



## ARAŞTIRMA / RESEARCH

# Surgical antibiotic prophylaxis and compliance with the standard treatment guidelines in acute appendectomy at tertiary care teaching hospital

Cerrahi antibiyotik profilaksisi ve üçüncü basamak eğitim hastanesinde akut apendektomide standart tedavi kılavuzlarına uyulması

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### Abstract

**Purpose:** This study was conducted to investigate the rational use of surgical antibiotic prophylaxis (SAP) in acute appendectomy.

**Materials and Methods:** This research analyzed prospectively prescriptions of 400 patients who underwent acute appendectomy during six months study period at teaching hospital (Pakistan). Appropriates of SAP was evaluated according to American College of Surgeons and American Society of Health-System Pharmacists (ASHP) guidelines. The World Health Organization recommended Anatomical Therapeutic Chemical (ATC) methodology was also used for antibiotic utilization.

**Result:** Mean age of these patients was 28 years (IQR = 16-45; SD=8.5) years with majority of male patients (60%). Out of these, 37.3% adhered according to guidelines with respect to correct choice, 100% for dose, 100% for route and 49.5% for timing of antibiotic (optimal value 100%). The commonly and inappropriately prescribed antibiotic was ceftriaxone. Combination use of SAP was also reported.

**Conclusion:** Inappropriate choice, timing and misuse of antibiotics are main reported problems in this study.

**Keywords:** Acute appendicitis, antibiotic guidelines, surgical prophylaxis, Hospital

### Öz

**Amaç:** Bu çalışma akut apendektomide cerrahi antibiyotik profilaksisinin (SAP) rasyonel kullanımını araştırmak için yapıldı.

**Gereç ve Yöntem:** Bu araştırma, eğitim hastanesinde (Pakistan) altı aylık çalışma süresi boyunca akut apendektomi yapılan 400 hastanın reçetesini prospektif olarak analiz etti. SAP'nin ödenekleri Amerikan Cerrahlar Koleji ve Amerikan Sağlık Sistemi Eczacıları Birliği (ASHP) kurallarına göre değerlendirildi. Antibiyotik kullanımı için Dünya Sağlık Örgütü Anatomik Tedavi Kimyasal (ATC) metodolojisini de kullandı.

**Bulgular:** Bu hastaların yaş ortalaması 28 idi (IQR = 16-45; SD = 8.5). Bunlardan% 37,3'ü doğru seçim, doz için% 100, rota için%100 ve antibiyotik zamanlaması için%49,5 (optimal değer%100) ile ilgili kurallara göre yapılmıştır. Sık ve uygunsuz olarak reçete edilen antibiyotik seftriaksondu. SAP'nin kombinasyon kullanımı da rapor edildi.

**Sonuç:** Uygun olmayan seçim, antibiyotiklerin zamanlaması ve yanlış kullanımı bu çalışmada bildirilen başlıca problemlerdir.

**Anahtar kelimeler:** Akut apandisit, antibiyotik kılavuzları, cerrahi profilaksi, hastane

## INTRODUCTION

Acute appendectomy is the most common reason for an abdominal surgery, and having 7-15% chances of lifetime incidence<sup>1</sup>. It was reported that, only in America, a cost of \$3 billion/per year was consumed by hospitalized appendicitis patients<sup>2</sup>. Surgical Site

Infections (SSIs) are commonly occurred hospital acquired infection after any surgical procedure. SSIs responsible for substantial burden in the form disease state, death and cost of pharmaceutical care<sup>3</sup>. The reported incidence of acute appendectomy was 7.2% in Brazil, 6.2% in China, 5.9% in Sweden and 2.9% in USA<sup>4,5</sup>.

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Surgical Antibiotic Prophylaxis (SAP) is usually administered carefully before surgery to prevent SSIs<sup>5</sup>. Administration of right antibiotic with respect to dose, time, route and duration are the important step for optimal use of SAP. Inappropriate use of SAP is responsible for antimicrobial resistance, increased hospital stays and ultimately increased costs of therapy<sup>3,6,7</sup>. It is evident that appropriate administration of SAP is effective in reducing risk of SSIs, antibiotic resistance and cost of therapy<sup>3,8,9</sup>. SAP is strongly recommended for uncomplicated acute appendectomy (4-6). SAP occurs in one third of all antibiotic use in hospitals and 80% of all antibiotic use in surgery<sup>10,11</sup>.

