Usage Pattern of Antimicrobial Agents in Surgical Patients of a Tertiary Care Teaching Hospital in Ajman, United Arab Emirates

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ABSTRACT

The extensive use of AMAs has paved the pathway for antibiotic resistance among commonly encountered microorganisms. Additionally, rational use of antimicrobial agents (AMAs) is extremely vital for positive patient outcomes. Hence, we aimed to analyse the pattern of use of AMAs in patients who had undergone surgery at Thumbay Hospital, Ajman, United Arab Emirates and to study the incidence of adverse drug reactions in the same group of patients.

The data were collected over a one-year period after Institutional Ethics Committee approval. Case record analysis of AMAs prescribed to surgical patients was done with the help of a questionnaire. Most surgeries were related to ano-rectal (24%), obstetrics (23.5%) and ENT (14%) problems. AMAs were prescribed to 86.5% of the patients as surgical antimicrobial prophylaxis (SAP), with the majority being prescribed only one AMA (45.8%). Metronidazole (40.9%), Ceftriaxone (21.2%) and Cefuroxime (10.8%) were the leading AMAs for SAP. Almost all the patients (91.5%) were prescribed AMAs at discharge and Cefuroxime (23.2%), Metronidazole (20.7%) and Amoxicillin-Clavulanic acid combination (17.7%) were the principal AMAs recommended. The average duration of prescription of AMAs at discharge was 6.4 days. Mild adverse drug reactions were encountered, which did not pose any serious health risk to the patients. Proactive interventions focusing on the surgical team like formal educational sessions on antimicrobial stewardship, consistent auditing and regular updates about current SAP guidelines are the need of the hour.

INTRODUCTION

Antimicrobial agents (AMAs) are commonly prescribed for control of surgical site infections (SSI), which pose a constant challenge to surgeons. SSI are the second most common hospital acquired infection that lead to indiscriminate prophylactic use of AMAs favouring development of drug resistance. SSI frequently occurs despite strict adherence to aseptic surgical conditions leading to increased morbidity and mortality. They account for approximately 15% of nosocomial infections and are associated with prolonged hospital stays and increased costs (Bratzler and Houck, 2005). Factors influencing the development of SSI's include bacterial inoculum and virulence, host defences, perioperative care, and intraoperative management. The patient ends up with various complications, incomplete recovery, prolonged hospital stay and increased health care cost.
Apart from other practices such as control of comorbid conditions, operative environment, proper skin cleansing, periodic assessment of the surgical site etc., surgical antibiotic prophylaxis (SAP) had been significantly effective in reducing postoperative complications (Bratzler and Houck, 2005; Giri et al., 2008). Prophylactic use of AMA in urological and colorectal surgery has been found to be highly effective (Song and Glenny, 1998; Kanamuru et al., 2004). Prophylactic AMA are advised in procedures linked with high infection rates, prosthetic material implantation and those in which the infections may cause serious morbidity (Chang et al., 2006). Moreover, any surgeries in patients with evident pre-existing infection (abscess, pus, or necrotic tissue) warrants active treatment rather than proactive prophylaxis. Cephalosporins (such as cefazolin) are appropriate first line agents for most surgical procedures, targeting the most likely organisms while avoiding broad-spectrum AMAs therapy that may lead to the development of AMAs resistance. Duration of prophylaxis should not exceed 24 hours (Bratzler et al., 2013).

There have been several reports regarding the inappropriate prophylactic use of AMA not in conformation with the international guidelines for preventing SSI. Appropriate use of AMAs prophylaxis is vitally important from a clinical perspective, and is essential if the usefulness of AMA is to be preserved and the further spread of resistance limited (Bratzler et al., 2013). Optimal use includes proper case selection, use of appropriate agents, proper dosing, correct route of administration, timing, and duration and intra operative dosing when appropriate.

The drug prescribing pattern keeps changing with time as a result of microbial resistance, adverse effects and new drugs. We were unable to find studies analysing prescribing patterns of AMA in surgical patients in Ajman, United Arab Emirates (UAE). Moreover, studies on the utilization of drugs in our hospital are lacking. Such studies are necessary to obtain baseline data on drug use and create a database for comparison with future. Thus, it was aimed to analyse the prescribing pattern of AMAs in patients who have undergone surgery at Thumbay Hospital, Ajman, UAE and to investigate the incidence of adverse drug reactions in in the same group of patients. Studying the prescribing pattern of AMAs in surgical patients is expected to help in identifying the trend of any associated problems which can be curtailed by introducing new drugs in the prescriptions so as to maximize the therapeutic benefit and minimizing the risk of adverse drug reactions. The awareness about the drug of choice in management of infection may result in reduced drug burden and lower cost of treatment.

