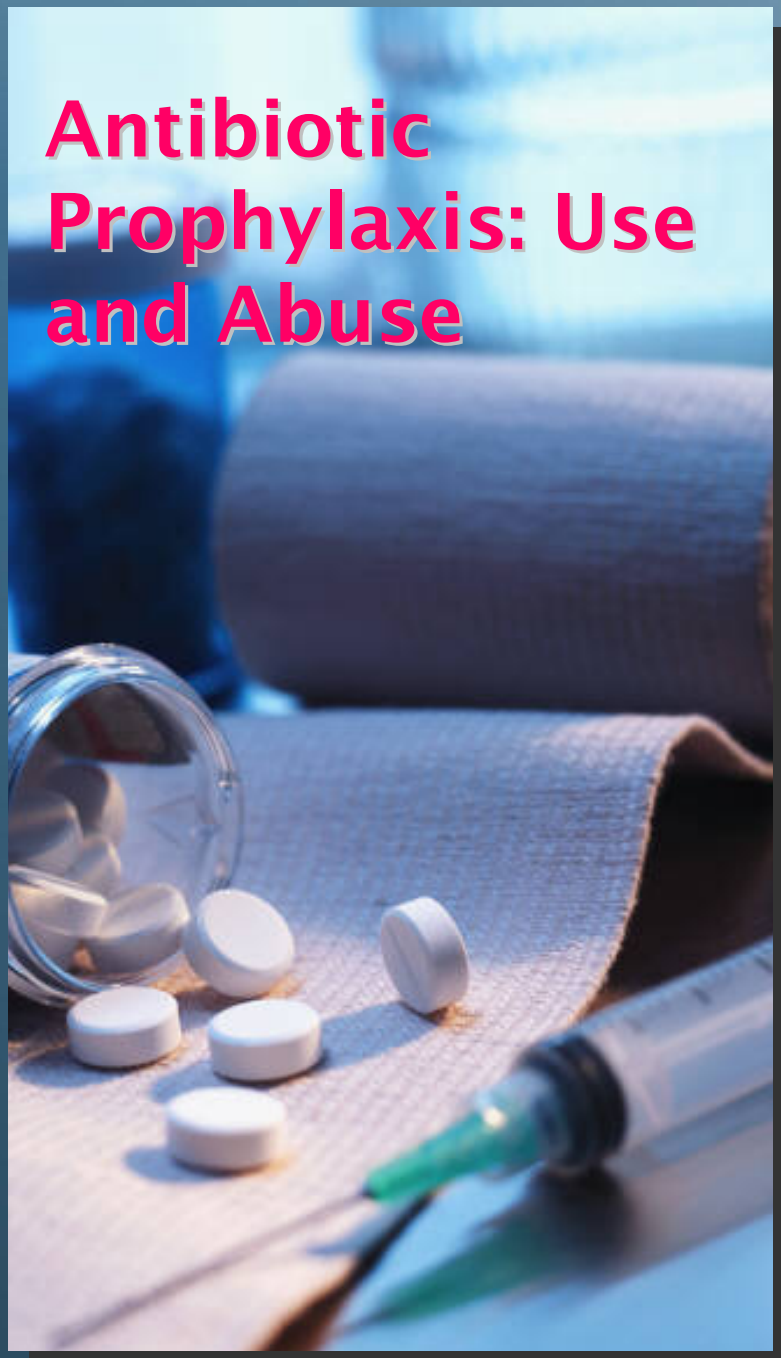
Antibiotic Prophylaxis: Use and Abuse



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Antibiotic Prophylaxis

- Definition – prevention of disease by administration of an antimicrobial agent
- Given to an individual who is at risk of developing an infection because of exposure or an impairment of host defense
- Does NOT apply to those situations in which infection is already established

Antibiotic Prophylaxis

- Only justified by the severe consequences of possible infection (e.g., endocarditis after dental procedures, infection of a surgical prosthesis)
- Recommendations change periodically on the basis of evolving knowledge, changing pathogens, and the susceptibility to antimicrobial agents

Criteria for effective antimicrobial prophylaxis

1. The antimicrobial drug or drugs used for prophylaxis must have activity against the likely infectious agent or must disrupt pathogenesis (e.g., prevent toxin production)
2. The host should have a defined and finite risk of disease. An assessment to determine the risk is multifactorial, taking into account both the incidence and severity of infection if it occurs and the communicability of the agent

Criteria for effective antimicrobial prophylaxis

3. The safety of a chemoprophylactic agent must be such that complications of its administration do not outweigh the risks of infection (i.e. an acceptable risk-to-benefit ratio)

4. The chemoprophylactic agent must have been taken or given, and adequate tissue concentration must be present at the time of exposure to the infectious agent.

Lecture Outline

I. Chemoprophylaxis in Healthy Children

II. Chemoprophylaxis in Children with Conditions Predisposing to Infection

III. Chemoprophylaxis for Surgical Procedures and Trauma

Chemoprophylaxis in Healthy Children

1. for surgical infections
2. exposure to agents causing septicemia, meningitis, and other infections with significant morbidity

Chemoprophylaxis in Healthy Children

Examples:

- *Neisseria meningitides*
- *Hemophilus influenzae type b*
- Group B Streptococcus
- Human Immunodeficiency Virus
- Respiratory Tract Pathogens - *Mycobacterium tuberculosis, Bordetella pertussis*

Chemoprophylaxis for Healthy Children Exposed to Specific Pathogens

Neisseria meningitidis	**Rifampicin** (20 mg/kg) for 2-4 days or **Ceftriaxone** (125-250 mg single dose) or Ciprofloxacin (for ≥ 18 years) (500 mg single dose)

Neisseria meningitides

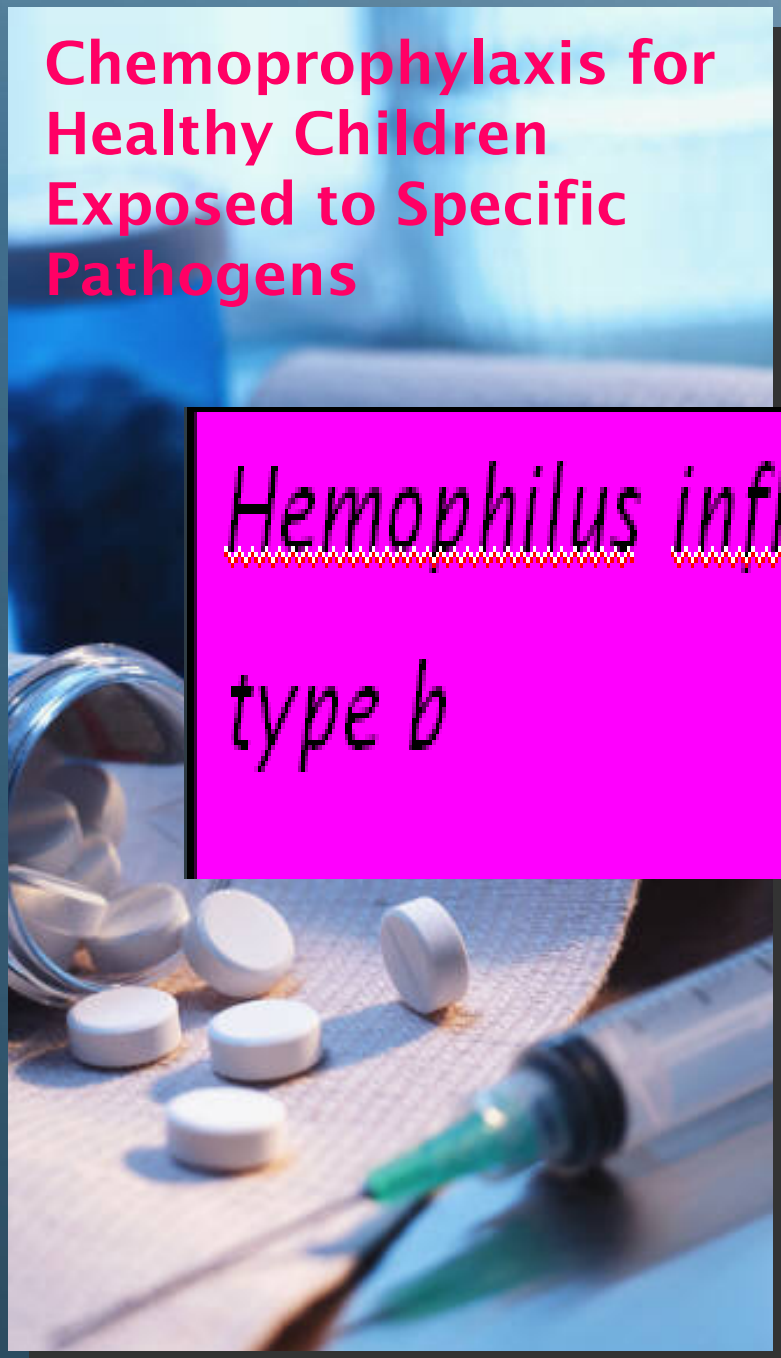
- **reported secondary attack rates among household contacts of index cases range from 0.25% in adults to 10% for infants younger than 1 year**
- **Penicillin –** ineffective prophylactic agent

- **Rifampicin**
  - Effective in eliminating nasopharungeal carriage of *N. meningitides* when given in a standard 2-day regimen
  - Prophylaxis should be instituted as soon as possible, preferably within 24 hours for contacts in households and childcare centers, and sometimes for school contacts as well as persons who have had contact with infected oral secretions

Neisseria meningitides

- Alternative agents – ceftriaxone (parenteral, expensive), fluoroquinolones (contraindicated in pregnant women and prepubertal children)

