Surgical Antibiotic Prophylaxis

Why a Clinical Practice Guideline?

Infection of the surgical site is a common but an avoidable complication of any surgical procedure. It is important to note that surgical technique, operating theatre procedures, aseptic technique during and after operation should be of highest standard.[1] In addition many types of operations benefit from antibiotic prophylaxis.[1]

The necessity for a guideline arose due to unavailability of national guidelines.

For whom is this guideline intended?

These guidelines are mainly targeted at the Surgeons / Anesthetists and other staff members at different levels of hospitals as classified by the Ministry of Health (Ministry of Health). However for successful use of the guideline the involvement of the hospital administration is essential. Although it is targeted for the institutions under the Ministry of Health any private health facility which is involved in surgical care is encouraged to use them.

Objectives

- To provide evidence based recommendations to Surgeons / Anesthetists to choose the best course of management in patient care.
- To provide recommendations to the administration to help in the improvement of quality of service delivery.

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Introduction

Use of prophylactic antibiotics when indicated will reduce the incidence of surgical site infection; reduce hospital stay, mortality, morbidity and cost of care.

Appropriate use of antibiotics for prophylaxis reduces the risk of emergence of resistance in bacteria and adverse effects on patients.

This guideline is intended for use by surgeons, anesthetists and medical officers involved in surgical care.

2.1 Risk factors for surgical site infection

2.1.1 Type of operation

Operations can be classified in to 4 classes according to the incidence of bacterial contamination and subsequent infection.

Class	Definition
A. Clean	Operations in which no inflammation is encountered and the respiratory, alimentary or genitourinary tracts are not entered into. There is no break in aseptic operating theatre technique.
B. Clean- contaminated	Operations in which the respiratory, alimentary or genitourinary tracts are entered

into but without significant spillage.

C. Contaminated — Operations where acute Inflammation (without pus) is encountered, or where there is visible contamination of the wound. Examples include gross spillage from a hollow viscus during the operation or compound / open injuries operated on within four hours.

D. Dirty — Operations in the presence of pus, where there is a previously perforated hollow viscus, or compound / open injuries more than four hours old.

The guideline applies to all elective operations in the clean, clean-contaminated or contaminated categories. Recommendations for prophylaxis of emergency surgery are limited to clean operations (e.g. emergency repair of abdominal aortic aneurysm or open fixation of a closed fracture) and emergency caesarean section, which is a clean-contaminated operation. The emergency operations with contaminated or dirty wounds require antibiotic therapy rather than prophylaxis.[3]

2.1.2 Insertion of prosthetic implants-

Insertion of prosthetic devices will increase the risk of infection.

2.1.3 Duration of surgery-

Risk of developing infection will be proportional to the duration of surgery.

2.1.4 Co-morbidities –

The co-morbidities such as obesity, diabetes mellitus etc. will increase the chance of infection.

2.2 Principles of prophylaxis

2.2.1 Indications for prophylaxis

Of the operation types mentioned earlier prophylaxis is indicated for contaminated; clean contaminated and some categories of clean operations.

2.2.2 Routes of administration of prophylaxis

Prophylaxis is usually given by intra-venous (IV) route. Under certain circumstances intra-muscular (IM) or rectal routes or oral administration is appropriate. With the exception of ophthalmic surgery, topical antibiotic prophylaxis is not recommended.[2]

2.2.3 Timing of prophylaxis

- IV antibiotic should be given as soon as the patient is stabilized after induction of anaesthesia except for vancomycin where the infusion should be finished, prior to the induction.

- However in orthopaedic surgery prophylaxis needs to be given at least 10 minutes prior to application of tourniquet.[2]
- IM should be given at the time of premedication for surgery.[2]
- Oral metronidazole should be given 6-12 hours prior to surgery.

2.2.4 Duration of prophylaxis

- In general a single dose of parenteral antibiotic is sufficient since the critical period for successful prophylaxis is the 4 hours following implantation of organism into the wound.

- A 2nd dose of prophylaxis is indicated;
  a) if the operation is prolonged beyond three hours.[2]
  b) under specific circumstances like amputation of an ischaemic limb or when there is significant blood loss.(>1.5 liters). [3]
  c) if there is a delay in starting the operation. [2]

The practice of continuing prophylactic antibiotics until surgical drains have been removed is of unproven benefit.

Prophylactic antimicrobial agents should be discontinued within 24 hours of the end of surgery.[5]

- Recommended indications and appropriate antibiotic

See annexure for recommended indications and level of evidence.

