Original Article

Surgical Antibiotic Prophylaxis: Adherence to hospital's guidelines

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Abstract

Aim: This study was designed to assess the compliance to local hospital guidelines for antimicrobial prophylaxis in general surgery in terms of the appropriateness of prophylactic antibiotic indication, the choice of antibiotic, the dose administered, the time of administration and the duration of prophylaxis.

Method: Data regarding antibiotic prophylaxis was collected from the patients' records and compared to the local guidelines. The overall percentage adherence was then calculated, as well as the percentage of correct antibiotic, dose, administration and duration.

Findings: A total of 110 cases, which included patients undergoing general surgery procedures, were assessed from 6 surgical wards. From the total, only 9.3% were found to be completely adherent to local guidelines. In 24.4% of the cases, correct use of antibiotics, dose and route of administration was observed, while correct duration of prophylaxis was recorded in 9.3% of the cases.

Conclusion: Antibiotic prophylaxis is an effective and cost-efficient way of avoiding surgical skin infections; hence hospitals should ensure appropriate use of antibiotic prophylaxis.

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Keywords

antibiotic prophylaxis; general surgery; guideline adherence

Introduction

Antibiotic prophylaxis refers to the administration of a brief course of antimicrobial therapy to prevent infection complications following surgery. The incidence of surgical wound infection is reduced when antibiotic prophylaxis is administered appropriately. Prophylaxis is normally recommended for all clean-contaminated, contaminated and dirty procedures. For clean procedures, it may be considered for certain patients and surgeries that meet specific risk criteria.[1]

The European Centre for disease prevention and control (ECDC), in a paper entitled 'Systemic review and evidence-based guidance on peri-operative antibiotic prophylaxis', identifies 5 key Perioperative Antibiotic Prophylaxis (PAP) modalities. These refer to effective measures to improve the compliance of healthcare professionals with appropriate administration, timing, dosage and duration of PAP, preventing surgical skin infections (SSIs), and include:

1. Establishing a multidisciplinary anti-microbial team to develop and implement protocol of appropriate PAP.
2. To ensure appropriate timing, the anaesthesiologist should be responsible of PAP.
3. Efficacy is greatly affected by the timing of antibiotic administration. Ideally, the first dose should be administered less than 60 minutes before surgical incision (usually in anaesthetic room at induction of anaesthesia).
4. If the duration of the procedure exceeds one to two half-lives of the antibiotic or there is extensive blood loss intra-operatively, re-administration is recommended.
5. Generally, post-operative administration is not indicated.[2]

The antibiotic chosen should be a narrow-spectrum agent(s) that targets the organism(s) most commonly causing wound infection in the concerned procedure. If two drugs are of otherwise equal spectrum, efficacy and toxicity, the less expensive drug should be chosen. Drugs that are likely to be used in the treatment of severe sepsis should be avoided to prevent development of resistance. [3]

The general indication for surgical prophylaxis is a single dose, except in cases involving potentially high contamination such as large bowel intervention and the insertion of prostheses. The duration of PAP should not exceed 24 hours after the end of surgery.[3]

Surgical skin infections not only have an enormous impact on the patients' quality of life but also on the financial cost of patient care.[1-2]

Method

The audit was conducted over a period of 4 weeks from 17th August 2015 – 14th September 2015, and looked at elective and emergency General Surgery procedures carried out in the principal General Hospital of Malta – Mater Dei Hospital.

The audit reviewed medical, anaesthetic and nursing records, as well as medication charts, and. antibiotic prescriptions were then compared with the local hospital guidelines on antibiotic choice, duration of prophylaxis, dose, dosing interval and timing of the first dose. The latter local guidelines for antimicrobial surgical prophylaxis, were approved and issued by the Infection Control Committee, at Mater Dei Hospital.

Data was obtained from the general surgical wards (S1, S2, S4, S5, SAU) and Day Care Unit. At the outset, the outline of the study and protocol was first shown to and accepted by theNursing Officer in charge of each ward. A list of post-operative patients was obtained and data obtained from these patients' files.

Outcome measures:

The main outcome measures of this study were:

- The appropriateness of prophylactic antibiotic indication
- Choice of antibiotic
- Dose administered
- Time of administration
- Duration of prophylaxis

Audit Measurement tool

The data was recorded under three headings as shown in table 1.

Method of Analysis

The collected data was analysed using the flow chart in figure 1.

