How Good is Compliance with Surgical Antibiotic Prophylaxis Guidelines in Erbil/ Iraq?

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Abstract—Background: Clinical confirmation firmly established the efficacy of antibiotic prophylaxis in preventing surgical site infection. However excessive or incorrect antibiotic use increases costs and favours the emergence of antibiotic resistance. Several guidelines for antibiotic prophylaxis in surgery have been published.

Objectives: The aim of this study is to assess the degree of adherence to the recommendations of antibiotic prophylaxis guidelines practice in general surgery procedures performed at Rizgary teaching hospital in Erbil, Iraq.

Patients and methods: A total of 1387 consecutive general surgical procedures performed at Rizgary teaching hospital in a period of 6 month were observed. Questionnaires concerning demographic data, types of surgery and parameters of antibiotic prophylaxis (antibiotic choice, route, dose, timing of first dose, timing of operative redosing and duration of prophylaxis) were completed.

Results: Out of 1387 patients, 703 (50.7%) underwent a clean and 684 (49.3%) underwent a clean-contaminated surgical operation. Although, 960 (69.2%) of procedures required prophylaxis, it was administered only in 149 (15.5%). It was inappropriately administered in 26 (6.1%) of 427 procedures in whom prophylaxis was not indicated. It was revealed that 123 (82.6%) out of 149 administered in 26 (6.1%) of 427 procedures in whom prophylaxis was only administered in 149 (15.5%). It was inappropriately administered in 26 (6.1%) of 427 procedures in whom prophylaxis was administered only in 149 (15.5%).

Unfortunately, adherence to guidelines is often poor. Many quality-improvement projects have identified errors in the administration of antibiotic prophylaxis before surgery as an independent risk factor for some postoperative infections. Improvements in the timing of initial administration, the appropriate choice of antibiotic agents, and shorter durations of administration have more clearly defined the value of this technique in reducing postoperative SSIs. Several guidelines for antibiotic prophylaxis in surgery have been published. The aim of which is to provide guidance on the rational use of antibiotics, so that they serve effectively and efficiently with the least adverse effects on patients and community, and that resistance of microorganisms could be minimized. Unfortunately, adherence to guidelines is often poor.

The purpose of this study was to assess the adherence of general surgeons to major aspects of surgical prophylaxis in a large hospital in Erbil city, Kurdistan, Iraq. These measures were (1) the proportion of patients who have parenteral antibiotic prophylaxis initiated within 1 hour before the surgical incision, (2) the proportion of patients who are provided a prophylactic antibiotic agent that is consistent with currently published guidelines, and (3) the proportion of patients whose prophylactic antibiotic therapy is discontinued within 24 hours after the end of surgery.

Keywords----Surgery, Antibiotic prophylaxis, Compliance.

I. INTRODUCTION

Surgical site infections (SSIs) are the second most common type of nosocomial infections [1]. Up to 2% to 5% of patients undergoing clean extraabdominal operations and up to 20% of patients undergoing intra-abdominal operations will develop an SSI [2].

Clinical confirmation firmly established the efficacy of perioperative antibiotic prophylaxis (PAP) in preventing wound infection [3-7]. Optimal prophylaxis ensures that adequate concentrations of an appropriate antimicrobial are present in the serum, tissue and wound during the entire time that the incision is open and at risk of bacterial contamination [2-4,6].

Many quality-improvement projects have identified errors in the administration of antibiotic prophylaxis before surgery as an independent risk factor for some postoperative infections [1]. Improvements in the timing of initial administration, the appropriate choice of antibiotic agents, and shorter durations of administration have more clearly defined the value of this technique in reducing postoperative SSIs [8]. Several guidelines for antibiotic prophylaxis in surgery have been published [3]. The aim of which is to provide guidance on the rational use of antibiotics, so that they serve effectively and efficiently with the least adverse effects on patients and community, and that resistance of microorganisms could be minimized [9]. Unfortunately, adherence to guidelines is often poor [10].

The purpose of this study was to assess the adherence of general surgeons to major aspects of surgical prophylaxis in a large hospital in Erbil city, Kurdistan, Iraq. These measures were (1) the proportion of patients who have parenteral antibiotic prophylaxis initiated within 1 hour before the surgical incision, (2) the proportion of patients who are provided a prophylactic antibiotic agent that is consistent with currently published guidelines, and (3) the proportion of patients whose prophylactic antibiotic therapy is discontinued within 24 hours after the end of surgery.

