antibiotic prophylaxis (SAP) guidelines recommended by the ASHP.

Regarding dosage and administration, all 267 patients with appropriately selected antibiotics received intravenous infusion administration, but only 254 patients (95.13%) received the correct dosage according to ASHP, Sanford guide, and Ministry of Health guidelines. Along with that, the rate of patients assessed as suitable for prophylactic antibiotic dosage is 60,7%, this rate is higher than the study at a Thong Nhat Hospital hospital in 2020 (76.4%)[18].

Prophylactic antibiotics are recommended and for most surgeries, a single prophylactic dose is sufficient and should generally be used within 24 hours postoperatively [6]. In most cases, antibiotics were continued until hospital discharge, with only 14 patients (5.51%) out of 254 patients meeting all four criteria having their antibiotics discontinued on the day of surgery. The result is lower than the study at a Thong Nhat Hospital hospital in 2020 (54,7%)[18].

Prolonging the use of antibiotics after surgery without preoperative infection can increase the risk of antibiotic resistance, adverse reactions and raises the burden of treatment costs for patients and the healthcare insurance system. The reason for this situation may stem from the common belief among physicians that extending antibiotic use is necessary for preventing postoperative infections.

CONCLUSIONS

Based on the study results, the overall appropriateness prophylactic of antibiotic use is relatively low (3,35%), the main reason is the inappropriate duration of administration (96,65%). In addition, the inappropriate selection and use of antibiotics contributed to the overall inappropriate antibiotic. Therefore, it is essential to develop guidelines for prophylactic antibiotic use to improve treatment outcomes and prevent surgical site infections and antibiotic resistance.

REFERENCES

1. World Health Organization. Global guidelines for the prevention of surgical site infection.2018.
2. Nguyễn Việt Hùng và cộng sự. Đặc điểm dịch tễ học nhiễm khuẩn vết mổ và tình hình sử dụng kháng sinh ở bệnh nhân phẫu thuật tại một số bệnh viện tỉnh phía Bắc - 2008. Y học thực hành, 2010; 705(2):48-52.
3. Nguyễn Việt Hùng, Trương Anh Thư. Tỷ lệ, phân bố, các yếu tố liên quan và tác nhân gây nhiễm khuẩn Bệnh viện Bạch Mai năm 2012. Y học thực hành, 2013; 5:167-169.
4. Berriós-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg 2017; 152: 784–791.
5. Arriba-Fernandez A, Molina-Cabrillana J, Serra-Majem L, García-de-Carlos P. Assessment of the surgical site infection in colon surgery and antibiotic prophylaxis adequacy: a multi-center incidence study. Cir Esp (Engl Ed). 2022;100(11):718–24.
6. Bratzler D. W., Dellinger E. P., et al. Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery. Am

J Health Syst Pharm, 2013; 70(3): 195 – 283.

7. Bộ Y tế. Quyết định 708/QĐ-BYT ngày 02 tháng 03 năm 2015 về việc ban hành tài liệu chuyên môn "Hướng dẫn sử dụng kháng sinh". 2015.
8. World Health Organization (2016). Global Guidelines for the Prevention of Surgical Site Infection. WHO Document Production Services, Geneva, Switzerland, 2016.
9. Cheng Hang, Chen Brian Po-Han, et al. Prolonged Operative Duration Increases Risk of Surgical Site Infections: A Systematic Review. Surg Infect (Larchmt) 2017; 18: 722–735.
10. E. Korol, K. Johnston, et al. A Systematic Review of Risk Factors Associated with Surgical Site Infections among Surgical Patients. PLoS One 2013; 8(12): e83743-e83743.
11. Marchi M., Pan A., Gagliotti C., et al. The Italian national surgical site infection surveillance programme and its positive impact, 2009 to 2011. Euro Surveill; 19(21): 20815.
12. Trần Quế Sơn, Nguyễn Thế Hiệp, cs. Yếu tố nguy cơ liên quan đến nhiễm khuẩn vết mổ ở người bệnh sau phẫu thuật bệnh lý gan-mật-tụy và ống tiêu hóa: Hồi cứu 120 ca bệnh tại Bệnh viện Bạch Mai. Tạp chí nghiên cứu Y học 2023; 169(8): 173-181.
13. Kaye KS, Schmit K, Pieper C, et al. The effect of increasing age on the risk of surgical site infection, J Infect Dis, 2005; 191(7):1056-62.
14. Phạm Thị Kim Huệ và Đặng Nguyễn Đoan Trang. Khảo sát việc sử dụng kháng sinh dự phòng trong phẫu thuật sạch, sạch - nhiễm tại Bệnh viện Đại học Y Dược TP.HCM giai đoạn 09/2016 - 05/2017. Y học TP. Hồ Chí Minh, 2018; 22(1):83-88.
15. Almasaudi AS, McSorley ST, Edwards CA,et al. The relationship between body mass index and short-term postoperative outcomes in patients undergoing potentially curative surgery Aor colorectal cancer: A systematic review and meta-analysis. Crit Rev Oncol Hematol, 2018; 121:68-73.
16. Phạm Văn Tân. Nghiên cứu nhiễm khuẩn vết mổ các phẫu thuật tiêu hóa tại khoa Ngoại Bệnh viện Bạch Mai. 2016. Luận án Tiến sỹ y học. Học viện Quân y, Hà Nội, Việt Nam.
17. Nguyễn Thị Thu Hà, Nguyễn Mai Hoa, Vũ Thùy Dung, cs. Đặc điểm sử dụng kháng sinh trên bệnh nhân phẫu thuật theo chương trình tại khoa phẫu thuật tiêu hóa gan mật tụy, Bệnh viện Bạch Mai. Tạp chí y học lâm sàng 2021; 120: 73 – 82.
18. Nguyen HT, Bui QTH, Vo TV, Pham HTT, Vo TD. Antibiotic use in gastrointestinal surgery patients at a Vietnamese national hospital. BMC Gastroenterol. 2022 Nov 22;22(1):480.