All the patients who were already on antibiotic treatment prior to surgery were excluded. The remaining patients where then subdivided into two groups, according to whether antibiotic prophylaxis was recommended or not and, if not, whether antibiotics were administered anyway.
Where recommended, patients were subdivided according to whether antibiotics were given or not, and subsequently on the appropriateness of choice, dose, route of administration, timing and duration of prophylaxis.

The data was then inputted in a database, where surgeons were given a code (1-14) in order to ensure anonymity. Codes were also used for the wound classes (see table 1 above) (1-4) and for the rest of the variables, 1 was taken toindicate yes and 0 indicated no.

The percentage of patients in each category was calculated using the following formula:

$$\frac{Number\ of\ patients\ in\ (X)\ category}{Total\ number\ of patients}\ X\ 100 = \%$$

Results

A total of 110 patients were collected from a total of six surgical wards. A list of the procedures carried out is shown in table 2.

13 patients were excluded from this audit as they were on antibiotic treatment prior to surgery. The remaining cases were divided into two categories, namely 'prophylaxis recommended' and 'not recommended'. The results are depicted in figure 2.

Out of the 88 cases in which antibiotic prophylaxis was recommended, 2 cases were excluded from table 3, as antibiotics were not given.

Assessment of individual parameters:

Indication

In concordance with the local guidelines, antibiotic prophylaxis was indicated in 88 cases but was given in 86 cases (97.7%).

Table 1: *Data recorded*

Patient specific details:
Name and Surname
Gender
Age
ID number
Date of admission
Admitting consultant
Admission ward and bed number
Patient coming from: Home/ Institution/ Unknown
Medical Information:
Procedure carried out
Date of operation
Surgeon carrying out procedure
Wound class (clean, 1; clean-contaminated, 2; contaminated, 3; dirty, 4)
Status of surgery (elective or emergency)
Previous history of MRSA or CRE (carbapenem-resistant enterobacteriaceae)
Co-morbidities (diabetes, COPD, CHF, corticosteroid use, blood transfusions, drains)
ASA class
Smoker
Any surgical complications
Procedure specific prophylaxis:
Generic name
Administered dose
Route of administration
Time of administration
Duration of antibiotic prophylaxis
Time the agent was discontinued
Appropriateness of prophylaxis