II. PATIENTS AND METHODS

This prospective study was performed in the department of general surgery in Rizgary teaching hospital in Erbil city, Kurdistan, Iraq, from September 2009 to March 2010. Rizgary teaching hospital is one of the major hospitals in Erbil- Iraq. The hospital is composed of 493 beds, in which nearly all medical specialties are available (with 105 specialists) in addition to administrative and allied services. There are 12 operating room complexes, monthly average statistics revealed 2002 admissions and 911 operative procedures (around 162 major, 641 median and 108 minor surgical operations).

A total of 1387 consecutive surgical procedures were...
observed by the investigator without the knowledge of the surgeons, anaesthetists or other operation theatre staff. An ‘operation’ was defined as any procedure involving skin incision, undertaken in an operation theatre under anaesthesia. The criteria for inclusion were: elective clean and clean-contaminated surgical operations (including patients with non-perforated or non-gangrenous appendicitis) according to the classification of the National Academy of Sciences–National Research Council criteria [4].

Patients were excluded from the study if they were operated on urgently and if their operations were done under local anaesthesia because of lack of adequate information on medical records (out of 1590 procedures, 203 were excluded). The operations were performed by 18 surgeons during the period of 6 months.

The study was conducted on a real-time basis. Medical records were reviewed while the patients were in the post-operative period. The collection of data for every patient was obtained using pre-coded questionnaires. The questionnaire included personal data (name; age; gender and file numbers), the type and the length of the procedure, type of anaesthesia and details about using antibiotic before surgery for prophylaxis. The following aspects of surgical prophylaxis were examined: the antibiotic agent, the route of administration, the dosage, the timing of administration, the timing of re-dosing and the duration of prophylaxis. The investigator did not intervene in decision making for surgical antibiotic prophylaxis in any way.

There was no standard protocol in the wards or in the operating room, specifying antibiotic agents for certain procedures, based on the interpretation of the guidelines. The recommendations for antibiotic prophylaxis guideline based on several published guidelines, was used as a benchmark for analysing compliance and appropriateness of antibiotic prophylaxis in the cases where used prophylaxis. The courses of antibiotic agents were evaluated. If more than one drug was prescribed for a single operation, all parameters for each drug were evaluated separately. If an antibiotic agent was given while it was not indicated, the parameters such as antibiotic choice, dose, duration, dosing interval and timing were also evaluated. Compliance with the recommendations of the prophylactic surgical antibiotic guidelines was assessed for every aspect of antibiotic prophylaxis. This recommendation for antibiotic prophylaxis guideline is detailed below is based on several published guidelines [7,9,11].

- **Indication:** clean operations: laparoscopic or non-laparoscopic herniorrhaphy with mesh, laparoscopic or non-laparoscopic herniorrhaphy without mesh, breast and thyroid.
- **Clean-contaminated operations:** colorectum, non-complicated appendicectomy (infected), open biliary, open cholecystectomy, laparoscopic cholecystectomy, gastroduodenal, intestinal and PNS excision.
- **Choice:** Spectrum appropriate to the operative site (i.e., staphylococcal coverage for clean operations and gram-negative/anaerobic coverage for bowel procedures).
- **Timing:** All doses must be given within 1 hour prior to surgical incision but preferably just before the induction of anaesthesia (except for Vancomycin should be given within 2 hours prior to surgical incision).
- **Dose:** The initial antibiotic dose should be adjusted based on the patient’s body weight, adjusted dosing weight or body mass index.
- **Operative redosing:** If duration of surgical procedure is >3 hours, patient should receive additional prophylactic dose intraoperatively (at one to two half-lives of the antibiotic is recommended for the duration of the procedure).
- **Duration:** The duration of antibiotic prophylaxis should not be longer than 24 hours after the end of surgery.
- **Data:** Data were entered in a database, and analyzed using the Microsoft Excel 2007. Compliance with the recommendations of the prophylactic surgical antibiotic guidelines was assessed for every aspect of antibiotic prophylaxis.

III. **Results**

Patients ranged in age from 1 to 80 years, with a mean age of 34 years. More than half of the patients 754 (54.4%) were women. All the procedures were elective, of these 703 (50.7%) were clean surgical operations, while 684 (49.3%) were clean-contaminated. Inguinal hernia repair and laparoscopic (Lap) cholecystectomy were the commonest operations in each category respectively Table I.

A total of 175 doses of antibiotics were administered for the 1387 procedures, 149 doses in procedures were PAP was indicated and 26 doses in procedures were PAP was not an indication according to the guidelines. For the procedures were PAP was indicated (n=960), only 149 (15.5%) patients received it, 57 (12%) in the clean operations category and a slightly better practice was seen in the clean-contaminated procedures where 92 (19.2%) received prophylaxis Fig. 1.

