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Evaluation of Antibiotic Prophylaxis Administration at the General and Neuro-Surgery Ward of a Teaching Hospital in Tehran, Iran

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A B S T R A C T

The common cause of healthcare-associated infections is surgical site infections (SSIs). The appropriate use of antibiotic prophylaxis plays an important role in the prevention and reduction of surgical site infection. So, this study was evaluated the antibiotics prophylaxis administration in surgical patients. A prospective cross-sectional study was conducted on surgical patients from July 2015 to December 2016. Data were collected for all patients who undergoing surgery and met inclusion criteria. CDC Guideline for wound classification and antibiotic prophylaxis administration were used. SPSS software version 21 was used for data analysis of descriptive statistics. A total of 134 patients who undergoing surgery and met the study criteria were evaluated. Of these, 81 (60.4%) were males. The mean+SD age of the participants was 40.74+18.3. Most commonly used agent was vancomycin plus ceftazidime (71.6%). Duration of antibiotic administration and appropriate antibiotics were not compatible with guidelines. Educational interventions are necessary to improve administration of antibiotic prophylaxis prior to surgery and reduce surgical site infection.

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Introduction

The common cause of healthcare-associated infections is surgical site infections (SSIs) [1, 2]. Surgical site infections are defined by Centers for Disease Control and Prevention (CDC) as an infection that is related to an operative procedure that can occur at or near the surgical incision within 30 or 90 days after the procedure [1]. SSIs are often occurring at the incision site but deeper adjacent structures can be involved as well [3]. SSIs occur as a nosocomial infection among surgical patients by incidence of approximately 38 percent. It is estimated that SSIs develop approximately 1 in 24 patients who undergo inpatient surgery in the United States [4, 5]. SSI can develop in-hospital problem and has a severe consequences for the patients [6]. Postoperative infections after neurosurgical procedures can be bothersome for the patients [7]. Wounds are classified according to National academy of sciences and the national Research Council to clean, clean-contaminated, contaminated or dirty [8]. Malis as a pioneer reported that local and preoperative antibiotic prophylaxis has a beneficial effect on the prevention of infection in neurosurgical procedures [9]. Current guidelines show that between 33% and 60% of SSIs are preventable [10, 11]. The goal of antimicrobial prophylaxis during the operative procedure is reducing the burden of microorganisms at the surgical site and consequently prevention of SSIs. The beneficial effect of antibiotic prophylaxis for prevention and reducing surgical site infection has been clearly proven. Therefore, if antibiotic selection is done wrongly, deleterious outcomes will be occurred for the patients [12]. According to local microbial resistance patterns, the *appropriate* use of prophylactic antibiotics can improve the effectiveness of antibiotics and thereby preventing the emergence of *antibiotic-resistant bacteria* [13]. Surgeons often administer a broad-spectrum antibiotic as a prophylaxy prior to surgery or they administer antibiotics that are not complied with the valuable guidelines that have been existed [14]. This background prompted us to evaluate the pattern and rationality of antibiotic prophylaxis of surgical and neurosurgical patients undergoing surgery in a referral center of surgery in Loghman Hospital, Tehran, IRAN from 1 July 2015 to 31 December 2016.

Materials and Methods

A cross sectional study was carried out in the Neurosurgery and general surgery wards of Loghman Hospital, a referral center of surgery in Tehran, IRAN from July 2015 to December 2016. The surgical procedures were classified into clean, clean-contaminated and contaminated based on CDC Wound Classification [15].

All patients undergoing these procedures were included in this study. Inclusion criteria were: patients who were undergoing clean and clean-contaminated surgery. Exclusion criteria were: patients have infection prior to surgery, patients undergoing contaminated or dirty surgery, pregnant or breast feeding women. Data from the medical records of patients who were met inclusion criteria, including patient demographics, type of surgical procedure, choice of antibiotic regimens before surgery, time of administration were collected. Also, type of antibiotic regimen, duration of administration and occurrence of infection after surgery were collected. In addition, the appropriateness of antibiotic prophylaxis which administered for the patients compared with the U.S. Centers for Disease Control and Prevention guideline [16].

Statistical analysis

We used Statistical Package for the Social Sciences 21 (SPSS Inc, Chicago, Illinois, USA) for analysis. Frequencies and percentages were used to describe categorical variables while means and standard deviations were used to describe continuous variables.