Chemoprophylaxis for Healthy Children Exposed to Specific Pathogens



Hemophilus influenzae type b	Rifampicin 20 mg/kg OD for 4 days

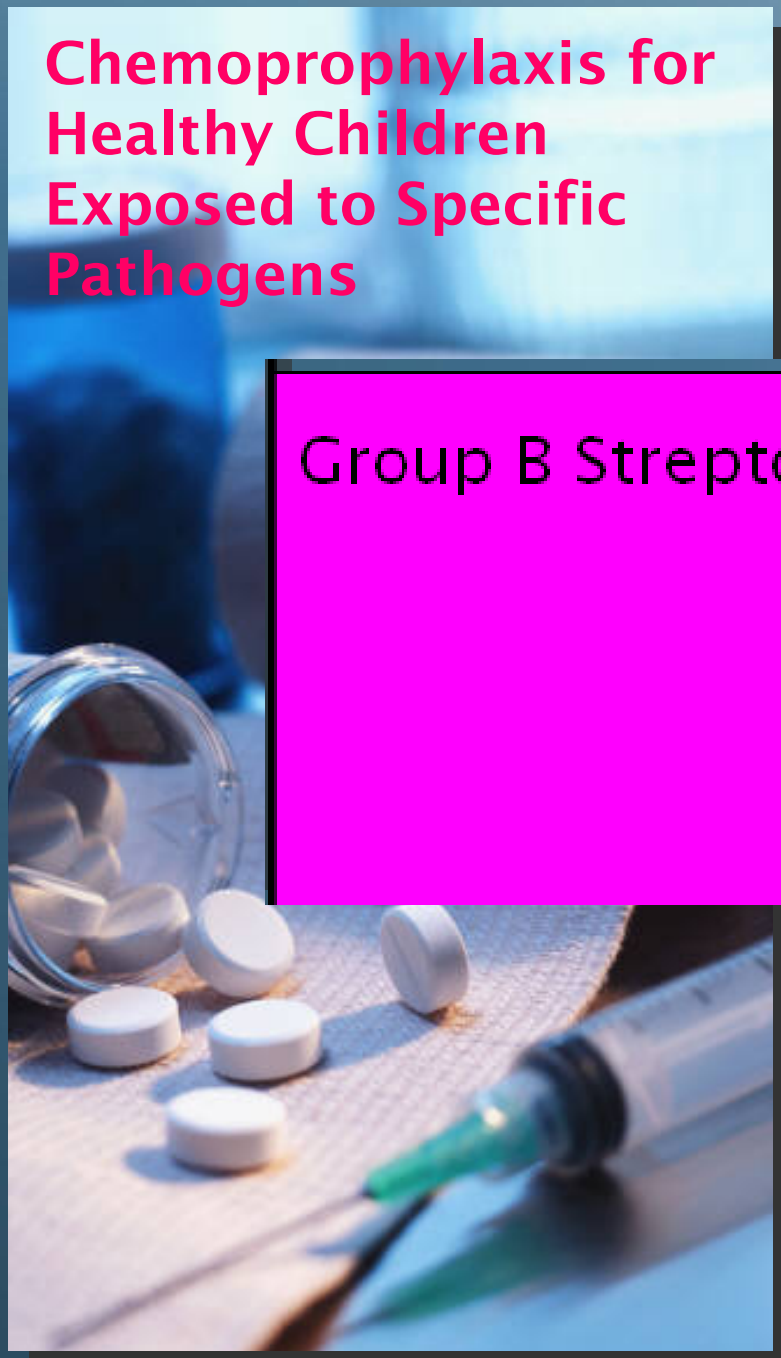
Hemophilus influenzae type b

- **Rifampicin** – 95% effective in eradication of nsopharyngeal carriage of *Hemophilus influenzae* type b (Hib) in children
- Prophylaxis – indicated if an incompletely immunized child younger than 4 years has close exposure to a case of invasive *Hemophilus* disease

Hemophilus influenzae type b

- Efficacy of prophylaxis for invasive strains of *H. influenzae* other than type b has not been evaluated
- Indications for prophylaxis:
  - 2 or more cases of Hib disease have occurred within a 60-day period
  - incompletely immunized children younger than 4 years have been exposed

Chemoprophylaxis for Healthy Children Exposed to Specific Pathogens



Group B Streptococcus	**Ampicillin** (maternal intrapartum) 2 g then 1 g IV q 4 hours until delivery

Group B Streptococcus

- Intrapartum administration of ampicillin or penicillin to women prevents early-onset disease

Chemoprophylaxis for Healthy Children Exposed to Specific Pathogens

Human Immunodeficiency Virus	**Zidovudine** 100 mg 5x/day administered to mother during pregnancy with continued treatment of Infant 2 mg/kg p.o. for weeks after delivery

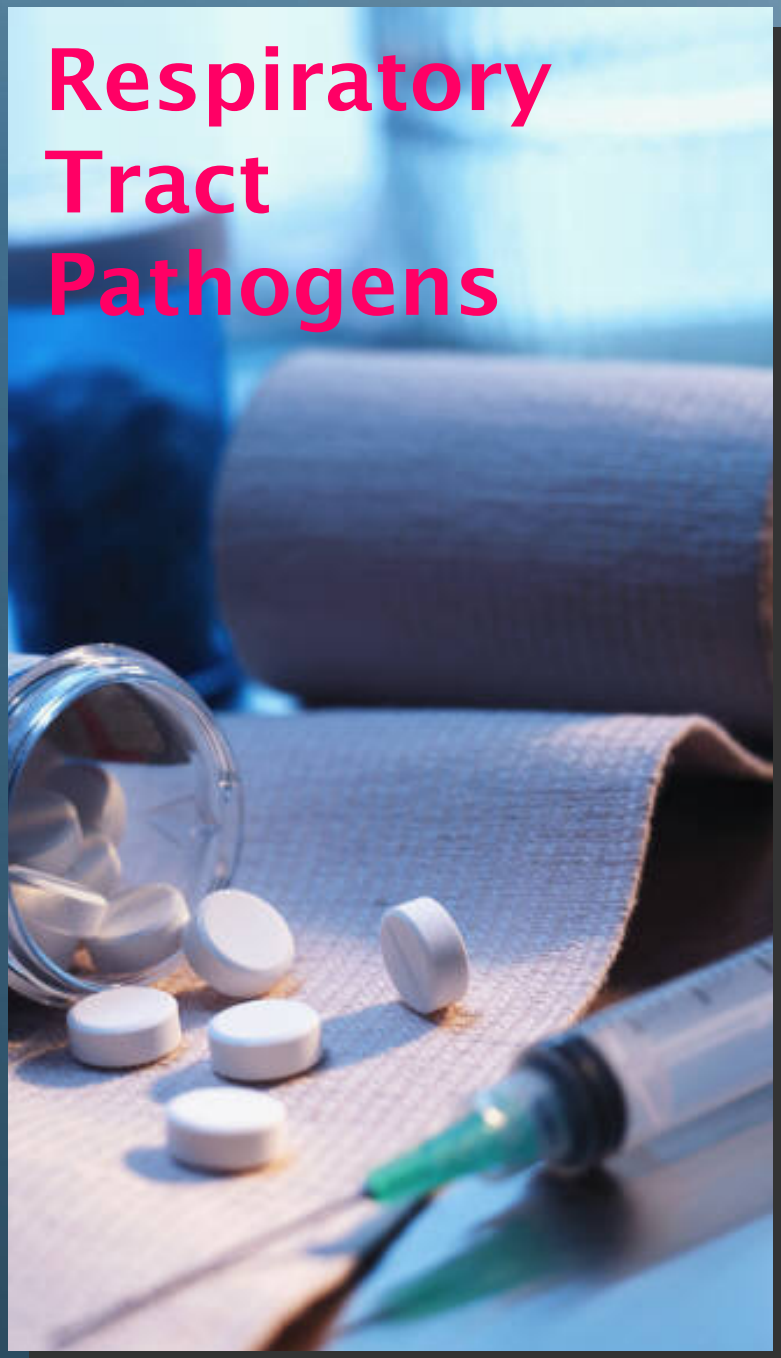
Human Immunodeficiency Virus

- Administration of zidovudine to the mother during pregnancy with continued treatment of the infant for 6 weeks after delivery prevents perinatal or intrauterine transmission of HIV
- Studies show that zidovudine reduced the rate of HIV transmission to the infant from 25.5% to 8.3%

Human Immunodeficiency Virus

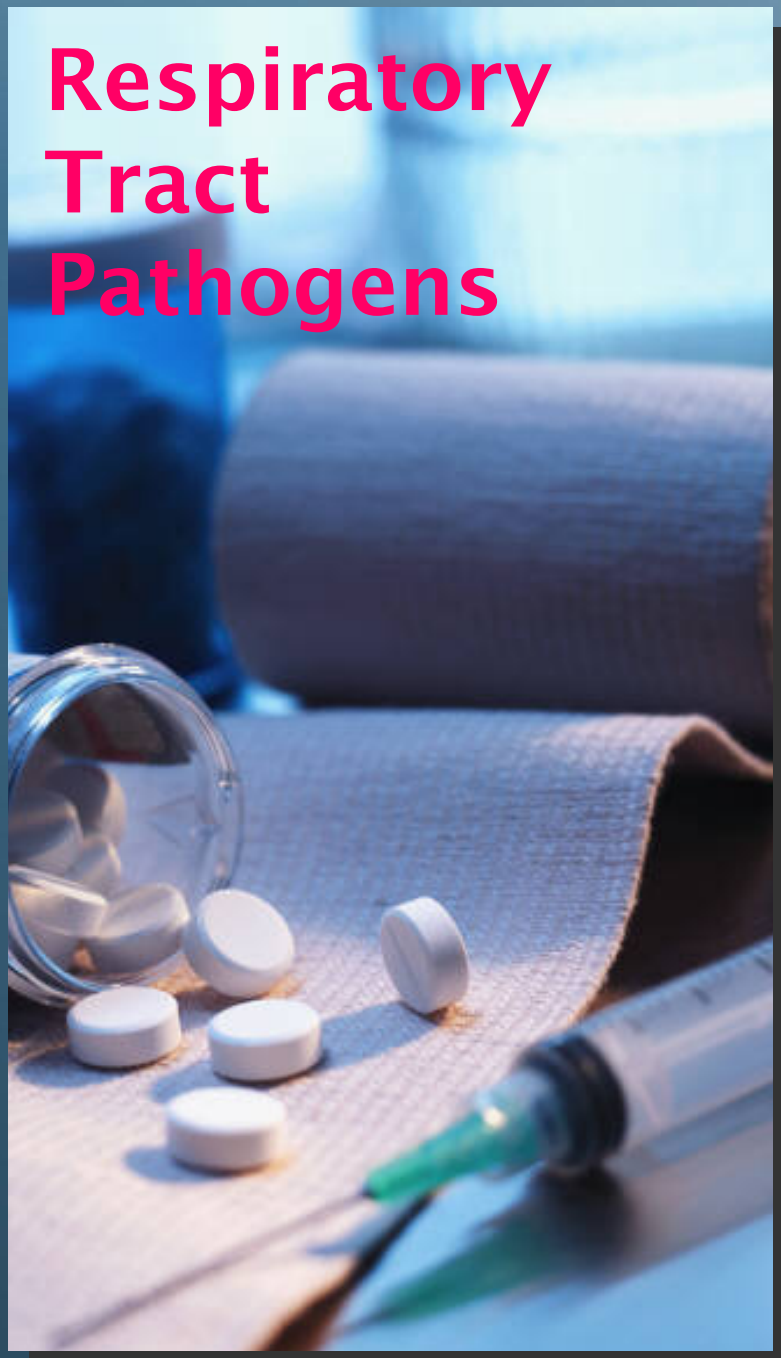
- Some studies show that zidovudine when administered within 12 to 24 hours after occupational exposure also reduces the risk of HIV infection