We found that antibiotic(s) were administered inappropriately for 26 (6.1%) of 427 procedures for which antibiotic prophylaxis was not indicated Fig. 2, 13 (5.9%) of the clean and 13 (6.3%) of the clean-contaminated procedures received antibiotics in the operation room.

Ceftriaxon 1 gram has been used as PAP in 147 procedures, it was combined with Metronedazole 500mg in a patient who underwent colorectal surgery and Ampiclox® (Ampicilline 500mg + Cloxacilinne 500mg) was used in one patient. Weight of patients was not used for calculating the dose of antibiotics in any of the procedures.

For 123 (82.6%) out of 149 patients where PAP used, prophylaxis was started within the induction of anaesthesia, and for 26 (17.4%) patients, prophylaxis was started after the induction of anaesthesia (after skin incision). All the doses were administered intravenously. The duration of prophylaxis was more than 24 hours for all procedures. Second dose (redosing) was not given for nine procedures in which the time of operation was more than three hours.
Hundred percent compliance with all recommendations (in terms of indications, choice, timing, dose, route, redosing and duration) were not achieved for any study patient (0%).

IV. DISCUSSION

The evidence for effectiveness of perioperative antibiotic prophylaxis is well established [2]. Several studies assessing compliance with surgical prophylaxis guidelines in hospitals worldwide have been published [4]. Up to our knowledge this is the first study from Iraq assessing compliance with surgical antibiotic prophylaxis. The findings are accurate and valid as this was a prospective study under direct observation.

The hospital’s supply of available antibiotics has been previously reported to have an important effect on choice of antibiotic for prophylaxis [12]. Appropriate prophylactic agent used in RTH was only 1.3% whereas in India it was 68% [4], Iran 5.9% [5], Jordan 1.7% [13] Turkey 68% [14], India, and Netherlands 92% [15]. In our study, third-generation cephalosporin (Ceftriaxone) was the most popular prophylactic agents used, even though first-generation and second-generation cephalosporins have been recommended as first-line choices in all published guidelines [14]. Third-generation cephalosporins and fluoroquinolones should not be used for SSI prophylaxis because they have less activity against staphylococci than does cefazolin, their use induces the emergence of resistant organisms, and they cost more [5,14,16].

We found that antibiotic(s) were administered inappropriately for 6.1% of procedures for which antibiotic prophylaxis was not indicated. For e.g. inn anal and perianal procedures 13 patients received antibiotics in the operation room. The low incidence of postoperative fever implies a relatively low rate of bacteremia, and so it could refute the use of antibiotic prophylaxis in prevention of post-hemorroidectomy infection, where antibiotic prophylaxis is not prescribed [17].

In this study, appropriate decision making regarding use or nonuse of antibiotics was only 15.5% compared to other countries from 91 to 100% [2,4,5,13-15], probably this is due to lack of a protocol for antibiotic prophylaxis in surgery in our hospital. Several studies have indicated that guidelines can improve the quality of antibiotic use and therefore the quality of patient care [14,18]. An example is Amphia hospital in Netherlands, There were statistically significant improvements 2 months after the implementation of guidelines considering both dosing and timing and the costs of PAP were reduced [15].

A considerable amount of misuse of antibiotics and prolonged duration was apparent. No patients were weigh for decision of antibiotic dosing, thus under or over dose have been used. All patients were discharged on antibiotics (mainly oral) for more than 24 hours after the end of surgery. Appropriate duration of prophylaxis in our study was not achieved at all; while it was 36.3% in Greece [2] India 63% [4], 5.8% Iran [5], Jordan 39.4% [13]Turkey 20% [14], and Netherlands 82% [15]. Thus, antibiotic prophylaxis was overused, and prophylaxis was not discontinued within 24 hours after surgery. The majority of published evidence demonstrates that antibiotic prophylaxis after wound closure is unnecessary, and most studies comparing single-dose prophylaxis with multiple-dose prophylaxis have not shown benefits of additional doses [3,19]. Prolonged use of prophylactic antibiotics is associated with emergence of resistant bacterial strains [2-5,7]. Most of the published guidelines recommend discontinuing prophylaxis within 24-48 hours [3,20].

