

Hospital Infection Control

- * **Nosocomial infections** are infections acquired in the hospitals.
- * **Standard precautions** used to prevent transmission of diseases due to contact with blood, body fluids, non-intact skin & mucous membranes , contaminated items or possible droplet infections.
- * These precautions are used when dealing with any individuals (medical staff or patients) whether appear **healthy or infectious**.
- * **Standard precautions** include the followings :

I) Hand hygiene :

- **The most effective** precaution to prevent nosocomial infections.
- This include **washing the hands with soap and water and the use of alcohol gel** to decontaminate the hands.
- This should be performed **before and after** contact with the patient, after touching blood ...etc (even when gloves are worn during contact), before eating, after using restroom and after coughing or sneezing.

II) Personal protective equipment :

- Gloves should be worn when touching bloodetc.
- Surgical masks, gown and goggles are used if there is chance of spray or splash of blood or body fluids.
- In the operating room, covering the head with surgical cap.



III) Safe handling of needles and sharp instruments to prevent health care workers exposure to blood born infections.

- Used needle should be **discarded immediately** after use and not recapped or removed from the syringe.
- Used needles, scalpels or sharp instruments should be **placed in sharps plastic waste container.**



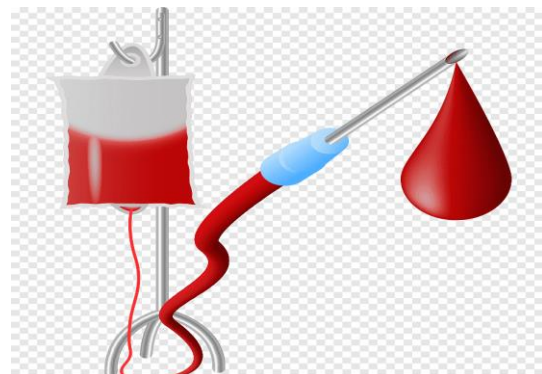
Plastic medical sharp container (waste box)

III) Safe injection practice :(to prevent hepatitis B, hepatitis C & HIV infections)

- Use a new needle and syringe with each injection of a patient and every time a medical vial or IV bag is accessed.



Medical vial



IV bag

V) Special precautions when operating on patient with **viral hepatitis or HIV :**

- Medical staff prone to blood born virus infections should be **vaccinated** against **hepatitis B virus** but there are no vaccination against hepatitis C and HIV.
- Clear **documentation** in the patient's records.
- Wear a full face high quality **mask**.
- **Eye protection**.
- Use disposable waterproof gowns.
- **Scrub** hands before and after the operation.
- Wear **double gloves**.
- Receives **sharps** (as needles & scalpels) , to and from the surgeons , indirectly in a **kidney basin** .



VI) Decontamination :

- It is the removal of microbial contamination by one of the followings :

A) Cleaning :

- It is the **removal of visible contamination**.
- It is a **necessary** prerequisite for effective **disinfection** and **sterilization**.

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- Cleaning must occur first **before disinfection** because disinfectants are not effective in presence of dirt and organic matter.



Organic matter

B) Disinfection :

- It is the **reduction** of viable **micro-organism** to **acceptable levels** .
- **Antiseptics** are topical disinfectants that can be **safely** applied to the **epithelial tissues** e.g. :
 - 1) **Povidone** iodine used for **skin** preparation , **hand wash** and **open wounds**. It is effective against **Gram positive** and gram **negative** organisms .
 - 2) Ethyl alcohol 70% used for **skin** preparation .
- Disinfection of medical instruments by **boiling water** .
- **Chemical disinfection** as Glutaraldehyde (Cidex) for short duration .

C) Sterilization :

- It is **complete destruction** of all micro-organisms (bacteria , spores , viruses & fungus) by one of the following methods :

- 1) Heat:** The standard method for sterilization is autoclaving (steam at 134 °C , under 2 atmospheric pressure for 20-30 minutes) .

Autoclave



2) Chemical sterilization :

- ♣ It used **if heat is not suitable** for sterilization.
- ♣ **Glutaraldehyde (Cidex)** at **long** immersion time e.g. immersion of endoscopes and laparoscopes control bacteria and hepatitis virus and HIV. The instruments should be **washed with sterile saline** after its use as glutaraldehyde is toxic .

3) Irradiation : as **gamma** or ultraviolet rays for **industrial** sterilization of **catheters or syringes** .

4) Gas sterilization :

- ♣ **Ethylene oxide gas** for **wrapped** equipments.
- ♣ **Gas plasma** for delicate **catheters** and endovascular wires.

Antibiotics

* **Choice of suitable antibiotic** :depends on the following factors:

- 1)Initial diagnosis** and the **initial antibiotic** chosen should be effective against the possible causative organism.
- 2)Relevant samples** e.g. pus, urine or sputum, should be obtained for **culture and sensitivity** before the first dose of antibiotic is given.
- 3)The change** from one antibiotic to another should be based mainly on the **clinical response** and result of **culture & sensitivity**. If there is satisfactory clinical response we don't change antibiotic.
- 4)The dose and duration** of antibiotic course depend on the pathology, clinical and laboratory assessment. Unnecessary high dose or prolonged course of antibiotic should be avoided whenever possible to avoid its toxicity.
- 5)Toxic or costly antibiotic** should be avoided if an equally effective substitute exists.
- 6)Patient factors:** allergy to antibiotic, renal & hepatic functions, tolerance to oral drugs, age, immunity and if female whether pregnancy or lactating.