Respiratory Tract Pathogens



- Isoniazid – effective in preventing new *Mycobacterium tuberculosis* infection in uninfected individuals
- Macrolides (5 days of azithromycin, 7 days of clarithromycin, 14 days of erythromycin) are effective in preventing transmission of *Bordetella pertussis* in household contacts if given before symptoms occur

Respiratory Tract Pathogens



- Influenza – although the best prophylaxis against influenza in high-risk patients (such as those with underlying cardiac or pulmonary disease) is through annual immunization, administration of either amantadine or rimantadine are effective as prophylaxis against influenza A in high-risk children 12 months and older during the epidemic season or until immunization can be completed whereas neuraminidase inhibitors (zanamivir and oseltamivir) can be used for prophylaxis in children older than 1 year of age

Chemoprophylaxis in Children with Conditions Predisposing to Infection

- Prophylaxis of children predisposed to development of infection by virtue of a defined immunodeficient state or underlying anatomic defect
- Prophylaxis is required over a prolonged period of risk and strict compliance with regimens is critical to preventing "breakthrough" infections

Chemoprophylaxis in Children with Conditions Predisposing to Infection

Examples:

- Prior Rheumatic Fever
- Asplenia
- Other underlying conditions
- Recurrent otitis media
- Recurrent urinary tract infection
- Cardiac abnormalities

Chemoprophylaxis in Children with Conditions Predisposing to Infection

Disorder	Prophylactic Agent
Prior Rheumatic Fever	**Benzathine Pen G** (1.2 million units q 3-4 weeks) or **Penicillin V** (250 mg 2x/day) or **Sulfisoxazole** (500 mg if ≤ 27 kg; 1 g if > 27 kg OD

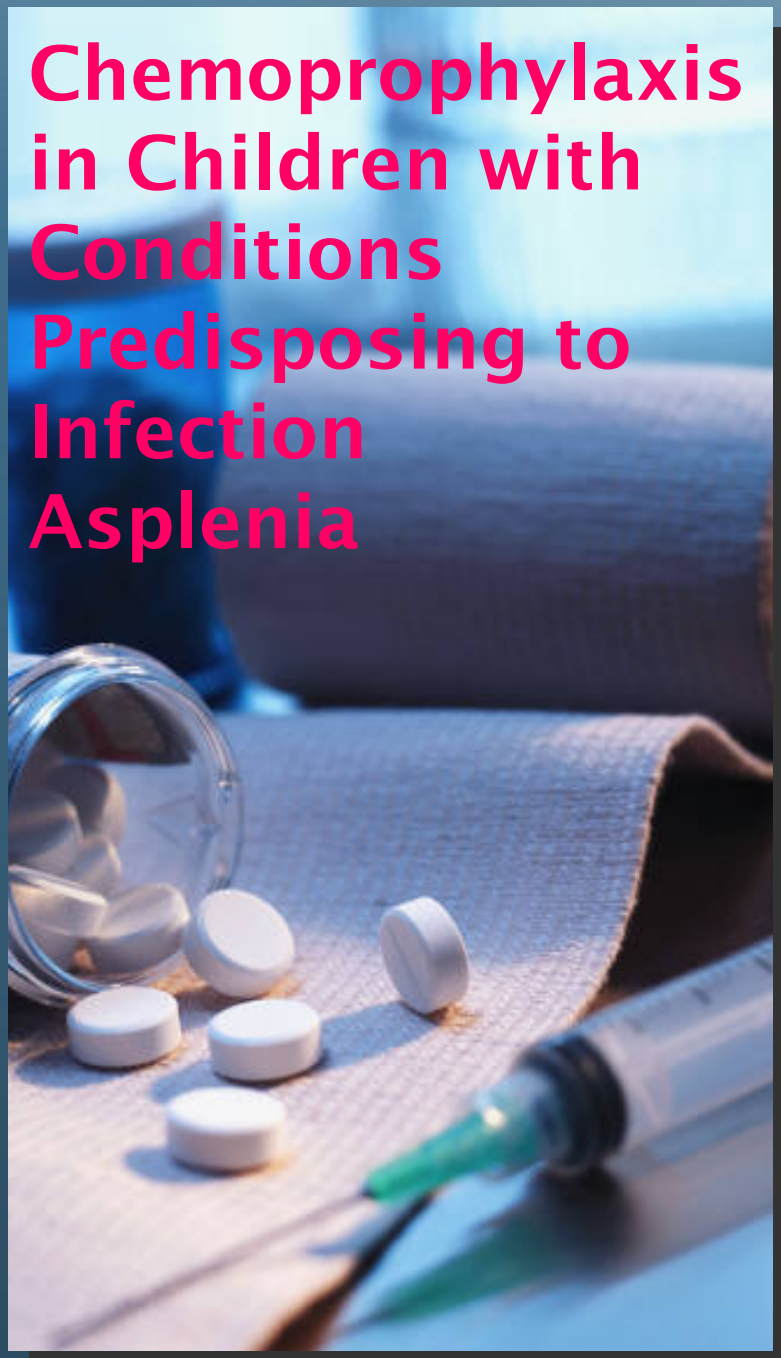
- **Patients with well-documented history of acute RF should receive continuous antibiotic prophylaxis to prevent recurrent attacks associated with either symptomatic or asymptomatic infection**

Prior Rheumatic Fever

- Current minimum duration of prophylaxis is for 5 years (or until age 21 years) for those without carditis, and 10 years (or well into adulthood) for those with carditis without residual heart disease and lifelong (or > 40 years) for those with carditis and residual heart disease.

Chemoprophylaxis in Children with Conditions Predisposing to Infection

Asplenia

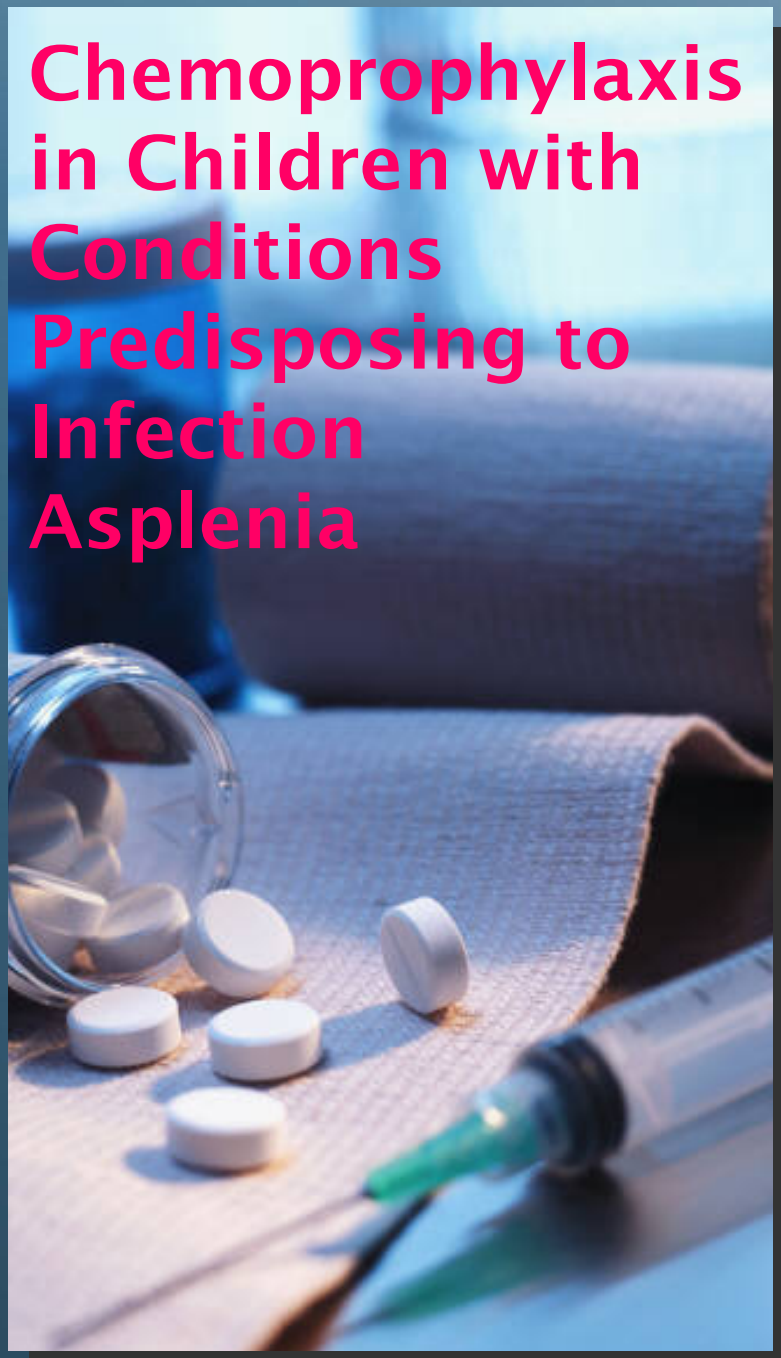


Disorder	Prophylactic Agent
Asplenia	**Penicillin V** (125 mg 2x/day if < 5 years, 250 mg 2x/day if ≥ 5 years