2.2.5 Cardiothoracic surgery

- **Coronary artery bypass graft (CABG)**
- **Prosthetic valve surgery**
- **Pulmonary resection**

Adult patients
1. cloxacillin 2g IVand gentamicin 2mg/kg **or**
2. cefuroxime 1.5 g **or**
3. vancomycin 1.5g and gentamicin 2mg/kg

Paediatric patients <12 years
1. cloxacillin 50mg/kg and gentamicin 2mg/kg **or**
2. cefuroxime 50 mg/kg **or** 3. vancomycin 30mg/kg and gentamicin 2mg/kg

In penicillin allergy or if there is a high incidence of MRSA in the unit or if the patient is colonized with MRSA vancomycin or teicoplanin is recommended. (Gentamicin may be added if there is a high incidence of Gram-negative infections.)

2.2.6 ENT surgery/ Oro-maxillo-facial surgery

Prophylaxis is recommended for procedures that involve an invasion through oral, nasal, pharyngeal or oesophageal mucosa, stapidectomy or similar operation.[2]

cefuroxime 1.5 g IV and metronidazole 500 mg IV
or
co-amoxyclav 1.2g IV

2.2.7 Gastrointestinal tract surgery

A. Colorectal surgery

cefuroxime 1.5 g IV with metronidazole 500 mg IV
or
gentamicin 2mg/kg with metronidazole 500 mg IV

B. Appendicectomy
cefuroxime 1.5 g IV with metronidazole 500 mg IV
or
gentamicin 2mg/kg with metronidazole 500 mg IV

C. Penetrating injury to abdomen
cefuroxime 1.5 g IV with metronidazole 500 mg IV
or gentamicin 2mg/kg with metronidazole 500 mg IV

D. Upper gastrointestinal tract
cefuroxime 1.5 g IV

E. Biliary surgery including laparoscopic surgery and ERCP (Endoscopic Retrograde Cholangiopancreatography)

cefuroxime 1.5 g IV
or
co-amoxyclav 1.2g IV

2.2.8 Neurosurgery

A. Clean surgery
cloxacillin 2g IV

In institutions where MRSA rate is high or patient is colonized with MRSA or patient is allergic to penicillin - vancomycin 1.5g/ IV infusion

B. Clean contaminated (eg cross sinuses or naso/oral pharynx)
cefuroxime1.5g and metronidazole 500mg IV
or
co-amoxyclav 1.2g IV

C. CSF shunt surgery
vancomycin 1.5g

2.2.9 Obstetric and Gynaecological Surgery

A. Caesarean section

cefuroxime 1.5 g IV and metronidazole 500 mg IV after the cord is clamped.

B. Hysterectomy (abdominal or vaginal)

cefuroxime 1.5 g IV and metronidazole 500 mg IV.

C. Induced abortion

cefuroxime 1.5 g IV and metronidazole 500 mg IV

If there is a history of pelvic inflammatory disease, gonorrhoea or multiple sexual partners – add doxycycline 300mg orally.

2.2.10 General surgery

A. Hernia repair

- with mesh → cefuroxime 1.5 g IV and metronidazole 500 mg IV
- without mesh → Not recommended

B. Breast surgery

- cefuroxime 1.5 g IV

2.2.11 Orthopaedic surgery

The prophylactic antimicrobials should be completely infused 10 minutes before inflation of the tourniquet.

A. Joint replacement / Internal fixation of closed fractures/ Spinal surgery/ insertion of prosthetic devices

cloxacillin 2g + gentamicin 2 mg/kg
or
cefuroxime 1.5g
or
in institutions where MRSA rate is high or patient is colonized with MRSA or in β lactam allergy –
vancomycin 1.5g
or
teicoplanin 400 mg

B. Clean, not involving implantation of foreign materials

prophylaxis is not indicated.

2.2.12 Urological surgery

Patients should have sterile urine pre-operatively. If bacteriuria is present, they should be treated according to culture sensitivity. Peri-operatively antibiotics should be given intravenously and followed by oral

administration until the catheter is removed or for 10 days.

Antimicrobial prophylaxis should be considered in high risk patients such as patients likely to require prolonged post-operative catheterization and patients in hospitals where hospital associated infection rate is >20%.

A. Transrectal prostatic biopsy

cotrimoxazole 960 mg orally – 1 hour before the surgery
or
ciprofloxacin 500 mg orally 1 hour before surgery
or
ciprofloxacin 200 mg IV

B. Prostatectomy

gentamicin 4mg/kg IV
or
ciprofloxacin 500 mg orally 1 hour before surgery
or
ciprofloxacin 200 mg IV
(The aim is to reduce the incidence of post-operative bacteraemia).[2]

2.2.13 Vascular surgery

- **Lower limb amputation for ischaemia**
- **Reconstruction of abdominal aorta**
- **Procedure on leg with a groin incision**
- **Any vascular procedure that involves a prosthetic material or foreign body**

cloxacillin 1g with gentamicin 4mg/kg
or
cefuroxime 1.5g
or
vancomycin 1.5g with or without gentamicin

If there is a high incidence of MRSA or methicillin resistant coagulase negative Staphylococcal infection or the procedure is a re-operation, use vancomycin.[2]