* **Important points related to antibiotic therapy in surgical practice :**

- 1) Antibiotic prophylaxis** is administration of antibiotic before surgical procedure (preoperative antibiotic).

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- The best timing is **30-120 minutes** before the incision.
- If surgical procedure is **prolonged, another dose** of antibiotic is added during the operation (intra-operative).
- Usually it needs **not to exceed** the operation period. It is **extended only for one day** after the operation (perioperative antibiotic prophylaxis) if there is gross contamination as **colonic or rectal surgery**.
- This achieves **high tissue level** of antibiotic to **prevent bacteria** from getting foothold when contamination occurs.
- **Surgical site infections** including post-operative wound infections are markedly decreased by **antibiotic prophylaxis**.
- The first line of treatment of **post-operative wound infection** :
 - **Early before pus** formation is antibiotics.
 - **After pus formation**: drainage of pus by partial removal of sutures .

2) Cefazolin (first generation cephalosporin) is the best prophylaxis in **gastroduodenal** surgery , **cardiothoracic** surgery , **orthopaedic** surgery and **neurosurgery** .

- **In penicillin allergic patient fluroquinolone (e.g. ciprofloxacin)** is the antibiotic of choice .

3) Combination of Cefazolin and **metronidazole** (for anaerobic bacteria) is the best prophylaxis in **colo-rectal** surgery .

- **In penicillin allergic patient fluroquinolone (e.g. ciprofloxacin) with metonidazole or clindamycin is the combination of choice** .

4) Normal colonic bacteria residence are mixture of **Gram negative bacilli** and **anaerobes**.

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- Combination of oral **metronidazol (flagyl) and neomycin** , cover all colonic bacteria , for 2 days used for **colonic preparation** .
 - **Perioperative antibiotic prophylaxis** to prevent post-operative infection in colonic surgery by parenteral **ciprofloxacin & flagyl** .
- 5) The duration** of antibiotic therapy is **usually 3-6 days except** in **fecal peritonitis** (the most dangerous infection) , the duration is **10-15 days** .
- 6) Bacteroides** are the **commonest anaerobic** organism in surgical practice.
- Anaerobes are **sensitive to** metronidazole , clindamycin ,ampicillin & amoxicillin .
- 7) Pseudomonas aeruginosa** is aerobic **Gram negative bacilli** , commonly cause **nosocomial infections** as UT infections , pneumonia and septicaemia .It produce **green pus** .
- It is increasing **resistance** to antibiotics and may develop resistance during treatment.
 - The **best treatment** is usually **combination of 2** of the followings quinolones (e.g. ciprofloxacin) , carbapenems (e.g. imipenem) , 3rd generation cephalosporins (e.g. ceftriaxone) and aminoglycosides (e.g. gentamycin) .
 - In general the use of **aminoglycosides should be limited** due to their **ototoxicity and nephrotoxicity** and it is better to use safe alternative.
- 8) A penicillin allergic** patient is likely to have allergy to **cephalosporins** .
- The standard **alternative** in this case is **erythromycin**.

9) Clavulanic acid is a beta lactamase inhibitor.

- **Addition** of Clavulanic acid to **amoxicillin** extends its spectrum to include beta lactamase producing bacteria.

10) E.coli is the commonest organism cause **UT infections** .

- The **commonest antibiotic** used in UT infections are septrim , bactrim , Nitrofurantoin (Macrochantin, Macrobid) or quinolones (Ciprofloxacin) .

11) The commonest organism cause **biliary infections** are Gram negative bacteria (E.coli and Klebsiella).

- The **commonest antibiotic** used in biliary infections are one of the followings :
 - Mezlocillin or piperacillin .
 - Combination of ampicillin plus aminoglycoside for short period to avoid nephrotoxicity.
 - Cefazolin or Ciprofloxacin.

12) The main organism which cause clostridial gas gangrene is **clostridium perfringens** which was previously known as **clostridium Welchii**).

13) Nasal carriers of Staph. aureus play a major role in **Nosocomial infections. Eradication** of the carrier state among hospital staff **reduce** the incidence of such infections.

14) Staph. aureus & streptococci are sensitive to cephalosporins (e.g. **Cefazolin**), amoxycillin, & erythromycin.

15) Oral bacterial flora: include streptococci, staphylococci , anaerobes especially bacteroides , Granulicatella, Gemella, and Veillonella , lactobacilli , corynebacteria .

16) Cutaneous bacterial flora: streptococci, , staphylococci Enterobacter, Klebsiella, Escherichia coli, and Proteus .

17) In severe infections as acute generalized septic peritonitis or septic shock a **combination of a cephalosporin (e.g. cefazolin), aminoglycoside (e.g. gentamicin)& metronidazole cover all organisms.** When the results of **culture** are available, antibiotics can be changed.

* **Complications of Antibiotics :**

1) Hypersensitivity reaction :

- Common with **penicillin and streptomycin.**
- The reaction range from urticaria , fever , angioneurotic oedema , asthma and anaphylactic shock .

2) Vitamin B deficiency due alteration of intestinal flora with prolonged use of antibiotics .

3) Specific toxicity as nephrotoxicity and ototoxicity with aminoglycosides .

4) Superinfection: Caused by resistant organisms as proteus , pseudomonas or candida → infections in mouth , intestine , UT or lungs .