- **Asplenic children with malignancy, thalassemia, congenital anomalies or other diseases with high risk of fulminant infection should receive daily chemoprophylaxis**

Chemoprophylaxis in Children with Conditions Predisposing to Infection

Asplenia



- Recommendations for chemoprophylaxis less certain for children who undergo splenetomy for trauma
- Chemoprophylaxis and appropriate immunization (pneumococcal, meningococcal, *Hemophilus*) should be strongly considered for children < 5 years and should be considered for older children

Chemoprophylaxis in Children with Conditions Predisposing to Infection

Disorder	Prophylactic Agent
Recurrent otitis media	**Sulfisoxazole** (50 mg/kg at bedtime for 3-6 months) or **Amoxicillin** (20 mg/kg at bedtime for 3-6 months) or **Amoxicilin** (40 mg/kg per day in 3 divided doses at onset of URTI for 3-5 days)

- For children who experienced 3 episodes of acute otitis media within the previous 6 months or 4 episodes within the previous 12 months
- Continuous prophylaxis – more effective than intermittent prophylaxis

Chemoprophylaxis in Children with Conditions Predisposing to Infection

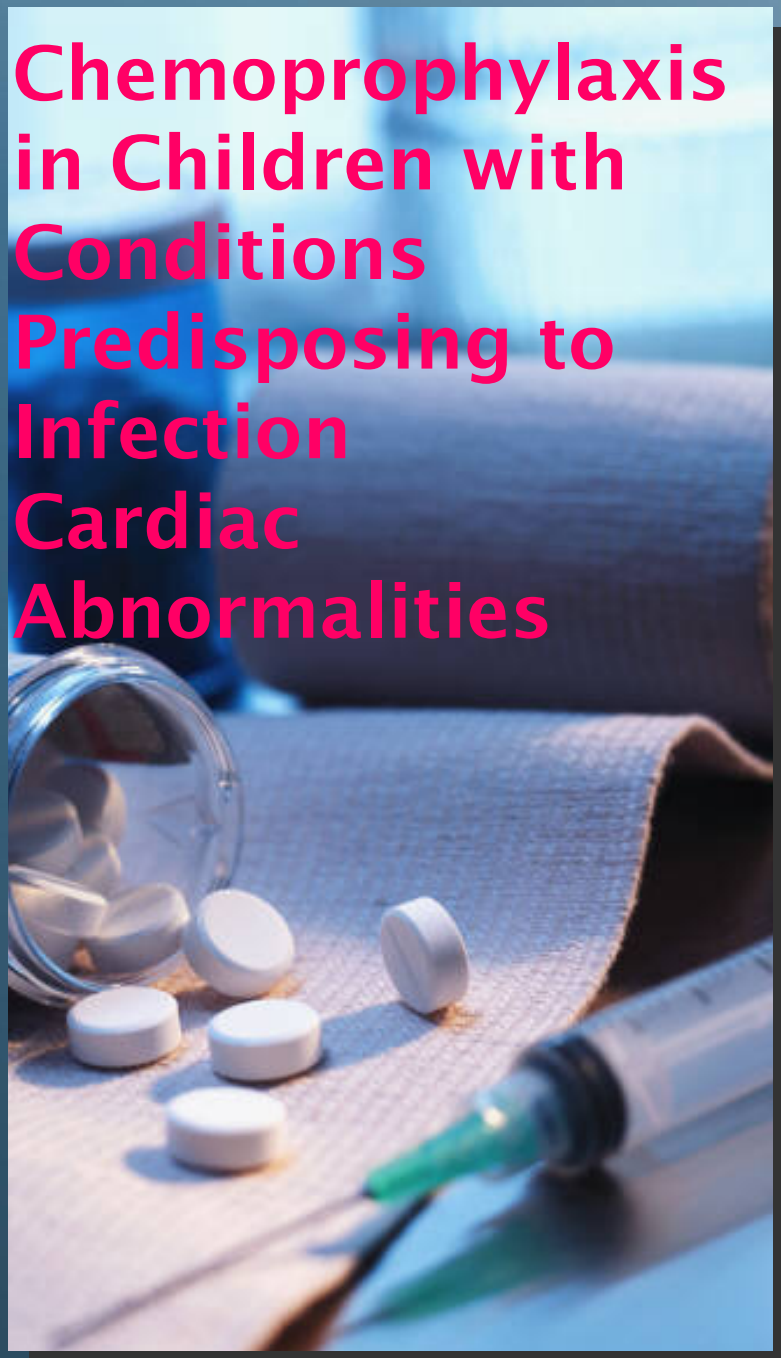
Disorder	Prophylactic Agent
Recurrent UTI	TMP-SMX (2 mg/kg OD for variable duration) Nitrofurantoin (1-2 mg/kg OD for variable duration)

- **Indicated in:**

1. Children with underlying anatomic or neurologic lesions leading to a higher risk of infection especially those with obstructive lesions or vesicoureteral reflux

2. Children without identifiable risk factors who suffer recurrent infections (3 or more UTI within a 1 year period)

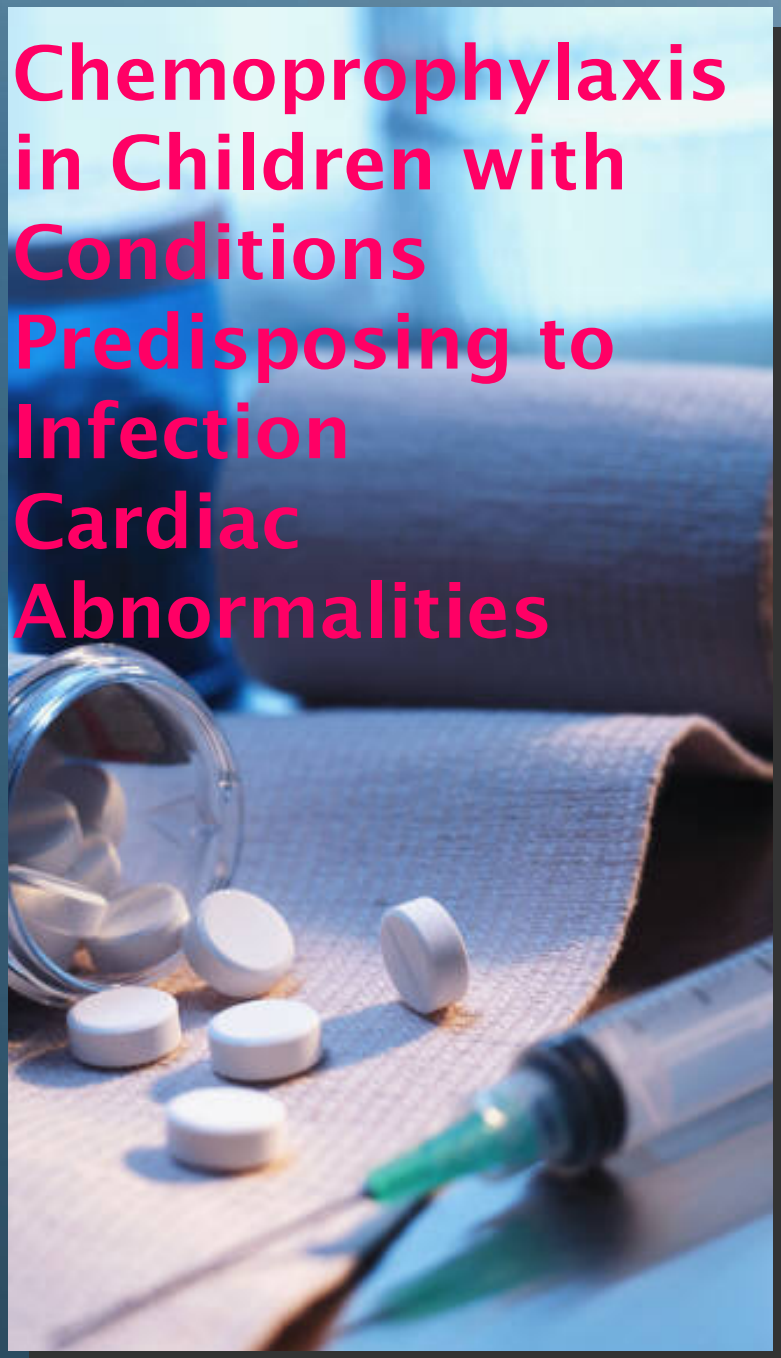
Chemoprophylaxis in Children with Conditions Predisposing to Infection Cardiac Abnormalities



- Cardiac conditions associated with highest risk of adverse outcome from endocarditis for which prophylaxis with dental procedures is recommended