Results

A total of 134 patients who undergoing surgery and met the study criteria were evaluated. Of total patients (n=134), 81 (60.4%) were males and 53 (39.6%) were females. The mean+SD age of the participants was 40.74+18.3.

Majority of surgery, 76 (56.6%) was due to brain tumor followed by hydrocephaly 14 (10.4%) and gastrointestinal cancer 9 (6.7%) and the least common procedures was gall bladder resection, hematoma and pre-anal abscess with the same rate of 2 (1.5%) (Table 1). One hundred three of the procedures were clean and 32 of the procedures were clean-contaminated. In our study, 18 patients (13.4%) involved by infection after surgery. Our result showed that majority of patients received vancomyin rather than cefazolin in neurosurgery. Also, in our study the most common antibiotics which used for the gastrointestinal surgery were ceftriaxone plus metronidazole. All antibiotic regimens that used as prophylaxis was shown in table 2. In our study, majority of antibiotics administered during anesthesia rather than 60 minutes prior to surgery or 120 minutes prior surgery if vancomycin is selected for prophylaxis. Frequency and percentage of time of administration of antibiotics prior to surgery was shown in table 3. The duration of postoperative antibiotics that administered after surgery was shown in table 4.

Table 1. Demographic data and type of surgery of patients.

Patients	**Frequency (percent)**
men	81 (60.4%)
Women	53 (39.6%)
Types of surgery	**Frequency (percent)**
CNS Tumor	76(56.6%)
Hydrocephaly	14(10.4%)
Gastrointestinal Cancer	9(6.7%)
Ileus	^(4.5%)
Scalp Fracture	5(3.5%)
CNS Cyst	5(3.5%)
CNS Abscess	3(2.2%)
Pancrase and gall bladder surgery	3(2.2%)
Apanditis	3(2.2%)
Cholesystectomia	2(1.5%)
Subdural hematoma (SDH)	2(1.5%)
Preanal Abscess	2(1.5%)

Table 2. Types of antibiotics that used as a prophylaxis prior to surgery.

Type of antibiotics	**Frequency**	**Percentage**
ceftriaxone + metronidazole	25	18.7
vancomycin + ceftazidime	96	71.6
ceftazidime	3	2.2
cefazolin	3	2.2
meropenem + ciprofloxacin	1	0.7
vancomycin	1	0.7
cefazolin + metronidazole	1	0.7
ceftriaxone + metronidazole + cefazolin	1	0.7
clindamycin + cefazolin	1	0.7
ceftriaxone + vancomycin	1	0.7
vancomycin + meropenem	1	0.7

Table 3. Frequency and percentage of time of administration of antibiotics prior to surgery.

Time of administration of antibiotic	Frequency	Percentage
2 hours prior to surgery	1	0.7
1 hours prior to surgery	1	0.7
30 minutes prior to surgery	29	21.6
During anesthesia	103	76.9

Table 4. The number of days receiving antibiotics postoperative surgery.

Number of days	Frequency	percentage
1	4	3.0
2	17	12.7
3	21	15.7
4	29	21.6
5	16	11.9
6	13	9.7
7	9	6.7
8	7	5.2
9	3	2.2
10	4	3.0
11	5	3.7
12	1	0.7
13	1	0.7
17	1	0.7
19	1	0.7
21	1	0.7
22	1	0.7

Discussion

Drug Utilization Evaluation (DUE) studies facilitate assessing the appropriateness and rational use of medications [19]. The aim of our study was drug use evaluation of the antibiotic prophylaxis in patients who underwent surgery and compare them with surgical antibiotic prophylaxis (SAP) guidelines. Majority of noncompliance with valuable guidelines in this study was inappropriate administration of antibiotics prior to surgery. In our study, antibiotics administered during anesthesia rather than 60 minutes prior to surgery or 120 minutes prior surgery if vancomycin is anselected for prophylaxis. Classen et al., [20] studied on the timing of antibiotic prophylaxis on 1708 patients who received the prophylactic antibiotics preoperatively. They found that the appropriate administration of antibiotics prior to surgery was associated with the lowest risk of surgical-wound infection. Our study was in line with this study. In Paradiso-Hardy et al. study in Canada [21] and Lallemand et al.study that was done in France [22], the timing of administration of antibiotic prophylaxis was correct in 72% and 61.4% of cases respectively. Our result is not similar to these studies. Also, different studies were done in Jordan [23], Netherlands [24] and Nicaragua [25] .They reported the timing of administration of antibiotic prophylaxis were correct in 99%, 50% and 22% respectively.