**MATERIALS AND METHODS**

A prospective observational study was undertaken in the surgical departments of Thumbay Hospital in Ajman, UAE. A standardized data collection form was used to extract information from the medical files of inpatients operated upon for different surgical conditions over one year. Any patient who had consumed AMA in the last seven days before/on day of visit to the surgical OPD was excluded from the study. Data of patients who expired in the hospital following any surgery were also not included.

The medical files were scrutinized for demographic details, surgical diagnosis, choice of AMA, dose and duration of therapy in patients who received AMAs for therapy or for prophylaxis, medical history, comorbidities and medication history. The details of antibiotic usage were recorded for each patient at two junctures: preoperative/perioperative for surgical antimicrobial prophylaxis (SAP) and at discharge. Any information on adverse drug reaction/s (ADR) reported/observed in these patients were also recorded.

The wound classification system was adapted from that of the Centers for Disease Control and Prevention, which briefly classifies surgical wounds into four classes: Clean; Clean-contaminated; Contaminated and Dirty (World Health Organization, 2018). Class I (Clean wounds) are encountered in situations without inflammation and the respiratory, alimentary, or genitourinary tracts are not entered. Class II (Clean-contaminated wounds) involve procedures in which the respiratory, alimentary or genitourinary tracts are entered but without significant spillage. Class III (Contaminated wounds) are observed in surgeries where acute inflammation (without pus) is encountered, or where there is visible contamination of the wound. Class IV (Dirty wounds) are existent in the presence of pus or compound/open injuries.

Any information identifying the patient or the surgeon was discarded. Informed consent was obtained from the surgical patients and permission of the surgical departments was taken to obtain the data. The study was approved by the Institutional Ethics Committee. Anonymity of patients and surgeons was maintained throughout the study.

**Data Analysis**

Data was analyzed using SPSS version 25 (SPSS Inc., Chicago, IL, USA) and presented as frequencies and percentages. The AMAs were classified into various classes based on their spectrum and chemical...
Table 1: Demographic characteristics and co-morbidities of study population (N=400)

| Characteristic          | Frequency | Percentage |
|-------------------------|-----------|------------|
| **Age**                 |           |            |
| ≤12 years               | 90        | 22.5       |
| 13 - 18 years           | 8         | 2          |
| 19 - 59 years           | 299       | 74.8       |
| ≥ 60 years              | 3         | 0.8        |
| **Gender**              |           |            |
| Male                    | 216       | 54         |
| Female                  | 184       | 46         |
| **Ethnicity**           |           |            |
| Asian                   | 208       | 52         |
| Arab                    | 157       | 39.3       |
| African                 | 32        | 7.8        |
| Caucasian               | 4         | 1          |
| **Health Insurance**    |           |            |
| (Not mentioned=2)       |           |            |
| Yes                     | 205       | 51.5       |
| No                      | 193       | 48.5       |
| **Smoking**             |           |            |
| (Not mentioned=10)      |           |            |
| Yes                     | 43        | 11         |
| No                      | 347       | 89         |
| **Co-morbidities**      |           |            |
| Hypertension            | 7         | 1.8        |
| Diabetes Mellitus       | 3         | 0.8        |
| Hypertension & Diabetes Mellitus | 11 | 2.75 |
| Gestational Diabetes Mellitus | 8 | 2 |
| Hypothyroid             | 9         | 2.2        |
| Miscellaneous (Hepatitis C; Anaemia; Dyslipidaemia, Bronchial Asthma) | 9 | 2.2 |