Figure 1: *The flow chart used as method of analysis*

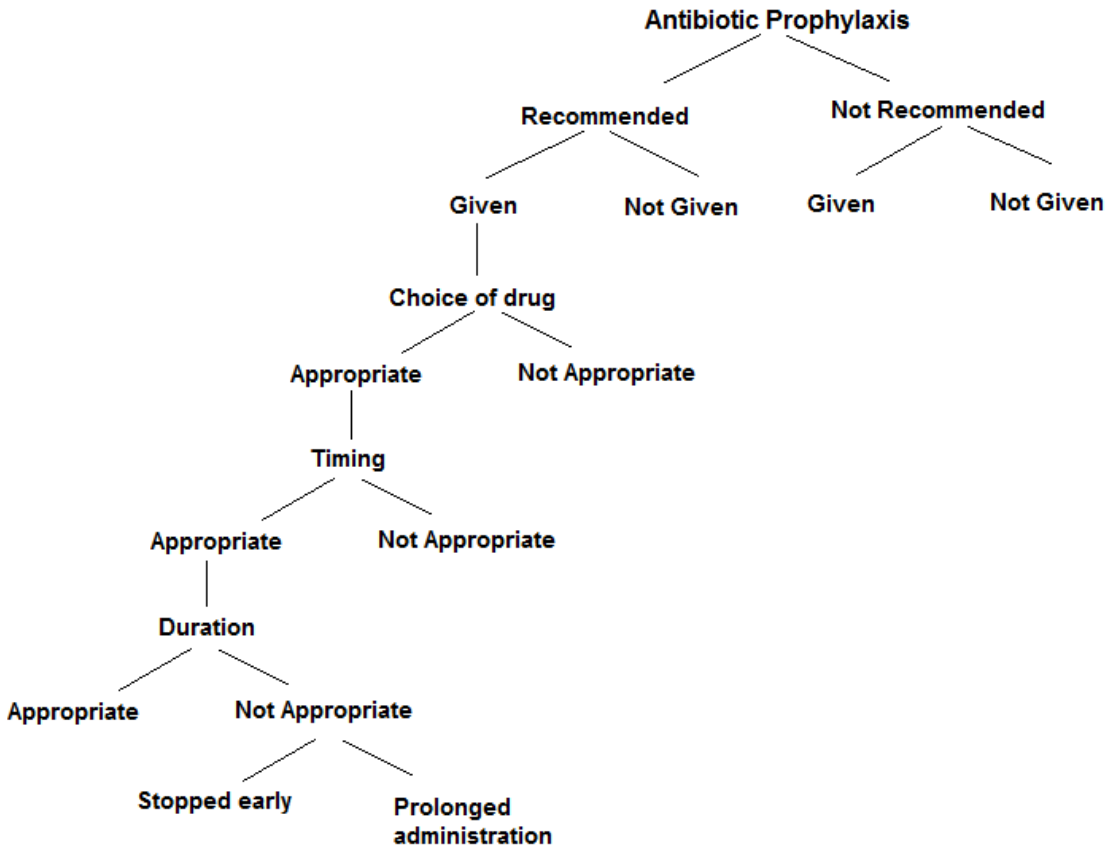


Table 2: *Types of procedures studied*

Type of procedure	**ICD-9 codes**	**Number of patients**
Abdominal surgery (non-gastrointestinal)	41.5, 52.0, 52.1, 53.0, 53.1, 53.29, 53.51, 53.69, 54.11, 54.19, 54.3	31
Upper gastrointestinal surgery (oesophageal, stomach, duodenal, small intestine)	42.40, 43.5, 44.39, 44.41, 45.6, 45.62, 46.01, 46.42, 46.51	19
Hepatobiliary surgery	41.5, 51.22, 51.23, 51.24, 52.6	6
Lower gastrointestinal surgery (appendicectomy and colorectal)	17.35, 17.36, 17.39, 45.73, 45.81, 47.0, 47.01, 48.52, 48.62, 48.69, 49.0	44
Skin and other clean procedures (breast and endocrine)	06.4, 07.3, 85.45, 86.01, 86.04, 86.11	11

Figure 2: *Recommended cases of perioperative antibiotic prophylaxis*

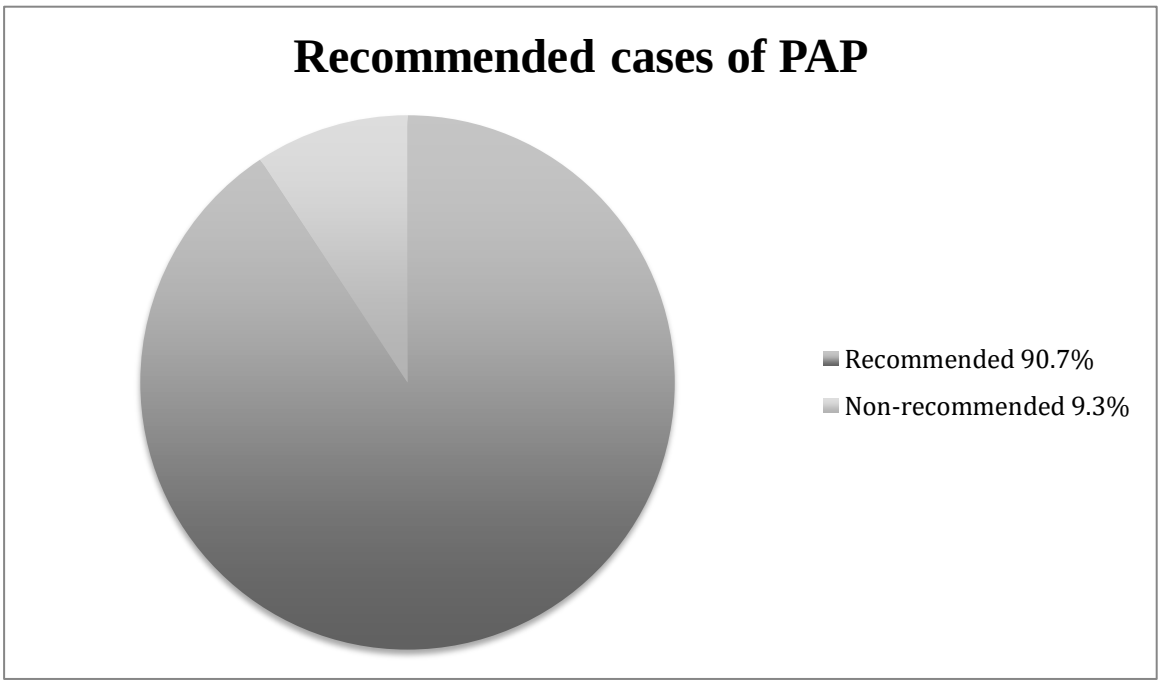


Table 3: *Number of patients and percentage adherent to each individual parameter*