  1. Prosthetic cardiac valve
  2. Previous infective endocarditis

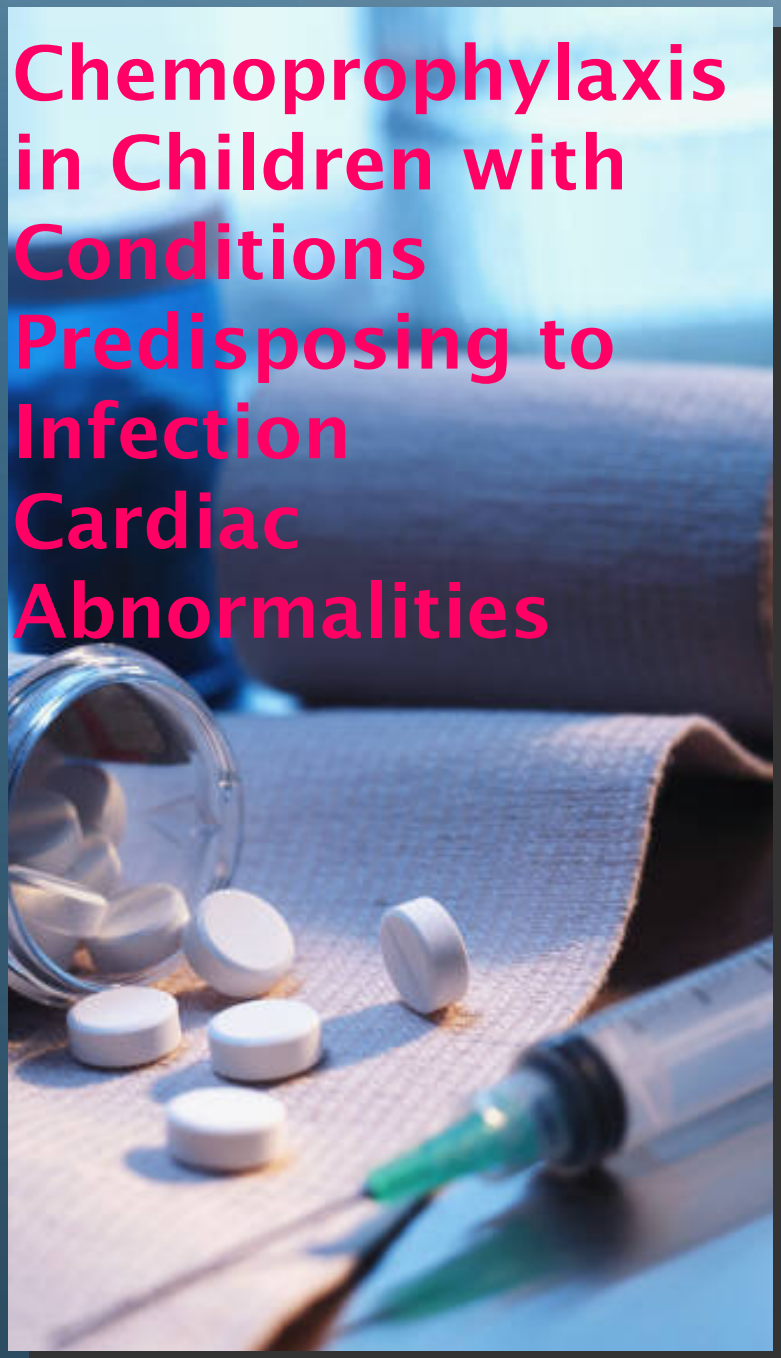
Chemoprophylaxis in Children with Conditions Predisposing to Infection Cardiac Abnormalities



- Cardiac conditions associated with highest risk of adverse outcome from endocarditis for which prophylaxis with dental procedures is recommended

3. Congenital heart disease
   a. Unrepaired cyanotic CHD including palliative shunts and conduits
   b. Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first 6 months of the procedure

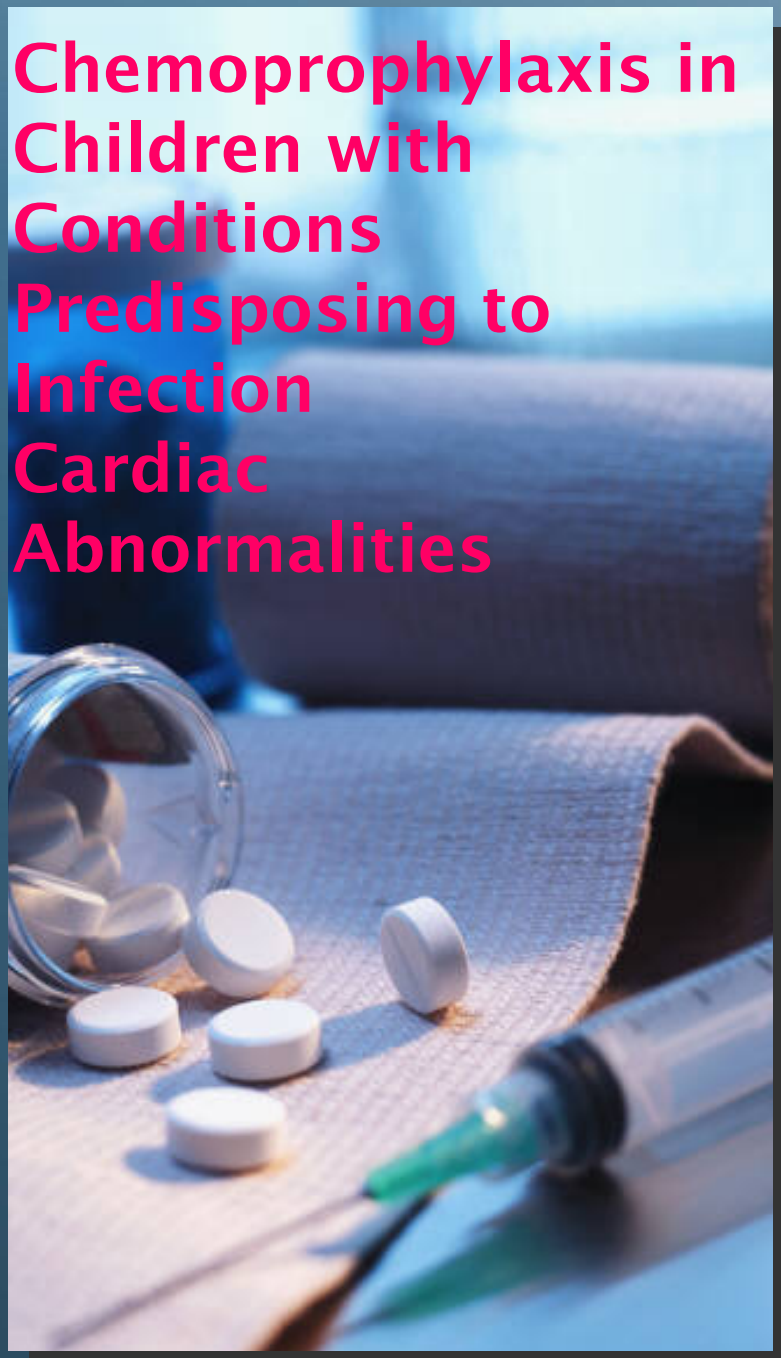
Chemoprophylaxis in Children with Conditions Predisposing to Infection Cardiac Abnormalities



- Cardiac conditions associated with highest risk of adverse outcome from endocarditis for which prophylaxis with dental procedures is recommended

3. Congenital heart disease
    c. Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
4. Cardiac transplantation in which cardiac valvupathy has developed

Chemoprophylaxis in Children with Conditions Predisposing to Infection Cardiac Abnormalities



- Dental procedures for which endocarditis prophylaxis is recommended for above-mentioned patients – All dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa – professional cleaning with gingival probing, biopsies, suture removal, placement of orthodontic bands

Chemoprophylaxis in Children with Conditions Predisposing to Infection

Disorder	Prophylactic Agent
Endocarditis – dental, oral or upper respiratory tract procedures	Oral - once 30 to 60 mins before the procedure) Amoxicillin (50 mg/kg) Clindamycin for penicillin allergic (20 mg/kg) IV - once 30 to 60 mins before the procedure) Ampicillin (50 mg/kg) Azithromycin (15 mg/kg) Clarithromycin

Chemoprophylaxis for Surgical Procedures and Trauma

- Antimicrobial prophylaxis reduces the incidence of wound infection after certain operations.
- Indicated when the benefits of preventing wound infection outweigh the risks of potential adverse effects of the prophylactic regimen, emergence of resistant bacteria, drug interactions, superinfection and cost

Chemoprophylaxis for Surgical Procedures and Trauma

- Antimicrobial prophylaxis should be used only for procedures with high infection rates such as surgery
  1. Involving mucosal surfaces so-called clean contaminated
  2. Involving implantation of prosthetic material
  3. Where the consequences of infection is especially serious

Classification of Operative Wounds and Risk of Infection

Classification	Criteria	Risk (%)
Clean	Elective, not emergency, nontraumatic; primarily closed; no acute inflammation; no break in technique; respiratory, GI, biliary, and GU tracts not entered	<2

Classification of Operative Wounds and Risk of Infection

Classification	Criteria	Risk (%)
Clean-contaminated	Urgent or emergent, otherwise clean; elective opening of respiratory, GI, biliary, or GU tract with minimal spill and not infected urine or bile; minor technique break	<10

Classification of Operative Wounds and Risk of Infection

Classification	Criteria	Risk (%)
Contaminated	Nonpurulent inflammation; gross spill from GI tract; entry into biliary or GU tract in the presence of infection; major break in technique; penetrating trauma <4 hours duration; chronic open wounds to be grafted or covered	~20

Classification of Operative Wounds and Risk of Infection

Classification	Criteria	Risk (%)
Dirty	Purulent inflammation (e.g., abscess); preoperative perforation of respiratory GI or GU tract; penetrating trauma >4 hours duration	~40

GI, gastrointerstinal; GU, genitourinary

Chemoprophylaxis for Surgical Procedures and Trauma

Surgical Procedures for which Antibiotic Prophylaxis is Recommended

- Biliary tract surgery
- Gastrointestinal surgery
- Gastroduodenal procedures
- Gynecologic surgery – hysterectomy, Cesarean section, Therapeutic abortion
- Head and neck surgery – incision through oral or pharyngeal mucosa

Chemoprophylaxis for Surgical Procedures and Trauma

Surgical Procedures for which Antibiotic Prophylaxis is Recommended

- Neurosurgery – CSF shunt, craniotomy
- Orthopedic surgery –open reduction of a fracture, prosthetic joint replacement, amputation, laminectomy and spinal fusion
- Urologic surgery
- Vascular and cardiothoracic surgery – pulmonary resection, prosthetic valve, CABG, pacemaker or defibrillator implant, cardiac catheterization, peripheral vascular surgery

Chemoprophylaxis for Surgical Procedures and Trauma Organisms involved

Type of Surgical Procedure	Most Common Etiologic Agent of Surgical Wound Infection
Clean surgery	*Staphylococcus aureus* or MRSA depending on predominant strain in the institution
Foreign body insertion	Coagulase negative staphylococci
Surgery of colon	Gram negative bacteria, anaerobes