Table 2: Types of surgical procedures performed

| Department & Gynaecology | Procedure                        | Frequency | Percentage | Total (%) |
|--------------------------|----------------------------------|-----------|------------|-----------|
| General surgery          | Ano–rectal surgeries             | 96        | 24         | 184(46%)  |
|                         | Surgeries on male reproductive system including Circumcision | 38       | 9.5        |           |
|                         | Appendectomy                     | 28        | 7          |           |
|                         | Hernia repair                    | 12        | 3          |           |
|                         | Miscellaneous (Thyroid, breast abscess) | 6       | 1.5        |           |
| Obstetrics &             | Gastroduodenal/biliary           | 4         | 1          |           |
| Gynaecology              | Caesarean sections               | 94        | 23.5       | 123(30.8%)|
|                         | Gynaecology procedures including Hysterectomy | 20       | 5          |           |
|                         | Ectopic pregnancy                | 9         | 2.3        |           |
| ENT                      | Adenotonsillectomy               | 56        | 14         | 93(23.3%) |
|                         | Nasal surgeries                  | 22        | 5.5        |           |
|                         | Ear surgeries                    | 15        | 3.8        |           |
Table 3: Number of patients prescribed antimicrobial agents (N=400)

| Time Period | Number of drugs | ENT (%) | Departments | Obstetrics & Gynaecology (%) | Total (%) |
|-------------|-----------------|---------|--------------|-------------------------------|-----------|
|             |                 |         | General Surgery (%) |                             |           |
| Surgical    | 0               | 13 (3.3%) | 35(8.8%)      | 6(1.5%)                       | 54(13.5%) |
| anti-microbial prophylaxis (Pre-operative) | 1 | 74(18.5 %) | 89(22.3%)      | 20(5%)                        | 183(45.8%) |
|             | 2               | 6 (1.5%)  | 58(14.5%)      | 88(22%)                       | 152(38%)  |
|             | 3               | 0        | 2(0.5%)        | 9(2.3%)                       | 11(2.8%)  |
| Antimicrobial agents at discharge | 0 | 7 (1.8%)  | 23(5.8%)       | 4(1%)                         | 34(8.5%)  |
|             | 1               | 82 (20.5%) | 75(18.8%)      | 103(25.8%)                    | 260(65%)  |
|             | 2               | 4 (1%)    | 85(21.3%)      | 15(3.8%)                      | 104(26%)  |
|             | 3               | 0        | 1(0.3%)        | 1(0.3%)                       | 2(0.5%)   |
| Total number of patients | 93 (23.2%) | 184 (46%) | 123(30.8%) | 400(100%) |

group. A sample size of 400 was calculated based on the assumption of 50% antibiotic prescription pattern and considering a margin of error of 0.05. Around 30 major surgeries and 60 minor surgeries took place every month in Thumbay Hospital, Ajman in the year preceding the study.

RESULTS

Demographic and surgical procedure characteristics

The data revealed that majority of patients who underwent surgery were adults aged between 19 to 59 years (mean age±SD: 26.3 years±13.97); of Asian ethnicity; non-smokers and almost equally distributed by gender and health insurance coverage. Very few of the study population were suffering from concomitant diseases. The demographic characteristics and co-morbidities are elaborated in Table 1.

The categories of the surgical procedures in study population are depicted in Figure 1. The majority of our patients had Class I Clean surgical wounds (n=162; 40.5%) and underwent general surgical procedures (n=184; 46%), the most frequent being ano-recital procedures (24%) by the General Surgery (GS) department; Caesarean sections (23.5%) by the Obstetrics & Gynaecology (OBG) department and Adenotonsillectomy (14%) by the ENT department. The types of surgical procedures performed are elaborated in Table 2. No incidences of confirmed SSI were observed during the study period.

Surgical Antibiotic Prophylaxis (preoperative/peri-operative) pattern

AMAs were prescribed to 346 patients (86.5%) as SAP, with the majority of patients being prescribed only one AMA (45.8%). Majority of the patients of GS (22.3%) and ENT (18.5%) were prescribed one preoperative AMA while 22% of OBG patients were prescribed two AMA Table 3.

Consecutively, 520 different AMAs were prescribed and maximum were recommended by OBG department (n=223; 42.9%), followed by GS (n=211; 40.6%) and ENT (n=86; 16.5%) departments.

The most commonly prescribed class of AMAs were Cephalosporins (42.3%) and Nitroimidazoles (40.9%). Hence, Metronidazole (40.9%), Ceftriaxone (21.2%) and Cefuroxime (10.8%) were the leading AMAs prescribedTable 4. The majority of AMAs were administered intravenously (85.8%) and the rest were given orally (14.2%).

Almost half of the patients (40%) were prescribed an AMA in combination with Metronidazole. Most commonly prescribed AMA with Metronidazole was Ceftriaxone (21.5%). Of all the AMA combinations with Metronidazole, maximum were recommended by GS department (51.7%) followed by OBG department (47.9%) Table 5.