2.2.14 Ophthalmic surgery

A. Cataract surgery

gentamicin eye drops for 1-2 days
or
chloramphenicol eye drops for 1-2 days

2.3 References

1. Choice of antibacterial drugs – Abramowicz M et al; Treatment Guidelines from The Medical Letter, Volume 2 (Issue 19) March 2004.
2. Therapeutic Guidelines: Antibiotic: Version 13, 2006. Published and distributed by, Therapeutic Guidelines limited, ground floor, 23-47, Villiers Street, North Melbourne, Victoria 3051, Australia.
3. Antibiotic Prophylaxis in Surgery – Scottish Intercollegiate Guidelines Network –July 2000.
4. ASHP therapeutic guidelines 1999.
5. Antimicrobial Prophylaxis for Surgery: An Advisory Statement from the national Surgical infection prevention project; Bratzler D W and Houck P M; Clinical Infectious Diseases 2004; 38; 1706-1715.

2.4 Annexure

Operation	Recommendation	Outcome studied	Evidence Level
CARDIOTHORACIC SURGERY			
Cardiac pacemaker insertion	X recommended	Any infection	Ia
Open heart surgery, including: • Coronary artery bypass grafting • Prosthetic valve surgery	Y recommended	Wound infection	IIb
Pulmonary resection	X recommended	Surgical site infection	Ib
ENT SURGERY			
Head and neck surgery-contaminated/clean-contaminated	X recommended	Wound infection	Ia
Ear surgery-clean	**not** recommended	There is no evidence of effectiveness from randomized clinical trials	IV
Head and neck	**not**	There is no evidence	IV

surgery- clean	recommended	of effectiveness from randomized clinical trials	
Tonsillectomy	**not** recommended	There is no evidence of effectiveness of prophylaxis from randomized clinical trials (RCT). The cited trials are of treatment for 7 days after tonsillectomy, not prophylaxis.	IV
GENERAL SURGERY			
Colorectal surgery	X **highly** recommended	Infection/mortality	Ia
Appendicectomy	X recommended	Wound infection	Ib
Biliary surgery- open	X recommended	Wound infection	Ia
Breast surgery	Z recommended	Wound infection	IV
Clean-contaminated procedures	Z recommended	Wound infection	IV
Endoscopic gastrostomy	X recommended	Peristomal and other infection	Ib
Gastroduodenal surgery	X recommended	Wound infection	Ib
Oesophageal surgery	Z recommended	Effectiveness is inferred from evidence about other clean-contaminated procedures	IV

Laparoscopic or non-laparoscopic hernia surgery without a mesh	**not** recommended	Pooled results from two RCT show no statistically significant effect	1b
Laparoscopic cholecystectomy	**not** recommended	There is no evidence of effectiveness from RCT	IIb
ORTHOPAEDIC SURGERY			
Total hip replacement	X **highly** recommended	Hip infection	Ib
Prosthetic knee joint replacement	Y **highly** recommended	Observational data supports effectiveness	IIa
Closed fracture fixation	X recommended	Deep wound infection	Ib
Hip fracture repair	X recommended	Deep wound infection	
Spinal surgery	X recommended	Wound infection	
Insertion of prosthetic device	Z recommended	Effectiveness inferred from evidence about other procedures involving insertion of prosthetic devices	IV
Orthopaedic surgery without prosthetic device (elective)	**not** recommended	There is no evidence of effectiveness from RCT	IV

UROLOGY			
Transrectal prostate biophy	X recommended	Bacteriuria	Ib
Shock- wave lithotripsy	X recommended	Urinary tract infection	Ia
Transurethral resection of the prostate	X recommended	Urinary tract infection	Ib
Transurethral resection of bladder tumours	**not** recommended	No evidence in favor of prophylaxis exists	IV
VASCULAR SURGERY			
Lower limb amputation	X recommended	Wound infection	Ib
Vascular surgery- abdominal and lower limb	X recommended	Wound infection	Ib
NEUROSURGERY			
Craniotomy	X recommended	Wound Infection	Ia
CSF Shunt	X recommended	Wound and shunt infection	Ia
OBSTETRICS & GYNAECOLOGY			
Caesarean section	X recommended	Wound infection	Ia
Hysterectomy- abdominal	X recommended	Wound infection	Ia
Hysterectomy- vaginal	X recommended	Infectious morbidity/ pelvic infection	Ib
Induced abortion	X recommended	Upper genital tract infection	Ia

OPHTHALMOLOGY			
Cataract surgery	Z recommended	Effectiveness inferred from evidence about other procedures involving insertion of prosthetic devices	IV

STATEMENTS OF EVIDENCE

Ia Evidence obtained from meta-analysis of randomized controlled trails.

Ib Evidence obtained from at least one randomized controlled trial.

IIa Evidence obtained from at least one well-designed controlled study without randomization.

IIb Evidence obtained from at least one other type of well-designed quasi-experimental study.

III Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.

IV Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.