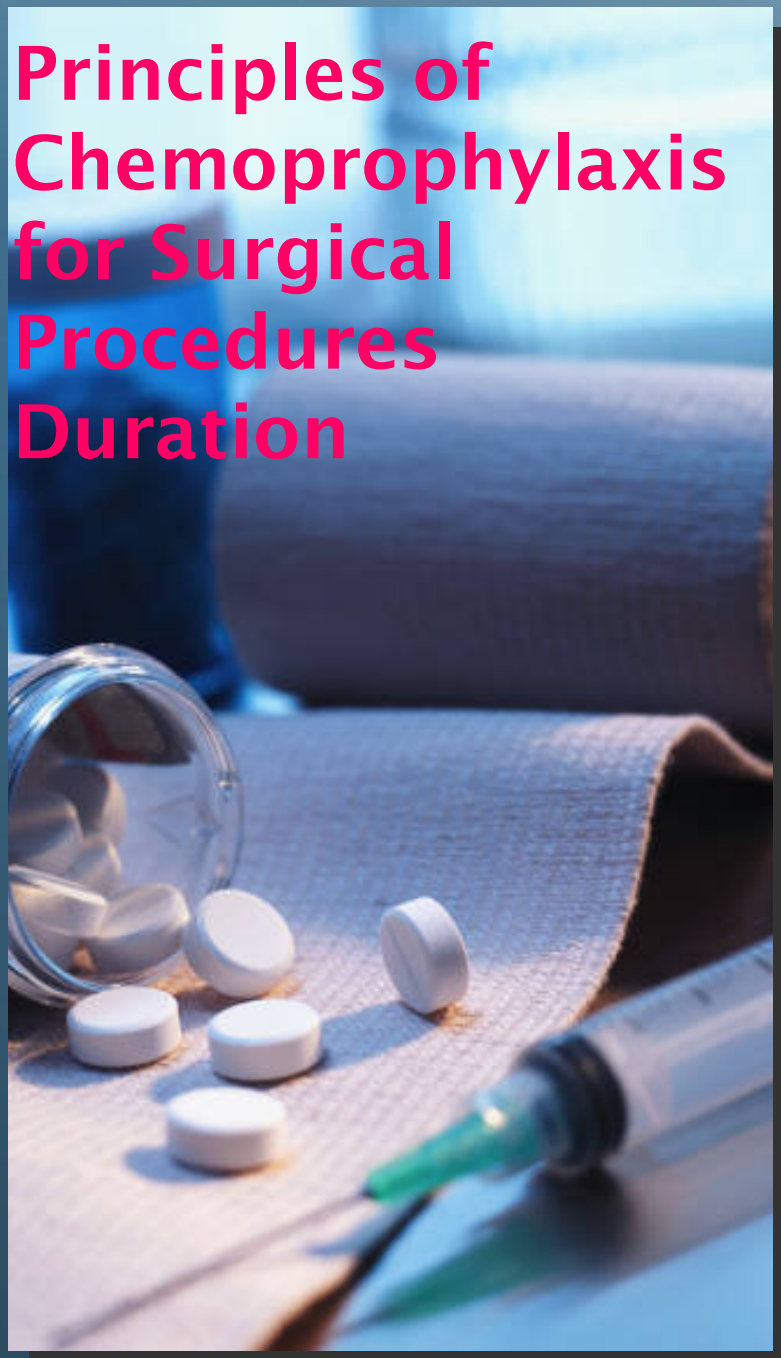
Chemoprophylaxis for Surgical Procedures and Trauma Organisms involved

Type of Surgical Procedure	Most Common Etiologic Agent of Surgical Wound Infection
Gynecologic surgery	Gram negative bacteria, beta Streptococci
Genitourinary surgery	Gram negative bacteria
Head and neck surgery	Oral anaerobes and other normal oral flora

Principles of Chemoprophylaxis for Surgical Procedures Timing

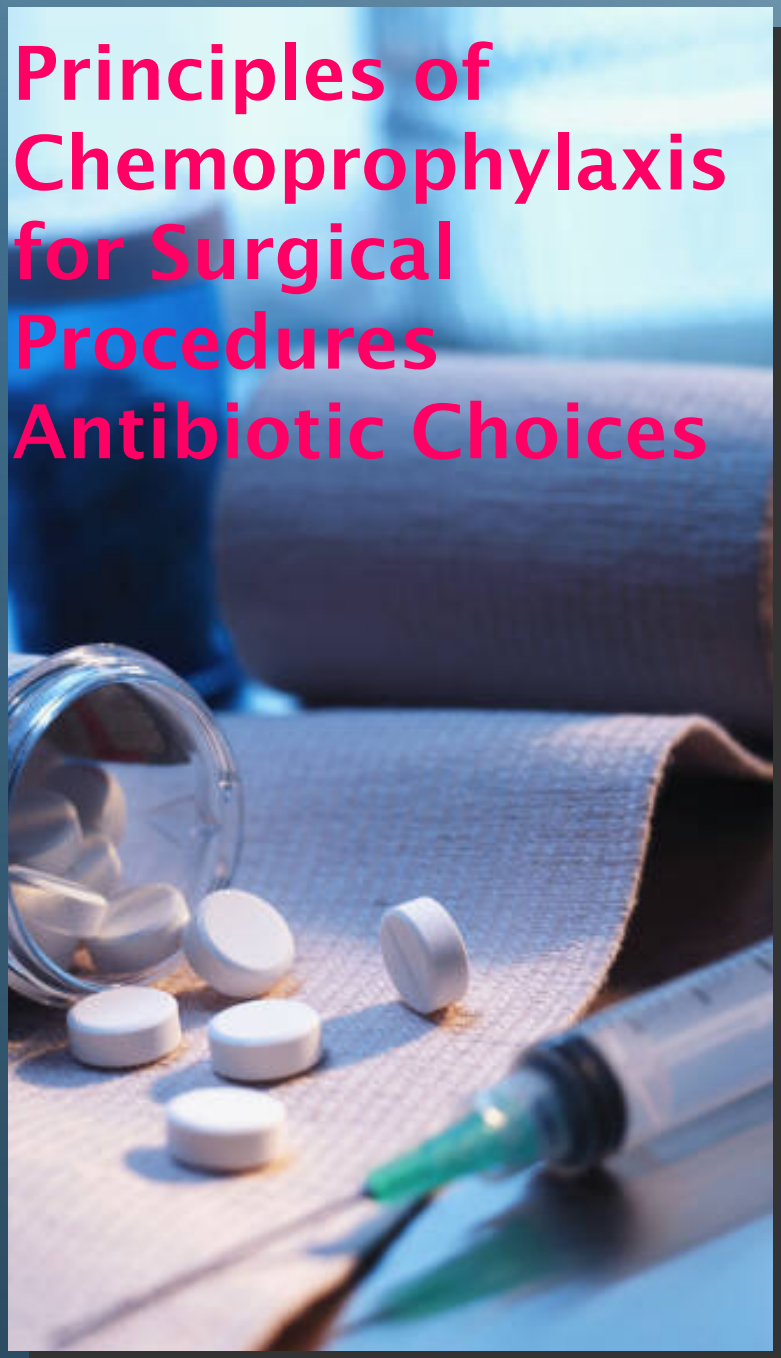
- Antibiotics must be given so that good tissue levels are present at the time of procedure and for the first 3 to 4 hours after the surgical incision
- Optimal time to give an antibiotic is 30 to 6o minutes before the incision is made
- For caesarian section, delay antibiotics until the umbilical cord is clamped

Principles of Chemoprophylaxis for Surgical Procedures Duration



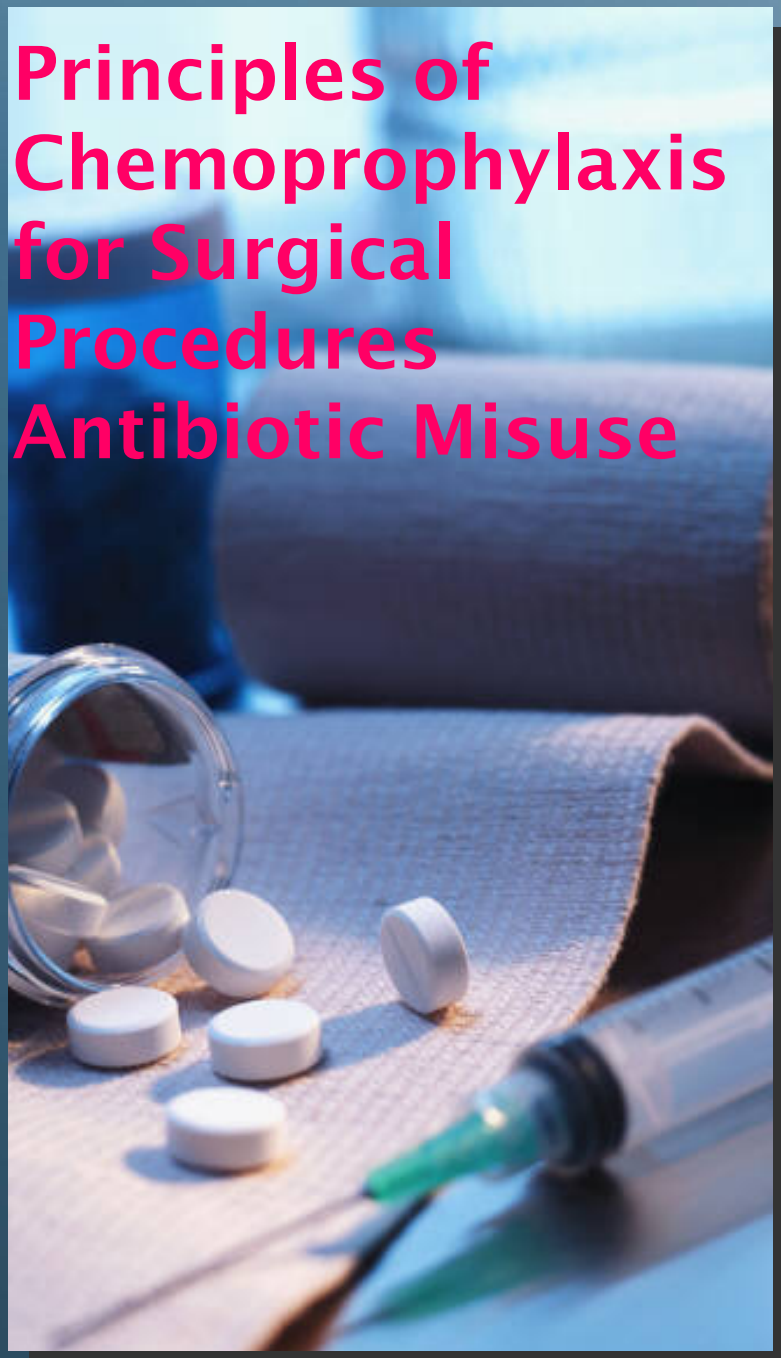
- A single dose is sufficient in most instances
- For prosthetic device insertion, up to 48 hours is used
- If procedure lasts several hours, redosing is suggested