One of the majorities of failures of our study towards the valuable and standard guidelines is

prolonging the duration of prophylaxis beyond the recommended time. In our study, majority (21.6%) of patients received antibiotic prophylaxis for 4 days. And only 3% of patients received prophylaxis for 24 hours. In our study 15% of patients received prophylaxis in a corrected time and lasting 85% received antibiotics incorrectly. Several studies were done in different country showed different results. Our result approximately is similar to these several studies.

Percentage of patients who received antibiotic prophylaxis beyond 24 hours after surgery was 65% in a study was done in France [26] and 59.3% in Qatar [27]. A study was done in Nicaragua, 78.4% received prophylaxis more than 24 hours [25] and 97% in Sudan [28]. In general, guidelines recommend either single dose of prophylaxis or prophylaxis for 24 hours after surgery. Prolonged prophylaxis can be harm full rather than beneficial effects and can induct resistance of bacterial strains and also increase the incidence of antibiotic associated diarrhea [29, 30]. Also, a systematic review assessed single dose of antimicrobial prophylaxis versus multiple dose for major surgery between 1974–1999. They showed that a single dose of antibiotic is as effective as multiple doses and surgical site infection (SSI) risk is not different for both single and multiple doses of antimicrobial prophylaxis [31].

According to standard guidelines [16- 18], most common antibiotic which administer for neurosurgery is cefazolin and its alternative is vancomycin, but our result showed that majority of patients received vancomyin rather than cefazolin. Also, for gastrointestinal surgery, cefazolin and its alternative clindamycin or vancomycin based on standard guidelines should be administered. However, in our study the most common antibiotics which used for the patients were ceftriaxone plus metronidazole.

Different studies also stated that surgeons administered antibiotics against standard guidelines. Kasteren *et al.* [24] found that the main reasons to compliance with standard guideline are lack of awareness of appropriate guidelines, lack of agreement of surgeon's with recommendation which existed in these guidelines and logistical limitations in the operating room.

Conclusion: Thus according to our results, developing a local Hospital guideline may be necessary for surgical antibiotic prophylaxis especially for neurosurgeon and general surgeons. This guideline should be developed based on bacterial epidemiology patterns of hospital and general surgery and neurosurgery operation rooms.

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Conflict of interest

Authors certify that there is no actual or potential conflict of interest in relation to this article.

References

[1] April 2013 CDC/NHSN Protocol Corrections, Clarification, and Additions. http://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent. pdf (Accessed on July 10, 2013).

[2] Global guidelines for the prevention of surgical site infection. World Health Organization 2016 http://www.who.int/gpsc/global-guidelines-web.pdf?ua=1 (Accessed on November 08, 2016)

[3] Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. Clin Microbiol Rev. 1993;6:428–442.

[4] Agency for Healthcare Research and Quality. Healthcare Cost and Utilization Project: Statistics on hospital stays. 2013. http://hcupnet.ahrq.gov/ (Accessed on July 27, 2016).

[5] Scott RD. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. CDC, Atlanta 2009.

[6] Smyth ET, Emmerson AM. Surgical site infection surveillance. J Hosp Infect. 2000;45:173-184.

[7] Valentini LG, Casali C, Chatenoud L, Chiaffarino F, Uberti-Foppa C, Broggi G. Surgical site infections after elective neurosurgery: a survey of 1747 patients. Neurosurgery. 2008;62:88–95.

[8] Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for Prevention of Surgical Site Infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control

Practices Advisory Committee. Am J Infect Control. 1999;27(2):97-132.

[9] Korinek AM, Golmard J-L, Elcheick A, et al. Risk factors for neurosurgical site infections after craniotomy: a critical reappraisal of antibiotic prophylaxis on 4,578 patients. Br J Neurosurg. 2005;19:155–162.

[10] Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. Infect Control Hosp Epidemiol. 2011;32:101–114.

[11] Yokoe DS, Classen D. Improving patient safety through infection control: a new healthcare imperative. Infect Control Hosp Epidemiol. 2008;29:S3–S11.

[12] Schonberger RB, Barash PG, Lagasse RS. The Surgical Care Improvement Project Antibiotic Guidelines: Should We Expect More Than Good Intentions? Anesth Analg. 2015;121:397-403.

