Prophylactic antimicrobial practice in the Orthopaedic wards of RIPAS Hospital

Lah Kheng CHUA
Department of Pharmacy, RIPAS Hospital, Bandar Seri Begawan, Brunei Darussalam

ABSTRACT

Introduction: Surgical site infections (SSI) are common healthcare associated infections (HAI) that is associated with increased morbidity and cost. Antimicrobial prophylaxis is effective when used appropriately. This study assesses the prophylactic antimicrobial prescribing and practice in the orthopaedic wards based on the Scottish Intercollegiate Guidelines Network (SIGN) guideline on antibiotic prophylaxis in surgery. **Materials and Methods:** Patients admitted to the Orthopaedics wards over a four-week period were studied (n = 68). Criterions 1 to 4; appropriateness, choice of antimicrobial and route of administration (1- given when indicated, 2- not given when not indicated, 3- appropriate choice and 4- given intravenously), criterions 5 to 7; allergy status and documentation (5: documentation, 6- details and 7- definite or possible history reaction immediately after penicillin therapy should not receive prophylaxis with a beta-lactam antimicrobial), criterions 8 to 10; documentation of antimicrobial given (8- name, dose and route of administration, 9- documentation in the appropriate 'one-off' section of the drug chart and 10- documentation of time of administration and surgical incision) and criterion 11 to 14; time and doses required (11- prophylaxis should be given 30 minutes before surgery, 12- additional intra-operative dose not required, 13- post-operative doses of prophylaxis not given and 14- a 24 hours regimen of prophylactic antimicrobial is given for primary arthroplasty procedures). A simple scoring system was used to allocate level of appropriateness. The rate was considered 'very good' for above 85%, 'good' for 70%-85%, 'moderate' for 50%-69%, 'poor' for 30%-49% and 'very poor' for below 30%. **Results:** The overall conformation to criteria and standards was 66.4% (95% CI 61.7-70.7). The rates were rated as 'very good' for criterion 1, 3, 4, 5b, 6, 8 and 9, 'good' for criterion 5a and 'poor' for criterions 2 and 5c. The adherence rates were 'very poor' to criterion 10a, 10b, 13 and 14. Intravenous cefuroxime was used as the first choice for antimicrobial prophylaxis. **Conclusions:** The overall practice was moderate and the choice of drug was considered appropriate. However, certain areas such as documentation needs improvement. A local guideline may be useful.

Keywords: Antimicrobial prescribing, antimicrobial prophylaxis, orthopaedic, surgical site infection

Correspondence author: Lah Kheng CHUA
Department of Pharmacy
RIPAS Hospital, Bandar Seri Begawan BA 1710,
Brunei Darussalam
Tel: +673 2242424 Ext 6477
E mail: clk88@hotmail.com

INTRODUCTION

Infection of the incised tissue or surgical site infection (SSI) is a common complication observed post-surgery, and is potentially avoid–

able. [1] SSI is associated with prolonged hospital stay and increased healthcare costs. The cost of treatment for patients who develop SSI following orthopaedic surgery can be enormous. [2] A study by Sculco on infected implants with prostheses removal, six weeks of parenteral antibiotics followed by prostheses re-implantation cost approximately US$50,000 per patient. [2] Patients' quality of life and physical mobility were also significantly reduced with SSIs. [3]

Antimicrobial prophylaxis, coupled with good surgical technique and strict infection control measures are important aspects in the prevention of SSI. [4] Antimicrobial prophylaxis against SSI is defined as the use of antimicrobials to prevent infections at the surgical site. [5] An ideal antimicrobial prophylaxis should prevent postoperative infection at the surgical site, prevent postoperative infectious morbidity and mortality, reduce the duration and cost of health care, produce no adverse effects and have no impact on the normal bacterial flora of the host. [6] To achieve these goals, the chosen antimicrobial must be the cheapest effective agent, safe, and active against the pathogens most likely to contaminate the wound, given in appropriate dose, route and time of administration to ensure adequate concentrations at the incision site during the period of potential contamination and administered for the shortest effective time to minimise adverse effects and the development of resistance. [6, 7] The decision on whether prophylaxis is indicated in a particular operation will depend on the patient's risk and the consequences of developing SSI, the effectiveness of prophylaxis in that operation and the risk of receiving prophylaxis. [7] The Scottish Intercollegiate Guidelines Network (SIGN) guideline on antibiotic prophylaxis in surgery has made the following recommendations for the indications of surgical antibiotic prophylaxis in orthopaedic surgery (Table 1). [7] The recommendations apply to all elective orthopaedic operations in the clean and contaminated categories and also emergency operation of clean categories (such as open fixation of closed fracture). [7] The guideline considered antibiotic therapy use in emergency operations of contaminated or dirty wounds as a standard therapy, not prophylaxis. [7]