Principles of Chemoprophylaxis for Surgical Procedures
Antibiotic Choices



- Cefazolin is favored for most surgical procedures because it is more active against *S. aureus* than the newer cephalosporins, is less expensive, does not suppress all bacteria, and has a moderately long serum half-life
- Cefotetan or metronidazole/gentamicin – preferred for colorectal surgery and appendectomy because of its additional activity against bowel anaerobes
- Vancomycin is used for antistaphylococcal activity if patient is allergic to cephalosporins or MRSA is a major hospital pathogen and prosthetic devices are being inserted

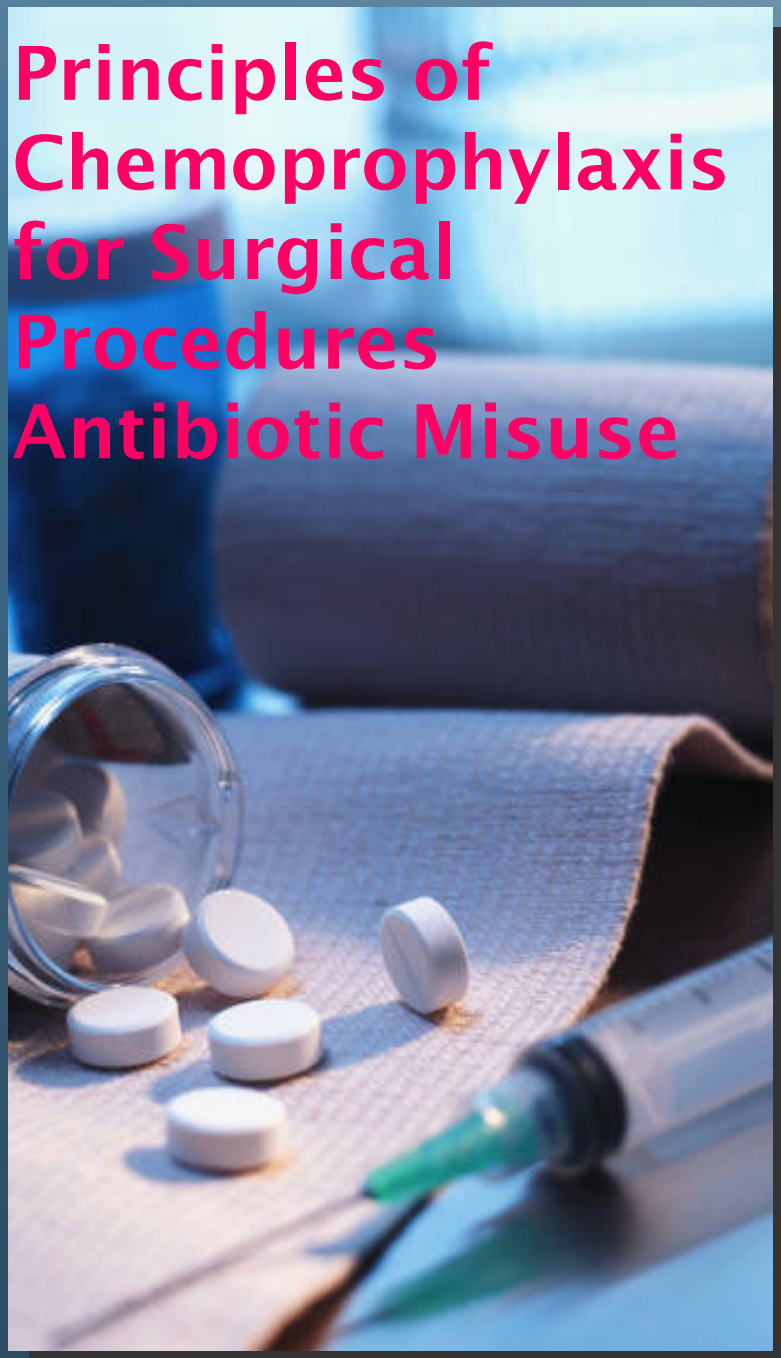
Principles of Chemoprophylaxis for Surgical Procedures Antibiotic Misuse



- Inappropriate choice, timing and duration of antibiotic prophylaxis is common in surgery
- Studies abroad:
  1. Utah Peer Review Organization evaluation of 21 hospitals, only 38% of patients received antimicrobial prophylaxis immediately before or during the operation and of 4753 days of use of prophylactic antibiotics, 3789 were considered excessive

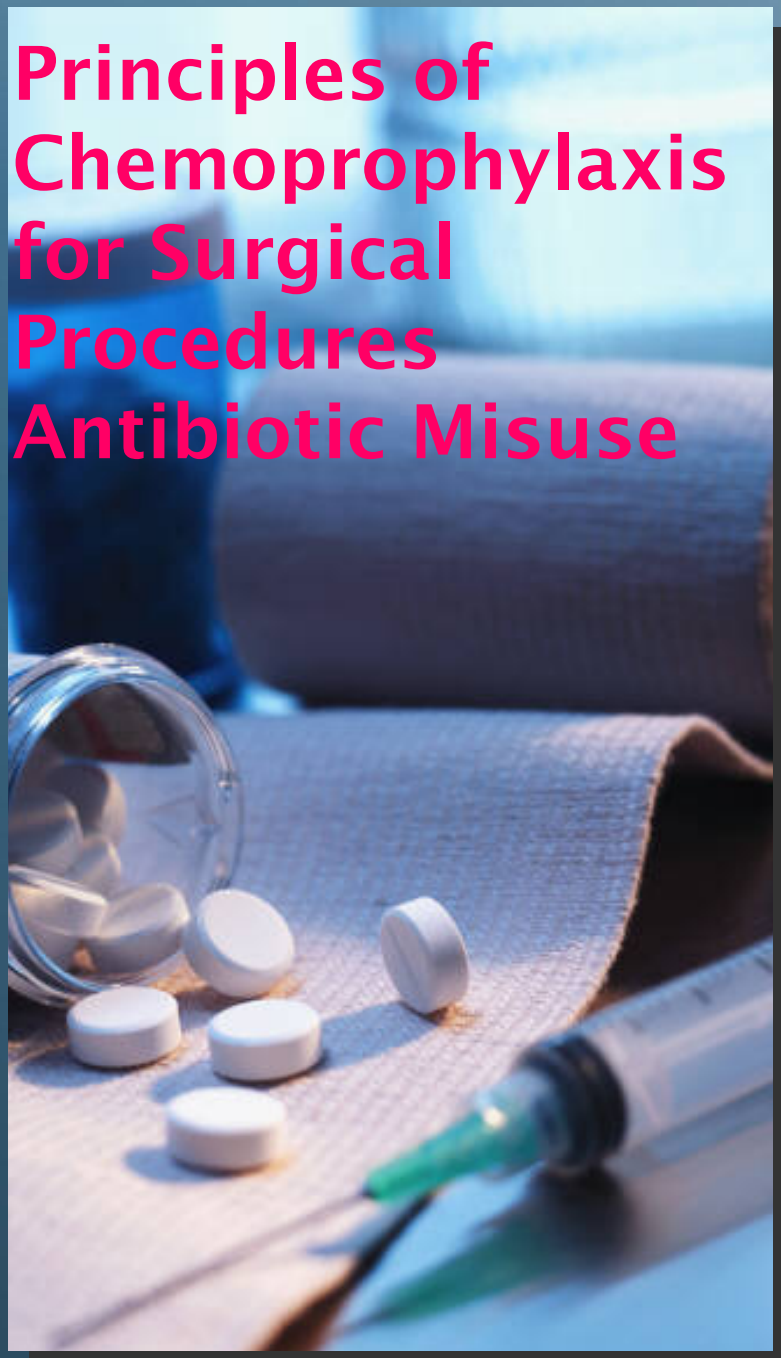
Utah Peer Review organization update, 1980; 3(1)

Principles of Chemoprophylaxis for Surgical Procedures Antibiotic Misuse



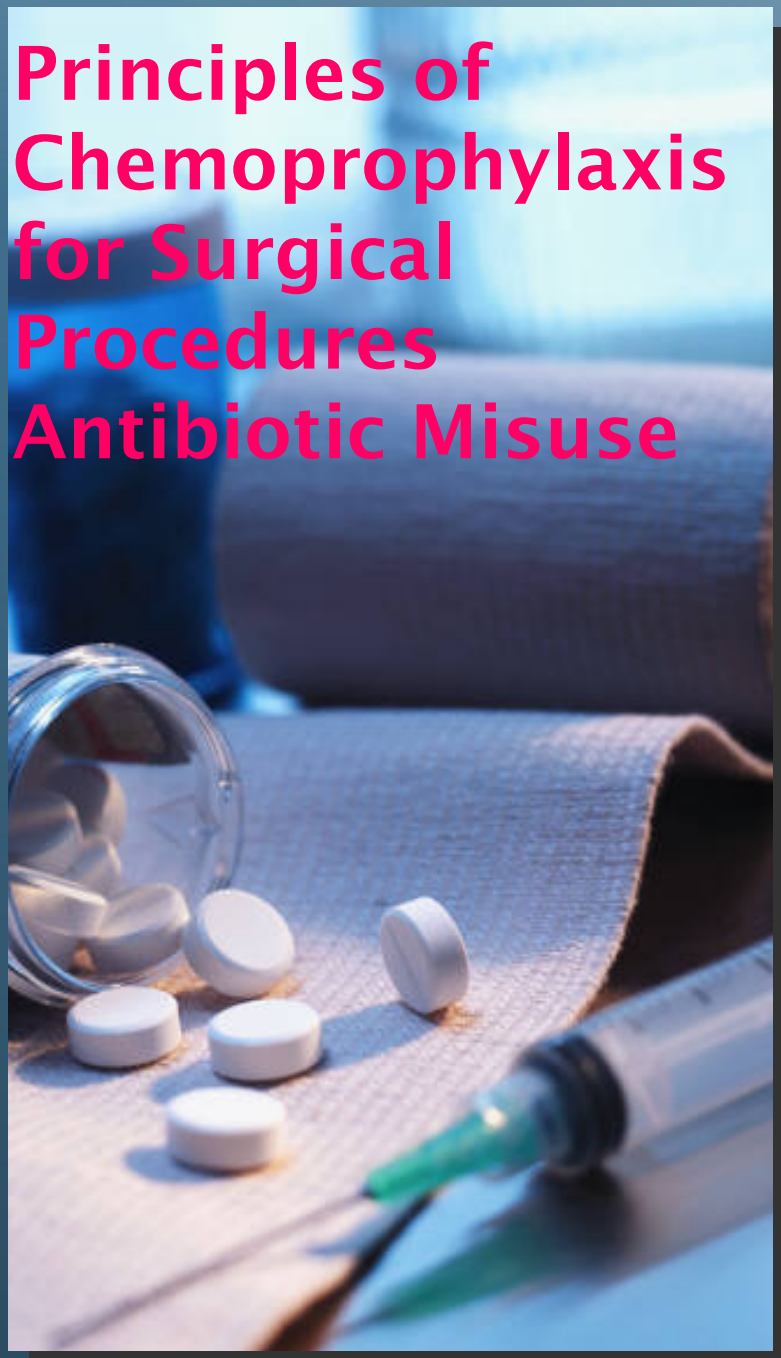
- Inappropriate choice, timing and duration of antibiotic prophylaxis is common in surgery
- Studies abroad:
  2. In, 1990 survey at LDS, University of Utah - more than half of overall use of antibiotics was inappropriate and 78% of inappropriate use involved antimicrobial prophylaxis in surgery