In Pakistan research regarding occurrence and surgical antibiotic prophylaxis practice is very scarce. There is an urgent need to change the prescribing practice for acute appendectomy in general and surgical prophylaxis in particular through improved antimicrobial stewardship strategies<sup>6,8</sup>. Therefore, the main goal of this study was to investigate prophylactic antibiotics practice with standard guidelines in acute appendectomy in main referral teaching hospital (Islamabad, Pakistan).

## MATERIALS AND METHODS

A prospective cross-sectional study was conducted to investigate medical records of patients underwent acute appendectomy, from 18, August, 2016 to 18, January 2017 in public sector tertiary care teaching hospital in Islamabad, Pakistan. The study was carried out ethically and approved from the Ethical/Institutional review boards of concerned hospitals (No. F.1-1/2015/ERB/SZABMU/), Islamabad, Pakistan. A written and oral informed consent was also taken from all participants before observing medication records.

Patient having age between 16-45 years with no previous infection and surgery were selected. Patient having perforated appendicitis, underwent other emergency operations, having previous performed acute appendectomy in combination with another procedure were excluded. Required information were entered in data collection form, which was based on previously evidence-based research<sup>6,7,10</sup>. For modification of data collection form, initially pilot study was performed on 15 participants. After pilot study, the final modified collection form comprised of four portions. *a*) Demographic information and medical data, *b*) surgical data (start and end time of

surgical procedure, duration of surgery, and duration of stay in hospital), *c*) SAP utilization data (name of antibiotic, dose, route, frequency, pre-operative administration time relative to incision), *d*) Lastly, appropriate SAP assessment (uses, selection, dose, route and time to administer) were documented.

Due to unavailability of institutional guideline, we assessed appropriateness of SAP according to updated available international guidelines of American College of Surgeons and Surgical Infection Society: surgical site infection guidelines, 2016 update (3) and American Society of Health-System Pharmacists (ASHP) guideline, 2013 (8) published guidelines were used to evaluate common parameters for SAP. World health organization/Anatomical Therapeutic Chemical (WHO/ATC) classification system was used for most common classes and combination of antibiotics.

## Statistical analysis

Descriptive statistics such as frequencies, percentages and averages are used for interpretation of data through Statistical Package for the Social Sciences (SPSS), Version 20.0. The latest recommendations for SAP use in acute appendectomy are summarized in Table 1.

## RESULT

During study period, a total of 400 eligible cases were observed. Patients who received prophylaxis included 239 (60%) males and 161 (40%) females. Mean age of these patients was 28 years (IQR = 16-45; SD=8.5). The mean weight of these patients was 75 kg (IQR = 47-107; SD=11.01). The median hospitalization period was 1.3 (IQR: 1-2; SD=.46) days.

All patients received antibiotics in our study. However, the wrong antibiotics were given in more than half 251 (62.7%). Patients in which the wrong antibiotic was given were not included in computation of correct dose. A correct antibiotic was administered to the 149 patients, and all patients received right dose of SAP (100%).

The route of administration was also according to guidelines recommendation (100%). About half of the patients (49.5%) received antibiotics within optimal time range. The percentage of patients receiving pre-operative antibiotic for surgical prophylaxis was 100% in our study. This study reported that two pre-operative antibiotics were

prescribed to 28% of patients. The most commonly prescribed class of antibiotic was cephalosporins. In case of individual antibiotics, ceftriaxone shared the maximum percentage followed by cefazolin. Most

commonly prescribed combination was Ceftriaxone plus metronidazole. Details about surgical prophylaxis practices shown in Table 2.

**Table 1. Recommendations for antibiotic prophylaxis in acute appendicitis**

Pre-operative Prescription					Evidence
Procedure	Antibiotic use	Route	Dose	Timing(min)	
Acute appendicitis					
First line	Cefazolin	IV	2g	60	A
	Cefoxitin	IV	2g	60	A
	Metronidazole	IV infusion	500mg	60	
	cefazolin plus metronidazole	IV+ IV infusion	2g+500mg	60	A
Alternative				60	A
	Clindamycin	IV	900 mg	60	A
	gentamicin	IV	2mg/kg	60	A
	Aztreonam	IV	2 g	60	A
	Ciprofloxacin	IV	400 mg	60	A
	Metronidazole plus gentamicin	IV infusion+ IV	500mg+2mg/kg	60	A