Before the SAP, a small number of patients (9.8%) also received AMAs from the time of hospital administration. Among them, Ceftriaxone and Metronidazole (5%) were prescribed to 4% and patients 5% patients, respectively.

Antimicrobial usage pattern at discharge (Postoperative antimicrobial agents)

At discharge, 366 patients (91.5%) were instructed to consume AMAs and most of them were prescribed one AMA (65%). Majority of the patients of OBG (25.8%) and ENT (20.5%) departments were prescribed one AMA postoperatively while 21.3 % of patients were prescribed two AMA in the GS department Table 3.
Table 4: Antimicrobial agents used preoperatively for surgical antimicrobial prophylaxis and at discharge

| Antimicrobial Class       | Name of Antimicrobial | Number of patients prescribed | Adult Dose & Route |
|--------------------------|-----------------------|-------------------------------|-------------------|
|                          |                       | Surgical antimicrobial prophylaxis | Postoperative At discharge |
| Cephalosporins: 2nd Generation | Cefuroxime/ Cefuroxime axetil | 56 | 110 | 1.2gm IV BD/ 500mg PO BD |
|                          | Cefaclor              | 1 | 12 | 500mg PO BD |
|                          | Ceftriaxone           | 110 | - | 1gm IV OD/BD |
|                          | Cefdinir              | 22 | 44 | 300mg PO BD |
|                          | Cepodoxime proxetil   | 12 | 9 | 200mg PO BD |
|                          | Ceftizoxime           | 10 | - | 1gm IV BD/TDS |
|                          | Cefixime              | 8 | 32 | 400mg PO OD/BD |
|                          | Cefotaxime            | 1 | - | 1gm IV OD |
|                          | Cefditoren            | - | 13 | 200mg/400 PO BD |
| Nitroimidazole           | Metronidazole         | 213 | 98 | 500mg IV/PO BD/TDS |
| Beta lactam antibiotic   | Amoxicillin + Clavulanic acid | 39 | 84 | 1.2gm IV BD/ 625 mg PO TDS |
|                          | Ampicillin            | 2 | - | 2 gm IV BD |
| Fluoroquinolones         | Ciprofloxacin         | 23 | 54 | 200mg IV BD/ 500 mg PO BD |
|                          | Moxifloxacin          | 10 | 7 | 400mg IV/PO OD |
|                          | Levofloxacin          | 1 | 1 | 500mg IV/PO OD |
| Macrolides               | Azithromycin          | 5 | 4 | 500mg IV/PO OD |
| Aminoglycosides          | Gentamicin            | 5 | | 80mg IV BD |
|                          | Amikacin              | 2 | | 500mg IV OD |
| Topical Antimicrobials   | Mupirocin             | - | 3 | NA |
|                          | Fusidic acid          | - | 3 | NA |
| Total number of Antimicrobial Agents | 520 | 474 | |

As compared to SAP, a lesser number of AMAs (474) were prescribed with the maximum recommended by GS department (n=248; 52.3%) followed by OBG (n=136; 28.7%) and ENT (n=90; 19%) departments. Again, Cephalosporin (46.4%) were most commonly prescribed class followed by Nitroimidazoles (20.7%) and Beta lactams (17.7%) and so Cefuroxime (23.2%), Metronidazole (20.7%) and Amoxicillin-Clavulanic acid combination (17.7%) were the principal AMAs at discharge Table 4.

The average duration of prescription of AMAs at discharge was 6.4 days (range 1 -8 days).

As far as route of administration was concerned, almost all the patients (98.5%) were prescribed AMAs orally except for six patients who were concurrently advised topical AMAs and one patient who was prescribed AMA intravenously.