Principles of Chemoprophylaxis for Surgical Procedures Antibiotic Misuse

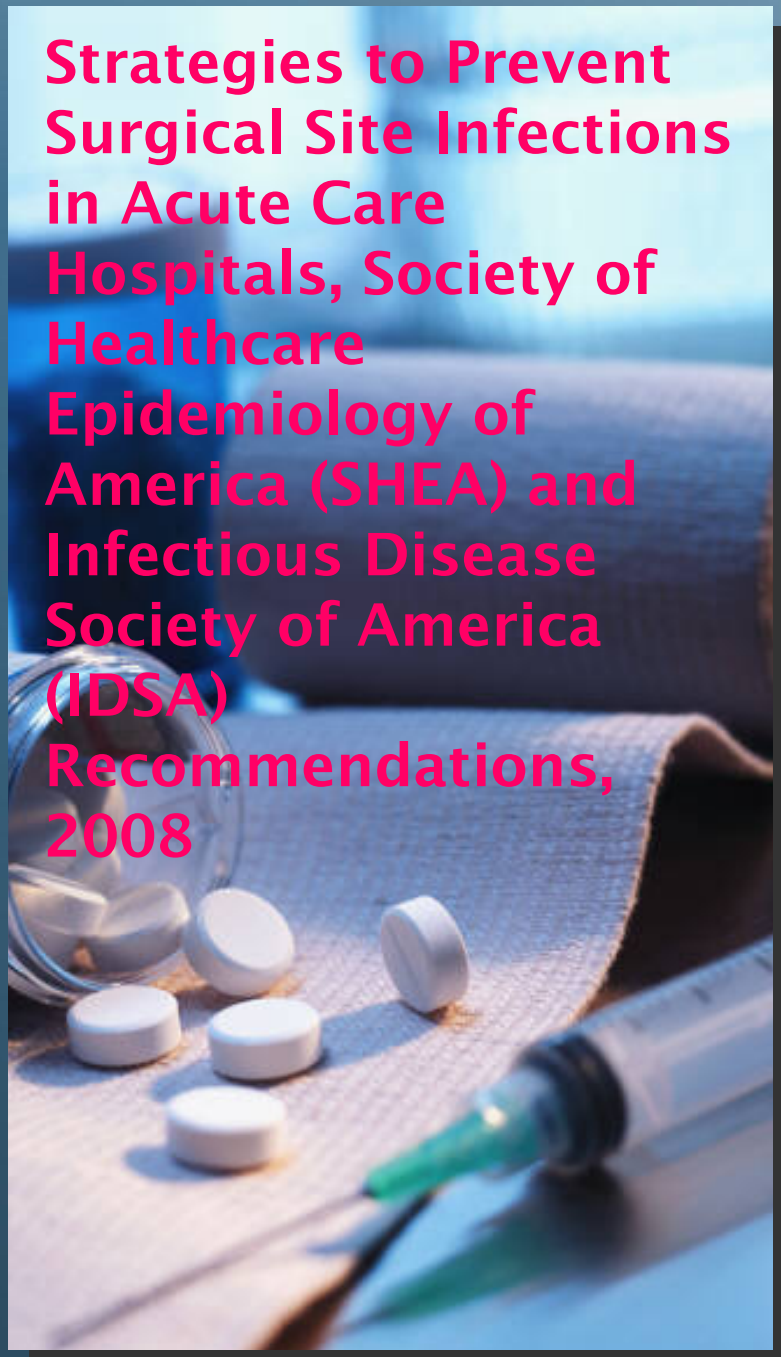


- Studies in the Philippines:
  - Dumo CC, Natino NF, Pena AC et al, PJMID 1995 – 89.4% of prophylactic antibiotics used for surgical procedures were inappropriately given at a big private hospital in Quezon City
  - Matti PRA, Querol RC, Antonio-Velmonte M et al, PJMID 2002 – 83.7% of 86 cases studies were given inappropriate antibiotic prophylaxis for elective surgical procedures at a university hospital in Manila

Principles of Chemoprophylaxis for Surgical Procedures Antibiotic Misuse

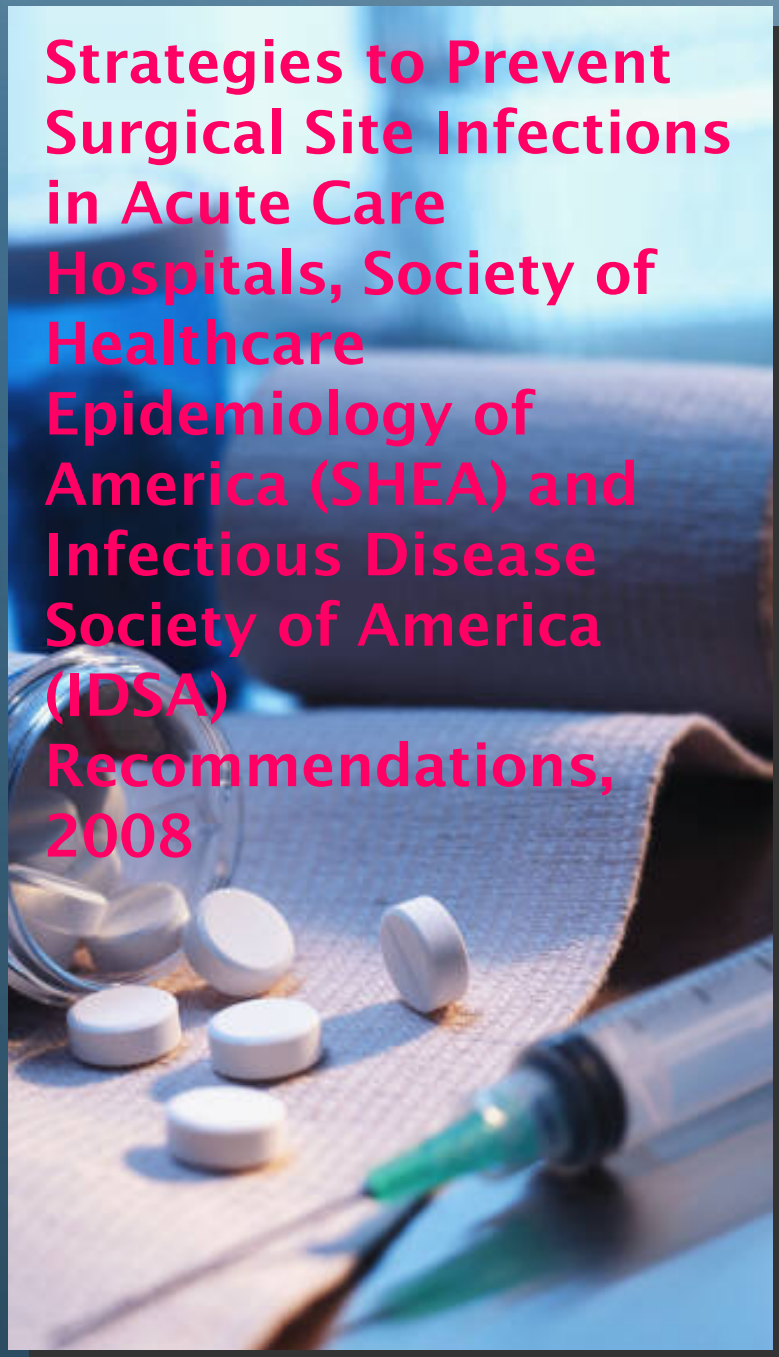


- Studies in the Philippines:
  - Flores AMP, Pena AC, Buenconcejo LS. PJMID 2004 – 92.4% of surgical cases at a tertiary care government hospital in Quezon City were given inappropriate antibiotic prophylaxis



Antibiotic Prophylaxis

- Administer only when indicated
- Timing - administer within 1 hour before incision to maximuize tissue concentration
- Choice – select appropriate agents on the basis of surgical procedure, most common pathogens causing SSI for a specific procedure and published recommendations



Antibiotic Prophylaxis

- Duration of therapy – stop prophylaxis within 24 hours after the procedure for all procedures except cardiac surgery where prophylaxis should be stopped within 48 hours

Strategies to Prevent Surgical Site Infections in Acute Care Hospitals, SHEA and IDSA Recommendations for Implementing Prevention and Monitoring Strategies, 2008

1. Measure and provide feedback to providers on the rates of compliance with process measures for prevention and monitoring of SSI including antimicrobial prophylaxis
2. Educate surgeons about SSI prevention
3. The hospital's senior management should be made responsible for ensuring that healthcare system supports an infection prevention and control program that effectively prevents occurrence of SSI

Thank You….