Table 1: The Scottish Intercollegiate Guidelines Network (SIGN) guideline on antibiotic prophylaxis in surgery.

Types of operations	Recommendations
Arthroplasty	Antibiotic prophylaxis is highly recommended. Antibiotic loaded cement is recommended in addition to intravenous antibiotic. Up to 24 hours of antibiotic prophylaxis should be considered.
Open fracture	Antibiotic prophylaxis highly recommended
Open surgery for close fracture	Antibiotic prophylaxis highly recommended
Hip fracture	Antibiotic prophylaxis highly recommended
Lower limb amputation	Antibiotic prophylaxis recommended
Soft tissue surgery of the hand	Antibiotic prophylaxis should be recommended
Surgery without prosthesis devices	Antibiotic prophylaxis is not recommended

Table 2: The criterions developed for the study based on the SIGN guidelines.

No.	Criterion	Standard	Exceptions
1	Patients undergoing surgery for which antimicrobial prophylaxis is recommended routinely should receive prophylaxis	100%	Documented reason why prophylaxis was not given
2	Patients undergoing surgery for which antimicrobial prophylaxis is not recommended routinely should not receive prophylaxis	100%	Documented reason why prophylaxis was given Emergency operations with contaminated or dirty wounds Elective operations with dirty wounds
3	The antimicrobials used for prophylaxis should cover the pathogens likely to be encountered for that operative site	100%	Documented rationale behind choice where this is not the case
4	Antimicrobial prophylaxis should be given intravenously	100%	Documented reason for use of an alternative route
5	Patients' allergy status should be documented and available at the time antimicrobial prophylaxis is prescribed	100%	
6	Details of the nature of any allergy should be documented	100%	
7	Patients with a history of anaphylaxis or other reaction immediately after penicillin therapy should not receive prophylaxis with a beta-lactam antimicrobial	100%	
8	The name, dose and route of all antimicrobial prophylaxis should be recorded	100%	
9	Antimicrobial prophylaxis should be prescribed on specific forms for this purpose or the 'one-off' dose section of the drug chart	100%	
10	The time of administration of antimicrobial prophylaxis and of surgical incision should be recorded	100%	
11	Prophylaxis should be given within 30 minutes of incision	100%	Documented reason for earlier/later dosing Use of an oral antimicrobial or an IV antimicrobial which has to be infused over ≥30 minutes (e.g. vancomycin or quinolones) Patients receiving treatment with an antimicrobial within 24 hours of surgery where the antimicrobial has an appropriate spectrum and sufficiently long half life to cover the surgery
12	Additional intra-operative doses of prophylaxis should not be given without a documented reason (e.g. intra-operative blood loss >1.5L,[1,2] haemodilution up to 15ml/kg,[1] prolonged surgery [1,2,3])	100%	
13	Post-operative doses of prophylaxis should not be given	100%	Arthroplasty Documented reason why prophylaxis was given post-operatively Emergency operations with contaminated or dirty wounds Elective operations with dirty wounds
14	For arthroplasty a 24 hour regimen of prophylactic antimicrobial should be given	100%	

This study assessed the prescribing practice in the orthopaedic wards in Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital.

MATERIALS AND METHODS

Patients admitted to the Orthopaedic departments of RIPAS Hospital over a four-week period (1st Feb to 28th Feb 2009) were included in this study. The inclusion criteria were all patients admitted for orthopaedic surgery and had undergone surgery more than 24 hours earlier. The exclusion criteria included: age less than 18 years, patients who did not undergo their surgery/procedure, unless this decision was taken after administration of a dose of prophylactic antimicrobial, preoperative patients and those who underwent their surgery/procedure <24 hours previously were excluded from the study.