Metronidazole was prescribed in combination with other AMAs to 22% of the patients. Ciprofloxacin (7%) or Amoxicillin – clavulanic acid (7%) were the common drugs selected in this combination. Similar to SAP, of all the AMA combinations with Metronidazole, maximum were recommended by GS department (86.7%) followed by OBG department (13.3%). None were prescribed by the ENT department Table 5.
Table 5: Combination of Antimicrobial agents with Metronidazole for surgical antimicrobial prophylaxis and at discharge (N=400)

| Name of Antimicrobial agents | Number of patients prescribed Antimicrobial agents in combination with metronidazole (Percentage) |
|-----------------------------|-----------------------------------------------------------------------------------------------|
|                             | Surgical antimicrobial prophylaxis | Postoperative At discharge |
| Ceftriaxone                 | 86 (21.5%)                           | -                           |
| Cefuroxime                  | 35 (8.8%)                            | 15 (3.8%)                   |
| Ciprofloxacin               | 15(3.8%)                             | 28 (7%)                     |
| Amoxicillin – clavulanic acid | 8 (2%)                          | 28 (7%)                     |
| Cefitoxime                  | 8 (2%)                                | -                           |
| Cefditoren                  |                                       | 7 (1.8%)                    |
| Gentamycin                  | 5 (1.3%)                              | 2 (0.5%)                    |
| Cefixime                    | 2 (0.5%)                              | -                           |
| Cefpodoxime                 | 1 (0.3%)                              | -                           |
| Cefdinir                    | 1 (0.3%)                              | 8 (2%)                      |
| Amikacin                    | 1 (0.3%)                              | -                           |
| Total number of patients    | 162 (40.5%)                           | 88 (22%)                    |

The AMAs used preoperatively and at discharge have been presented in Tables 3, 4 and 5.

**Adverse Drug Reactions**

The ADRs reported during postoperative hospitalization stay were nausea and vomiting (23%), metallic taste and anorexia (18%), diarrhea (11%), thromboplebitis (0.6%) and hypersensitivity (0.6%).

**Discussion**

The extensive use of AMAs has paved the pathway for antibiotic resistance among commonly encountered microorganisms. Moreover, development of newer antimicrobials has undergone a stagnation in recent times (Hsu et al., 2008). Hence, it is more than imperative that rational use of AMA be advocated to check the onslaught of antibiotic resistance. Effective use of AMAs requires not just monitoring but feedback on usage pattern as well because of the increasing risk of drug resistance. Though antibiotic treatment is not essential for patients undergoing surgery, they are used prophylactically to avoid post-surgical complications due to inadvertent contamination. Our study endeavors to assess the pattern of prophylactic use of AMA as well as the usage at discharge in surgical patients. Such a study paves the pathway for setting guidelines for rational use of AMAs in our setting in the future.

In our study majority of the patients had either Class I (Clean; 40.5%) or Class II (Clean-contaminated; 36.3%) surgical wounds. This pattern is analogous to a study in UAE, which scrutinized AMA prescription pattern and adherence of surgeons to current guidelines of SAP. An equal number of their patients underwent both Clean (46.4 %) and Clean-contaminated (46.8%) surgeries (Has-san et al., 2015). Unlike our study, the majority of patients in other studies in Nepal 45.5%; (Shah et al., 2011) and Malaysia 60.9%; (Oh et al., 2014) had undergone Class II (Clean-contaminated) procedures. Moreover, in contrast to our study where the maximum procedures were ano – rectal surgeries (24%) or caesarean sections (23.5%), gastro-duodenal/biliary were most commonly performed in UAE (41.6%) and Malaysia (37.9%).

Guidelines recommend that SAP is usually not necessary for Class I Clean surgeries unless the procedure is high risk with implantation of prosthetic materials and the consequences of infection in these patients are quite dangerous. However, the benefits of antimicrobial prophylaxis in surgeries linked to high rates of SSI (Class II Clean-contaminated or Class III Contaminated procedures) is undisputable and so SAP is absolutely justified for most of the surgeries in these two classes. The last category of wounds involves Dirty wounds which may be delayed traumatic wounds or those with excessive pus and potentially severely infected. Hence, therapeutic AMA and not prophylaxis is necessary for this class of wounds (Nestor, 2005). In our study, in spite of the fact that many of the procedures (40.5%) involved Class, I Clean wounds with no antimicrobial
Figure 1: Categories of surgical procedures in study population (N=400)

prophylaxis recommended (Bratzler et al., 2013), many of the patients undergoing these surgeries were prescribed antimicrobial prophylaxis. This may not be rational usage of AMAs.