For 82.6% of patients that received PAP, prophylaxis was started within the induction of anesthesia (timing) compared to that in Greece 100% [2] India 89% [4], Iran 40.7% [5], Jordan 99.1% [13], Turkey 61% [14], and Netherlands 50% [15]. For effective antibiotic prophylaxis, adequate concentrations of the drug must be present in the tissues at the onset and throughout the operative procedure [2,4,6,14,19,21]. To achieve this goal, the initial dose should be administered parenterally immediately before the operation. Incorrect timing of surgical prophylaxis is associated with increases by a factor of two to six in the rates of surgical-site infection for operative procedures in which prophylaxis is generally recommended [1,10,19]. The timing of administration of antibiotic in most studies was more satisfactory than other criteria [4] (commensurate with what was seen in our study).

The rate of infection increases when the duration of surgery exceeds three hours [20]. Therefore, additional courses of antibiotics are recommended if the surgery is prolonged for more than 3 hours or if the duration of the procedure is longer than twice the antibiotic’s half-life. However, no patients received additional courses of antibiotics during surgery in our study, although 9 (1.05%) patients underwent surgeries lasting more than three hours.

Compliance with all recommendations was not achieved for any study patient 0%. Several studies assessing compliance with surgical prophylaxis guidelines in hospitals worldwide have been published [4,5,14,20]. Overall compliance to guidelines has varied from as low as 0 to as high as 53%, usually in the range of 20–30% [4].

Barriers towards implementation of surgical prophylaxis guidelines have been studied and identified as lack of awareness, non-accountability, perception of guidelines as bureaucratic rather than education tools or perception of guidelines as cookbook medicine rather than allowing oneself to make one’s own medical decisions [22]. Another major reason for non-compliance is the false belief that high-end/multiple antibiotics and prolonged therapy will be more effective in preventing SSI as compared to short duration of narrow spectrum antibiotics [4].

Given the high frequency of antibiotics being prescribed for surgical prophylaxis in Erbil when not needed, adherence to standardized guidelines for surgical prophylaxis is urgently needed. A national guideline for surgical prophylaxis would be useful for improving local consensus regarding guidelines
and increasing the quality of antibiotic use. Prescribing practice is complex. There are many factors that affect physicians’ compliance with guideline recommendations, including cultural factors, educational background, training, nurse and pharmacist influences, medication supply, and logistics [5,18]. These factors were not investigated in this study. It is a good plan to design an evidence-based guideline that takes local conditions into account, as well as perform an interventional study to improve patient safety and decrease direct costs in the administration of antibiotic prophylaxis to prevent SSI in Erbil.

REFERENCES


### TABLE I

| TYPES AND PROPORTION OF PROCEDURES THAT RECEIVED PAP |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Clean Inguinal hernia repair | Total 197 | n 15 (7.6) | Clean contaminated Lap cholecystectomy 227 | Total 69 (24.9) |
| Clean Breast surgery | Total 127 | n 18 (14.2) | Clean contaminated PNS excision 101 | Total 9 (8.9) |
| Clean Umbilical &PUH repair | Total 83 | n 8 (9.6) | Clean contaminated Open cholecystectomy 32 | Total 0 (0) |
| Clean Thyroidectomy | Total 61 | n 12 (19.7) | Clean contaminated Appendectomy 29 | Total 2 (6.9) |
| Clean Mastectomy | Total 6 | n 4 (66.7) | Clean contaminated Colorectal surgery 10 | Total 3 (30) |
| Clean Post-op hernia repair | Total 3 | n 0 (0) | Clean contaminated Gastric surgery 9 | Total 1 (11.1) |
| Clean Hiatus hernia repair | Total 2 | n 0 (0) | Clean contaminated Liver surgery 9 | Total 3 (33.3) |
| Clean Splenectomy | Total 2 | n 0 (0) | Clean contaminated Diagnostic lap 7 | Total 3 (42.9) |
| Total | Total 481 | n 57 (12) | Total 1 (33.3) |
| Total 479 | 92 (19.2) |

n: number of patients that received antibiotics. Lap: laparoscopic, Post-op: postoperative, PUH: para-umbilical hernia, PNS: Pilonidal sinus
Fig. 1 Proportion of procedures that received PAP

<table>
<thead>
<tr>
<th></th>
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<tbody>
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<td>Clean</td>
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<td>424</td>
</tr>
<tr>
<td>Clean contaminated</td>
<td>92</td>
<td>387</td>
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<tr>
<td>Total</td>
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<td>811</td>
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Fig. 2 Proportion of procedures that received antibiotics in which PAP was not indicated

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<th>No PAP</th>
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<tbody>
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<td>209</td>
</tr>
<tr>
<td>Clean contaminated</td>
<td>13</td>
<td>192</td>
</tr>
<tr>
<td>Total</td>
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