[13] Allerberger F, Lechner A, Wechsler-Fördös A, Gareis R. Optimization of antibiotic use in hospitals-antimicrobial stewardship and the EU Project ABS International. Chemotherapy. 2008;54:260–267.

[14] Fonseca SN, Kunzle SR, Junqueira MJ, Nascimenta RT, de Andrade JL, Levin AS. Implementing 1-dose antibiotic prophylaxis for prevention of surgical site infection. Arch Surg. 2006;141:1109–1114.

[15] Deverick J. Anderson, Kelly Podgorny, Sandra I. Berríos-Torres, Dale W. Bratzler, E. Patchen Dellinger, Linda Greene, et al. Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. Infect Control Hosp Epidemiol. 2014;35: 605–627.

[16] Scottish Intercollegiate Guidelines Network (SIGN) Guidelines 104. Antibiotic prophylaxis in surgery. A national clinical guideline. Edinburgh, UK: SIGN; 2008. [Online] Available from: http://www.sign.ac.uk/pdf/sign104.pdf [Accessed on 26th April 2013].

[17] Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Surg Infect (Larchmt). 2013;14:73-156.

[18] Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health Syst Pharm. 2013 Feb 1;70:195-283.

[19] Tavakoli-Ardakani M, Eshraghi A, Hajhossein Talasaz A, Salamzadeh J. A drug utilization evaluation study of amphotericin B in neutropenic patients in a teaching hospital in iran. Iran J Pharm Res. 2012;11(1):151-156.

[20] Classen DC, Evans RS, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. N Engl J Med. 1992;30;326(5):281-6.

[21] Paradiso-Hardy FL, Cornish P, Pharand C, Fremes SE. A national survey of antimicrobial prophylaxis in adult cardiac surgery across Canada. Can J Infect Dis. 2002; 13:21–27.

[22] Lallemand S, Thouverez M, Bailly P, Bertrand X, Talon D. Non-observance of guidelines for surgical antimicrobial prophylaxis and surgical-site infections. Pharmacy World & Science. 2002; 24:95–99

[23] Al-Momany NH et al. Adherence to international antimicrobial prophylaxis guidelines in cardiac surgery: a Jordanian study demonstrates need for quality improvement. J Manag Care Pharm. 2009; 15:262–271.

[24] Van Kasteren ME, Al-Bakri AG, Makahleh ZM, Wazaify MM. Adherence to local hospital guidelines for surgical antimicrobial prophylaxis: a multicentre audit in Dutch hospitals. J Antimicrob Chemother. 2003; 51:1389–1396

[25] Van Disseldorp J, Slingenberg EJ, Matute A, Delgado E, Hak E. Application of guidelines on preoperative antibiotic prophylaxis in León, Nicaragua. Neth J Med. 2006;64: 411-416.

[26] Miliani K, L'Heriteau F, Astagneau P. Non-compliance with recommendations for the practice of antibiotic prophylaxis and risk of surgical site infection: results of a multilevel analysis from the INCISO Surveillance Network. J Antimicrob Chemother.2009; 64:1307-1315.

[27] Abdel-Aziz A, El-Menyar A, Al-Thani H, Zarour A, Parchani A, Asim M, et al. Adherence of surgeons to antimicrobial prophylaxis guideline in a tertiary general hospital in a rapidly developing country. Adv Pharmacol Sci. 2013: 6.

[28] Elbur AI, Yousif MA, Elsayed AS, Abdel-Rahman ME. An audit of prophylactic surgical antibiotic use in a Sudanese Teaching Hospital. Int J Clin Pharm. 2013; 35: 149-153.

[29] Heineck I, Ferreira MB, Schenkel EP. Prescribing practice for antibiotic prophylaxis for 3 commonly performed surgeries in a teaching hospital in Brazil. Am J Infect Control. 1999: 27:296–300.

[30] Harbarth S, Samore MH, Lichtenberg D, Carmeli Y. Prolonged antibiotic prophylaxis after cardiovascular surgery and its effect on surgical

site infections and antimicrobial resistance. Circulation. 2000;101:2916–2921.

[31] McDonald M, Grabsch E, Marshall C, Forbes A. Single versus multiple dose antimicrobial prophylaxis for major surgery: a systematic review. Aust N Z J Surg. 1998:68:388-396.