The selection of AMAs for SAP depend not just on the type, site and duration of surgery but also on the health condition of the patient, co-morbidities and levels of contamination. In addition, a balanced decision has to be made considering the cost and morbidity due to the SAP versus the cost and morbidity with SSI. In our study, a good number of patients (86.5%) received at least one AMAs prophylactically during the hospital stay. Cephalosporins were the most preferred group along with Metronidazole. Among the Cephalosporins, Ceftriaxone (21.2%) and Cefuroxime (10.8%) were preferred in majority of surgeries. Similar selection of Cephalosporins were also encountered in other studies from the UAE (Khanem et al., 2012; Abu-Gharbieh and Fahmy, 2012). Cefuroxime was mainly recommended for patients
who underwent appendectomy and cholecystectomy 42.4%; (Hassan et al., 2015). Though not comparable to our study (as none of our patients underwent any cardiac surgeries), in another study involving SAP in cardiac surgeries in UAE, Cefuroxime was also administered in almost all the patients 89.1%; (Abu-Gharbieh and Fahmy, 2012). In another study exploring SAP in women undergoing cesarean sections at a tertiary care hospital in UAE, Cefuroxime was most commonly prescribed 79%; (Khanem et al., 2012). In other studies conducted in India (Takeyama et al., 2004), Nepal (Shah et al., 2011) and Malaysia (Oh et al., 2014), other Cephalosporins like Cefotaxime (44.46%), Ceftriaxone (29.5%) and Cefoperazone (63.2%) were the most frequently prescribed preoperative AMAs respectively.

According to guidelines, for most procedures, Cefazolin is the recommended drug for antimicrobial prophylaxis due to its proven efficacy, appropriate and desirable spectrum of activity against microbes commonly encountered in surgery, acceptable safety and favourable economics (Bratzler et al., 2013). Considering the frequent types of surgeries carried out on our patients such as ano-rectal surgeries, circumcision, appendectomy; caesarian sections and ENT procedures, Cefazolin would have been the most appropriate choice. However, majority of the patients were prescribed the alternatively recommended drugs like Ceftriaxone and Cefuroxime (Bratzler et al., 2013).

No Intraoperative AMA were administered to any of our patients as most of the surgeries were of short duration. Guidelines recommend that intraoperative redosing is necessary only if the surgical procedure duration exceeds two half-lives of the AMA or if excessive blood loss is encountered (Bratzler et al., 2013).

In this study, almost half of the study population (45.8%) was prescribed single AMA as SAP whereas 40.8% of patients received more than one AMA. Much higher rates of single AMA administration has been reported in the other studies: 89% (Abu-Gharbieh and Fahmy, 2012); 79% (Khanem et al., 2012) and 65% (Shah et al., 2011). A single therapeutic dose of recommended efficacious AMA is adequate for SAP in most situations. Hence, the use of single preoperative AMA in this study is compliant with most guidelines.

The majority of our patients (85.8%) were given preoperative AMAs through intravenous route, whereas the rest were given the drugs orally (14.2%). It is recommended that systemic SAP be given through the intravenous route as this results in rapid, dependable drug concentrations in serum and tissue and leads to consistent antimicrobial activity against common microorganisms causing SSI in most types of surgery (Bratzler et al., 2013). Hence the route of administration of SAP in our study is justifiable.

Regarding the postoperative use of AMAs, almost all our patients (91.5%) were prescribed AMAs on discharge. Other studies have reported varied rates of postoperative administration of AMAs. In the UAE, while only 27.4% had the SAP continued as treatment postoperatively (Hassan et al., 2015), a larger fraction (79.3%) had it continued in cardiac patients (Abu-Gharbieh and Fahmy, 2012). Analogous to our study, almost all Nepalese patients 97.5%; (Shah et al., 2011) were given AMAs postoperatively while in Malaysia, only 23% continued with their prophylactic AMAs (Oh et al., 2014).

Unlike the pattern of AMAs given prophylactically, Cefuroxime (23.2%), Metronidazole (20.7%) and Amoxicillin-Clavulanic acid combination (17.7%) were most frequently prescribed. Similar choice of postoperative AMA was also reported from the study in UAE (Abu-Gharbieh and Fahmy, 2012) where Cefuroxime was continued for 79.3% of the patients. Other studies also reported the predominant use of Cephalosporins like Ceftriaxone 42%; (Takeyama et al., 2004) and Cefixime 42%; (Shah et al., 2011).

In our study, the majority of the study population (65%) was prescribed single AMA postoperatively whereas 26.5% patients received more than one AMA. Both higher 79.3% (Abu-Gharbieh and Fahmy, 2012) and lower 30.5% (Shah et al., 2011) rates of single AMA administration have been reported in the other studies. As simultaneous use of multiple AMAs may result in negative patient outcomes, enhanced chances of antimicrobial resistance and escalated healthcare costs (Corsonello et al., 2015), the selection of single AMA for most of our patients is quite justified.