Parameter	Number of patients	% Recommended
Correct antibiotic	21	24.4 %
Correct dose	21	24.4 %
Correct administration (route)	21	24.4 %
Correct duration(<24hours)	8	09.3 %

Antibiotic choice

The correct choice of antibiotic was given in 24.4% of cases (*n*=22). In the majority of cases where the choice was incorrect, it was due to an inappropriate combination of antibiotics. The most common example of this was the use of metronidazole and ciprofloxacin instead of metronidazole and gentamicin in gastrointestinal surgery. Also, discordance was noted in cases of appendicectomy where, in the majority, co-amoxiclav was prescribed instead of metronidazole and gentamicin.

Table 4 shows the combination of antibiotics used.

Duration of antibiotics

Perioperative antibiotic prophylaxis is generally indicated for less than 24 hours and in cases where antibiotics were given for more than 24 hours, the duration was considered inappropriate. The duration was appropriate in 9.3% of cases studied.

Timing

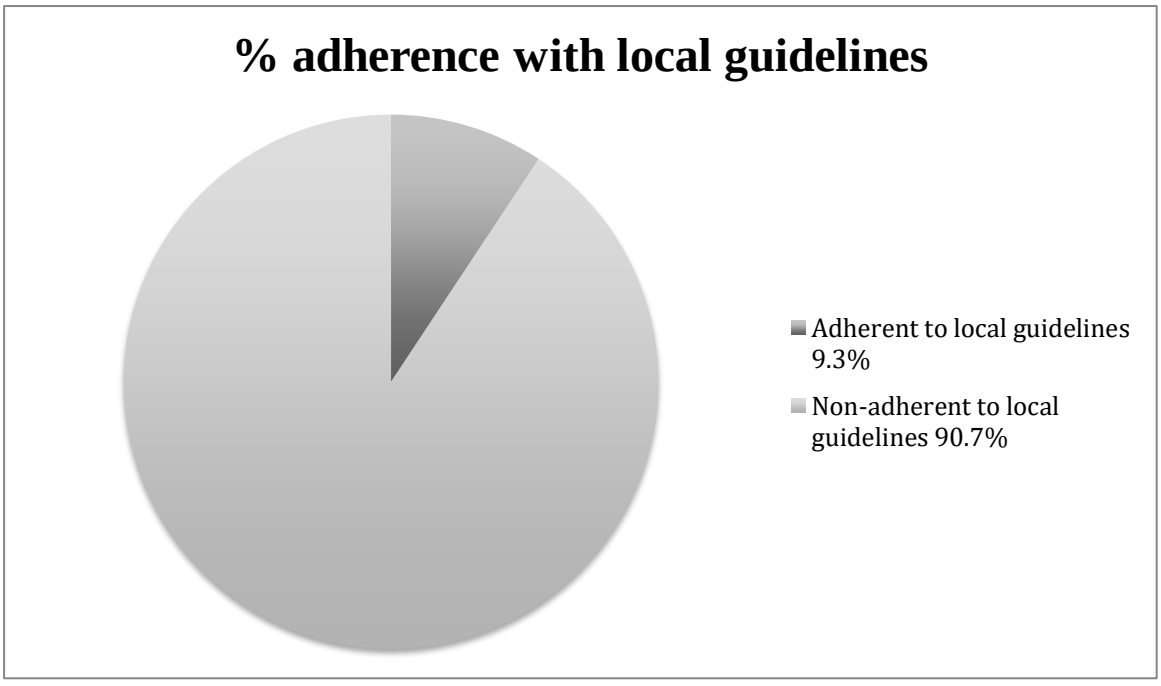
The percentage of correct timing of PAP could not be calculated accurately, as the exact timing was not documented in case files.

Adherence to the local guidelines including the correct bundle of antibiotic choice, dose, administration, timing and duration was observed in a total number of only 8 cases out of 86 (9.3%). This is shown in figure 3.