The data collection forms were filled in according to the information in theatre notes (or anaesthetic record), medical case notes and drug charts. The medical case notes, drug charts and theatre notes were examined to check if patient met the inclusion criteria. Files containing patient's medical case notes and drug charts which were not available during the visit were excluded from the screening.

A total of 68 cases were recruited

during the four-week study. Four cases were excluded due to missing details (missing details on age, incomplete details on the operation).

At the end of data collection, all the data collected for each patient was entered into SPSS 16.0 database and subsequently analysed based on the SIGN guideline on antibiotic prophylaxis in surgery [7] and the 14 criterion developed (Table 2).

Scores were used to allocate the level of appropriateness. The rate was considered 'very good' for above 85%, 'good' for 70%-85%, 'moderate' for 50%-69%, 'poor' for 30%-49% and 'very poor' for below 30%.

RESULTS

The mean age of the patient was 44 years old with males comprising 70.3% (n=45) and females 29.7% (n=19) of the sample. Majority of the admissions included in this study were emergency admissions (57.8%, n=37) with elective admissions comprising for the remainder (40.6%, n=26). The nature of admission for the remaining was unknown (1.6%, n=1).

The overall rates conforming to the SIGN criteria and standards was 66.4% (95% CI 61.7-70.7).

The rate were 'very good' for criterion 1, 3, 4, 5b 6, 8 and 9 as shown in Table 3. The rates were 'good' for criterion 5a and 'poor' for 2 and 5c and 'very poor' for the remaining criterion.

Poor rates were observed in documentation of patient's allergy in the theatre notes, exact time of administration of antimicrobial prophylaxis and time of surgical incision in the theatre room with overall achievement of 31.3% for documentation of patient's allergy in the theatre note and 0% for the documentation on precise time of administration of antimicrobial prophylaxis and time of surgical incision.

The conformation to criterion 13 and 14 were also found to be 'very poor', indicating single prophylactic dose was not widely practiced. Similar finding was observed in patients undergoing primary arthroplasty procedures where antimicrobial prophylaxes were given beyond 24 hours.

Intravenous cefuroxime was used as a first line drug in surgical prophylaxis for or–thopaedic procedures and was considered an appropriate choice. One case was given intravenous amoxicillin-clavulanic acid but was still considered appropriate as the isolated organisms (gram-positive cocci) were sensitive to either antimicrobial.

DISCUSSION

Antimicrobial prophylaxis has been shown to be associated with reduction in short-term morbidity, short and long-term postoperative mortality, risk of developing SSIs and a reduction in hospital stay and cost of treatment. [7, 8] However, antimicrobial prophylaxis is not without risk. The potential risks of anaphylaxis, antimicrobial resistance and risk of developing *Clostridium difficile* associated diarrhoea must be taken into consideration when considering prophylaxis. [7, 8] Importantly not all procedures requires prophylaxis. In clean procedures, prophylaxes are not indicated as the overall risk of SSI is only about 1.4%

Table 3: The overall conformation and non-conformation rates to the individual criteria (n = 64).