The average duration of postoperative AMA prescription was 6.4 days which is almost comparable to that in Nepalese patients 7.13 days; (Shah et al., 2011). Though the briefest duration of AMA prescription for warding off SSI is not documented, but most studies have concluded that the duration of SAP should be restricted to less than 24 hours as prolonged prophylaxis was unsuccessful in reducing SSIs rates (Kriaras, 2000). Moreover, prolonged postoperative continuation of AMAs may in fact be detrimental to the patient due to colonization with resistant species (Harbarth et al., 2000). Guidelines for SAP recommend the discontinuation of
the AMA prophylaxis postoperatively for most surgeries except for conditions where severe infection is already present (such as in Class IV Dirty surgeries) and the prolongation of AMA use beyond the perioperative period is considered as therapeutic intervention. Therefore, any use of postoperative AMAs, as in our study, is noncompliant with SAP guidelines. In spite of published evidence not recommending it, the prolonged use of AMA postoperatively is commonly practised. It is not just imperative that the infectious complications of surgical procedures be controlled but prudence dictates that the excessive use of unnecessary antibiotics be also curtailed.

Regarding the route of administration of the AMAs prescribed postoperatively, almost all were recommended orally for the convenience of our patients. In other studies, patients were administered the AMAs through both IV and oral route 60%; (Shah et al., 2011) or the IV route 100%; (Takeyama et al., 2004).

In our study, Metronidazole was usually combined with Ceftriaxone or with Ciprofloxacin/Amoxicillin – clavulanic acid preoperatively and at discharge respectively. However, in the study by (Hassan et al., 2015) and (Abu-Gharbieh and Fahmy, 2012) it was given in combination with Cefuroxime to 18.8% and 1% patients respectively preoperatively. The combination of Metronidazole with other AMAs was not used postoperatively in these studies.

Mild adverse drug reactions were encountered which did not pose any serious health risk to the patients. Nearly one-fourth of our patients complained of ADRs and a small percentage (0.6%) exhibited hypersensitivity and thrombophlebitis which were managed with appropriate drugs. Most ADRs reported were GIT related which were neither severe nor serious.

Prolonged prophylactic use of antibiotics encourages development of bacterial resistance and antibiotic-associated adverse drug reactions. Regular update of the antibiograms with organism-specific susceptibility data will be helpful to optimize the prescription of AMA. The antibiotic should be used only in case of high risk of contamination or to limit spread of infection based on the sensitivity report. The empirical use of broad spectrum/4th generation AMAs may result in multidrug resistance. A strict adherence to SAP guidelines and infection control policy in the hospital can minimize the use of AMAs during the recovery period, reduce the incidences of SSI and subsequent antimicrobial resistance (Dellit, 2007; Al-Momany et al., 2009). Evaluating the practicability, suitability and acceptance of SAP guidelines among the stakeholders (the surgeons and patients) is the key aspect of successful implementation of the guidelines. The results of our study might enlighten our institutional antimicrobial stewardship program team about the current adherence to SAP guidelines and the endorsement of the same by our surgeons. Proactive interventions focusing on the surgical team like formal educational sessions on antimicrobial stewardship, consistent auditing and regular updates about current SAP guidelines are the need of the hour. We also advocate future studies assessing the impact of these interventions to further improve the rational use of AMAs in our hospital.

The strength of our study was the prospective nature of the study design and inclusion of data from most surgical departments in our hospital. Our results could lead to positive changes in the adherence to SAP guidelines by surgeons and a more robust antibiotics stewardship program. The exclusion of the assessment of exact timing of dose of AMA before surgical incision, the small sample size, the absence of AMA resistance rates and inability to generalize results of the study are our major limitations.

CONCLUSIONS

Our study showed that the usage pattern of AMA in surgical patients in Thumbay hospital was appropriate in majority of situations and fairly consistent with current international antimicrobial prophylaxis guidelines. It also highlighted areas for future interventions to improve the rational utilization of antimicrobials in our setting. Proactive interventions focusing on the surgical team like formal educational sessions on antimicrobial stewardship, consistent auditing and regular updates about current SAP guidelines are the need of the hour.

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