**Table 2. Comparison of surgical prophylaxis practices with standard guidelines.**

Indicators	N of patients	% of patients	Optimal value
Antibiotic given	400	100%	100%
Correct antibiotic choice	149	37.3%	100%
Dose	149	100%	100%
Route			
Intravenous (IV)	400	100%	100%
Timing			
On time (within 30-60 minutes before SI)	198	49.5%	100%
Late (more than 60 min)	202	50.5%	100%
Pre-operative antibiotic	WHO/ATC code	Frequency (n)	Percentage (%)
Ceftriaxone	J01DD04	201	70
Cefazolin	J01DB04	37	12.9
Cefuroxime	J01DC02	28	9.7
Ampicillin	J01CA01	21	7.3
Total	-	287	100
Combinations			
Ceftriaxone <i>plus</i> metronidazole	J01DD04+J01XD01	74	65.5
Ampicillin <i>plus</i> metronidazole	J01CA01 +J01XD01	39	34.5
Total	-	113	100

## DISCUSSION

An incidence of acute appendectomy varies according to age and gender. In our study, the mean age for both genders were 28 years; this finding are

aligned with the 12- year population-based epidemiological study in Taiwan<sup>12</sup>. This finding slightly different from studies conducted in Korea<sup>13</sup> and Canada<sup>14</sup> which reported highest incidence rate at age of 10-19 years. In case of gender, the incidence

of acute appendectomy in male (60%) was higher as compared to female patients. These results are aligned with previously conducted studies 53.09 % in Taiwan<sup>12</sup>, 50% in South Korea<sup>13</sup> and 58% in Canada<sup>14</sup>. However, the incidence of acute appendectomy varied by country throughout the globe; further in-depth study via clinical trials are requires to explore this reason<sup>12</sup>.

SAP is a proven strategy in decreasing SSIs<sup>3,8</sup>. The fact that SAP was administered to almost all patients (100%). This indicates that the awareness of surgeons about the value of SAP in preventing SSIs but, the selection of appropriate antibiotic missed as per guidelines in majority of patients (n = 251; 62.7%). This value was higher than studies conducted in Philippines (44%)<sup>7</sup> and Iran (5.9%)<sup>15</sup>. However, higher adherence rate was reported by study conducted in Ethiopia (89%)<sup>6</sup>. Common errors in SAP selection included combination of antibiotics without any indication for combination therapy, use antibiotic not recommended for prophylaxis, such as broad-spectrum antibiotics.

Pre-operative timing of administration is another area that require improvements as per guidelines recommendations. In our study, about 50.5% of the SAP were not administered within appropriate time range (within 60 minutes of surgical incision). Antibiotics used for prophylaxis are more efficacious if used within one hour prior to skin incision time<sup>3,6,8</sup>. This study showed that, only 198 (49.5%) were received SAP within one hour prior to skin incision. Same results were reported in Ethiopian study (52.3%)<sup>6</sup>. The results was slightly different from Philippine (45%)<sup>7</sup> and Iranian study (40.7%)<sup>15</sup>. This study revealed that, more than half of the patients received SAP at the wrong time. It showed that those patients received less protection against SSIs because, due to greatest risk of contamination, it is necessary to administered SAP within optimal time for adequate levels of antibiotic in the blood and tissues during the surgical procedure<sup>3,8,15</sup>.

According to our study, inappropriate and overuse of ceftriaxone was observed as SAP in selected setting. Approximately 70% of the patients were administered ceftriaxone regardless of the drug is not recommended by the standard treatment guidelines. Ceftriaxone is a broad-spectrum antibiotic and has higher chances of resistance than cefazolin and other drugs commonly utilized as SAP<sup>3,6,8</sup>. Similar findings was reported by studies conducted in Ethiopia<sup>6</sup>, Latvia<sup>10</sup> and Iran<sup>15</sup>. Despite the availability of first line

therapy, surgeons prescribing practice were not adhered with recommended guidelines. Poor awareness and lack of agreement of surgeon's with guidelines recommendations are some barriers to guidelines non-adherence<sup>6</sup>.

Some limitations of this study must be acknowledged. Only one most commonly performed abdominal surgery (acute appendectomy) for appropriateness of SAP practice. Further longitudinal and interventional study are required to explored irrational use in others common surgical procedure. Second, present study uses published evidence-based international guidelines to measure because, there was no local consensus guidelines available in our setting. The reasons for non-adherence to guidelines were beyond the scope of the current study. Finally, these findings do however add a useful information, particularly around appropriate use of SAP, adherence with standard guidelines and health systems in developing countries.

Inappropriate choice, timing and misuse of antibiotics are main reported problems in this study. According to the guideline's recommendations. Promoting awareness and availability of antibiotics and recommended guidelines are principal interventions for proper use of SAP.

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