Criterion Number	Descriptor	Criterion applies	Recognised exception	Other valid documented exception	Adjusted applicability	Adherence	Adherence percentage and confidence interval (95% CI)
1	Patients undergoing surgery for which antimicrobial prophylaxis is recommended routinely should receive prophylaxis.	54	0	29	25	25	**100** (84.2-100)
2	Patients undergoing surgery for which antimicrobial prophylaxis is not recommended routinely should not receive prophylaxis	10	3	0	7	3	42.9 (15.8-75)
3	The antimicrobials used for prophylaxis should cover the pathogens likely to be encountered for that operative site	29	0	0	29	29	**100** (86.1-100)
4	Antimicrobial prophylaxis should be given intravenously	29	0	0	29	29	**100** (86.1-100)
5	Patients' allergy status should be documented and available at the time antimicrobial prophylaxis is prescribed						
	A) Documentation in case notes	64	0	0	64	53	82.8 (71.6-90.3)
	B) Documentation in kardex	64	0	0	64	61	95.3 (86.6-98.9)
	C) Documentation in theatre note	64	0	0	64	20	31.3 (21.2-43.4)
6	Details of the nature of any allergy should be documented	4	0	0	4	4	**100** (45.4-100)
7	Patients with a history of anaphylaxis or other reaction immediately after penicillin therapy should not receive prophylaxis with a beta-lactam antimicrobial	**Severity of penicillin allergy could not be determined due to insufficient details**					
8	The name, dose and route of all antimicrobial prophylaxis should be recorded	29	0	0	29	29	**100** (86.1-100)
9	Antimicrobial prophylaxis should be prescribed on specific forms for this purpose or the 'one-off' dose section of the drug chart	29	0	0	29	29	**100** (86.1-100)
10	The exact time of administration of antimicrobial prophylaxis should be recorded	29	0	0	29	0	0 (0.0-13.9)
	The exact time of surgical incision should be recorded	29	0	0	29	0	0 (0.0-13.9)
11	Prophylaxis should be given within 30 minutes of incision	**Unavailability of incision time & precise time of antimicrobial administration, criterion 11 could not be evaluated**					
12	Additional intra-operative doses of prophylaxis should not be given without a documented reason (e.g. intra-operative blood loss >1.5L, haemodilution up to 15ml/kg, prolonged surgery)	0	0	0	0	-	-
13	Post-operative doses of prophylaxis should not be given	29	6	0	23	0	0 (0.00-16.9)
14	For arthroplasty (primary) a 24 hour regimen of prophylactic antimicrobial should be given	6	0	0	6	0	0 (0.00-44.3)
	Total	**469**	**9**	**29**	**425**	**282**	**66.4% (61.7-70.7)**

without prophylaxis and the risk reduction achieved is relatively low. [6, 7, 9] However, in procedures that include prosthetic implants, prophylaxis is recommended. [6, 7, 9] In such cases, development of deep-implant SSIs can be detrimental and the cost of treatment is enormous. [9] Studies have shown that the presence of foreign bodies such as implanted material increases the risk of infection.[10]

Generally good antimicrobial prophylaxis practice involves many factors. These include knowledge of the appropriateness of the indications, the types of antimicrobial appropriate for a particular procedure, the local resistance pattern, the route of admin-

istration, the dose, duration, documentation of allergy and type of medications causing allergy, documentation of time of administration, time of surgical incision to appropriate documentation in the medication charts.

In most instances, a single antimicrobial agent given intravenously is more than adequate to prevent SSIs. [6, 7, 11] However, additional doses (especially for surgical procedures that last more than three hours) may be required. The organisms of concern in clean orthopaedic surgery are bacteria found on the skin, primarily aerobic gram-positive cocci. [10] A second generation cephalosporin such as cefuroxime is sufficient to provide adequate coverage against the majority of gram–positive and gram-negative bacteria. [10] Others factors such as cost, half-life of antimicrobials and safety should also be taken into account in the choice of antimicrobials. [7]

This study showed that conformation to accepted standard, in this case SIGN varied widely with an average of 66.4%, ranging from very good in some areas and poor in others.

Conformations were very good for criterions 1, 3, 4, 6, 8 and 9 that assessed appropriate indications, the choice of antimicrobials, route of administrations, documentation of the nature of allergy, appropriate documentations of antimicrobial given and documentation in the appropriate section of medical chart. These are not unexpected considering such knowledge or practice should be part of our daily activities.

An example of wide variation was seen in criterion 5, documentation of allergy. Generally, history of allergy was enquired in all patients and once allergy is documented, the documentation of the medications causing allergy were very good (100%). However, the number was small with only four patients with history of allergy. On the other hand documentation of allergy in the various documents were not consistent, 95.3% in the medication kardex, 82.3% in the case note and only 31.3% in the theatre notes. Documentations should be consistent and complete to avoid adverse reactions. Furthermore, documentation of severity of the symptoms and the time course of allergic event were not in details. Therefore, it was not possible to assess if the patients had true allergy to penicillin. Studies have shown that some cases of documented allergies are not true allergic reactions when further information is reviewed. For this reason, criterion 7 could not be evaluated. The only patient with penicillin allergy in this study had received prophylaxis intravenous cefuroxime but there was no documentation to indicate if this patient subsequently developed severe adverse reactions. It is possible that such details may have been checked and enquired but not documented. However, it cannot be emphasised enough that appropriate documentation is important.