Table 4: *Combinations of antibiotics used and their frequency of use*

Combinations	Frequency used
Co-amoxiclav	24
Metronidazole + Gentamicin	18
Ciprofloxacin + Metronidazole	16
Ciprofloxacin	7
Flucloxacillin	7
Piperacillin/ Tazobactam	6
Metronidazole + Cefuroxime	4
Metronidazole	2
Ciprofloxacin + Co-amoxiclav	1
Ciprofloxacin + Gentamicin + Metronidazole	1
Ciprofloxacin + Metronidazole + Co-amoxiclav	1
Co-amoxiclav + Gentamicin + Metronidazole	1
Gentamicin + Flucloxacillin	1
Gentamicin + Teicoplanin	1
Metronidazole + Piperacillin/ Tazobactam	1
Piperacillin/ Tazobactam + Phenoxymethylpenicillin	1

Figure 3: *Percentage adherence with local guidelines*



Discussion

Comparison of this study with international studies on antibiotic prophylaxis

Numerous studies from other countries have shown a wide variation of adherence to antibiotic prophylaxis. The overall compliance in the majority of these studies was less than 50%. [4] In a multicentre audit in 13 Dutch hospitals, 1763 procedures were considered, out of which 28% (*n*=493) had full adherence to the local guidelines. In this study the parameters that needed most improvement were the dose interval (57%; *n*=457) and timing (50%; *n*=810). On the other hand, antibiotic choice was correct in 92% (*n*=1621) of cases in contrast to 24.4% (*n*=22) achieved in our audit. This Dutch study by van Kasteren et al was more comprehensive, as multiple hospitals were included, a large number of procedures were studied and local guidelines were used as a point of reference as opposed to the majority of other studies that used international guidelines. However, this study is not the ideal comparison with our audit as it included other procedures apart from General Surgery. [5]

Obstacles that prevent the implementation of adequate PAP

The main barriers to adherence with recommended guidelines include lack of awareness of the latest version of the guidelines and lack of consensus or disagreement with the guidelines. Also there is a misconception amongst surgeons that multiple antibiotics or prolonged therapy are more effective in the prevention of surgical wound infections.[4]

Lack of communication between different staff members, inappropriate hand-over from the theatre to the wards regarding the duration of PAP, illegible handwriting and inappropriate documentation in the patient's notes are also major barriers to adherence with guidelines.[6]

Improvements

There are various ways to improve on the poor compliance observed in this study. Enforcing checklists prior to the operation will ensure optimal timing of antibiotic prophylaxis. Theatre nurses can be assigned this task before the start of the surgery.[2]

Personalised surgical antibiotic kits can be prepared by the hospital's pharmacy to be used for elective surgeries. These should include the appropriate combination and dose of antibiotics depending on the surgery. However, this would not apply in emergency situations or where there are contraindications such as allergies to the antibiotics. The PAP protocol should take into account individual patient factors like BMI, underlying diseases or colonisation with resistant pathogens.

Lack of awareness can be improved by offering continuous training and education to surgeons, anaesthesiologists and nursing staff to familiarise themselves with updated guidelines. [2] Also guidelines should be made easily accessible both electronically and in theatres as notices.[6] Time should be given to the health care professionals to adapt to newly updated versions of the guidelines.[5] It is important to test the feasibility and acceptance of clinical guidelines among the target group before implementation, in order to avoid lack of consensus and disagreement.[5]

Clear instructions regarding the duration (i.e. number of doses) of PAP should be included in the operation report sheet, as well as the treatment chart. Also standardised pre-printed order forms can be implemented to guarantee appropriate PAP administration.[7]

Guidelines should be set up by a multidisciplinary team including a medical officer, clinical microbiologist and a clinical pharmacist. This team should be available for consultation when required by the surgeons. [4] This would be particularly effective as surveys show that the majority of surgeons base their decisions on discussions with colleagues more than other sources of information.[8]

The advantage of using local over international guidelines is that these take into account local resistant bacterial strains and thus are more effective in preventing infection and complications.[3] Studies have also shown that there is a higher rate of adherence to local guidelines as opposed to international ones.[6]

Limitations of this audit

The results presented in this study may not be indicative of surgeons' compliance to the local guidelines as a limited number of cases were collected over a short time period (one month).

The timing of the administration of antibiotic prophylaxis was assumed to be at the induction of anaesthesia as recorded in the Anaesthesia Record Sheet, but this could not be verified.

Some information regarding the antibiotic prophylaxis given and the procedure details were missing from the patients' files.

Conclusion

Peri-operative antibiotic prophylaxis (PAP) is considered one of the most effective measures for preventing surgical site infections (SSI).

Barriers to appropriate administration of PAP include lack of education and awareness of guidelines, hierarchal problems, disagreement with guidelines, poor communication and feedback problems. Such obstacles can be overcome by the improvements mentioned in this paper.

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