Another area that requires improvement is the documentation in the appropriate sections of the medication charts. The route of administration, the name, dose and route of single dose antimicrobial prophylaxis should be documented clearly in the 'once only' section of the drug chart. In the theatre notes, documentation of the name and dose of antimicrobial given was 93.1% but it was of concern that the documentation of the

route and exact time of administration was poor. This is reflected in criterion 10 which was very poor. Similarly, the documentation of the incision time was poor. However, this may not be considered as part of the duty of the anaesthetists.

The conformation rates for criterion 13 and 14 were 'very poor'. All the surgeries carried out (elective or emergency cases) did not practice the use of single prophylactic dose. The minimum duration was three days intravenous antimicrobial followed by oral doses for majority of the orthopaedic cases where prophylactic antimicrobial was indicated. The American Academy of Orthopaedic Surgeons and the American Association of Orthopaedic Surgeons guideline showed that there is no evidence to support that antimicrobials continued beyond 24 hours provided additional benefits. [12] However, despite the lack of evidence, it may still be justified to continue antimicrobial for patients with a complex medical history such as those who are immuno-compromised. The ultimate decisions should be up to the consultant based on their clinical judgment. [7]

There are several limitations with the present study. First the sample size was small. Second, this study only assessed the practice of one specialty and as such may not be applicable to other specialties. However, given that there is no data available on current prescribing practice in our local setting, it will serve as a baseline for future study.

In conclusion, this study showed that the antimicrobial prophylaxis practice varies widely from very good to very poor when checked against the accepted standard. However, the overall practice can be considered as moderate and the choice of drug was considered appropriate. Certain areas need improvement as the documentations of several aspects. A local guideline may be useful.

REFERENCES

1: Mohamed HR, Anson J. Peri-operative antibacterial prophylaxis. Pharm J. 2004; 272:743-5.

2: Sculco TP. The economic impact of infected joint arthroplasty. Orthopedics 1995; 18:871-3.

3: Whitehouse JD, Friedman ND, Kirkland KB, Richardson WJ, Sexton DJ. The impact of surgical-site infections following orthopedic surgery at a community hospital and a university hospital: Adverse quality of life, excess length of stay, and extra cost. Infect Control Hosp Epidemiol 2002; 23:183-9.

4: Antibacterial prophylaxis for orthopaedic surgery. DTB 2001; 39:43-6.

5: Munckhof W. Antibiotics for surgical prophylaxis. Aust Prescr. 2005; 28:38-40.

6: American Society of Health-System Pharmacists. ASHP Therapeutic Guidelines on Antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm 1999; 56:1839-88.

7: Scottish Intercollegiate Guidelines Network (SIGN) Guidelines 104. Antibiotic prophylaxis in surgery. A national clinical guideline. Edinburgh, UK: SIGN, 2008. Available from http://www.sign.ac.uk/pdf/sign104.pdf (Accessed 26th September 2011).

8: Department of Microbiology and Pharmacy. Antibiotic Surgical Prophylaxis 2007. Calderdale and Huddersfield NHS Foundation Trust. Available from http://www.formulary.cht.nhs.uk/pdf,_doc_files_etc/MMC/057_Surgical%20Prophylaxis.pdf (Accessed 26th September 2011).

9: Hampson FG, Ridgway EJ. Prophylactic antibiotics in surgery. Surgery (Oxford) 2005; 23:290-3.

10: Prokuski L. Prophylactic Antibiotics in Orthopaedic Surgery. J Am Acad Orthop Surg 2008; 16:283-93.

11: Bratzler DW, Houck PM. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. Clin

Infect Dis 2004; 38:1706-15.

12: American Academy of Orthopaedic Surgeons. Information Statement on Recommendations for the use of intravenous antibiotic prophylaxis in primary total joint arthroplasty June 2004. Available at http://www.aaos.org/about/papers/advistmt/1027.asp (Accessed 6th December 2011).

Brunei Darussalam Healthcare in Pictures

Group photo of Brunei General Hospital healthcare staff taken in the Nursing quarter compound in Bandar Brunei.