INFECTION CONTROL IN OPERATION THEATRE

DR RAHUL KAMBLE

MBBS, MD Microbiology

Diploma Infectious Diseases (UNSW, Australia)

CC infection Control (Harvard Medical School)

Six Sigma Black Belt (GOI Certified)

CIA-JCI, NABH, NABL, RBNQA

PGDBA, PGDHM,PGDHA, PGDSR, PGDCR,

PGDOM, PGDMLS, PGDHI, PGDIM, PGDBI

Infection Control Philosophy

The aim of ICP is to eliminate the infection as quickly as possible and to ensure that patients, staff, equipment and floors are not a source of infection because

- Contamination of the operating theatre is a major cause of nosocomial infection.
- Good hygiene practice in hospitals and in operating theatres is mandatory to minimise nosocomial postoperative infections.

Safe environment of physical plant and storage space in restricted area of the OT

All the floors in the operating room (s) should be:

- Hard
- Seamless
- Easy to clean
- Without drains
- All the walls in the operating room (s) are free of fissures, or crevices
- All the ceilings in the operating room (s) are seamless and easy to clean
- There is one or more scrub sink areas with running water with elbow/foot taps for surgical scrubbing outside of the operating room (s)
- There is an area to store sterile and/or high-level disinfected supplies, instruments and equipment with:
    - Limited access to the storage area
    - Closed cabinets/ or Shelves

The operating theatre must be clean.

Absence of blood, dust, soil, debris, trash, insects and spider webs in the following sites:

1. Floors
2. Walls
3. Ceilings
4. Windows
5. OT lamps
6. Chairs
7. Sinks for surgical scrub
8. Tabletops and counters
9. Ledges and any other flat surfaces
10. OT tables
11. Trolleys
12. Equipment:
    a. Oxygen cylinders
    b. Suction machines
    c. Anesthesia equipment
13. Storage area
14. Recovery beds
15. Toilets

Aseptic techniques during surgical procedures.

Scrubbed personnel:

1. **Remove jewelry**
2. **Wear clean scrub suit** covering bare arms (one or two pieces)
3. **Wear clean surgical cap** or hood that covers hair
4. **Wear gumboots** or impervious closed shoes
5. **Wear sterile gown**
6. **Wear sterile surgical gloves**
7. **Wear double gloves if** the procedure involves coming in contact with large amount of blood or other body fluids (e.g. C-sections), and/or if the procedure is longer than 30 minutes
8. Wear protective eyewear
9. Wear face masks covering mouth and nose
10. Touch only sterile items or areas
11. Replace sterile gloves, as promptly as safety permits, if they become contaminated or torn during the procedure
12. Keep arms and hands within the sterile field at all times
13. Keep talking to a minimum in the presence of a sterile field
14. Keep forearms above the waist level
15. Never place hands under the upper arms

Surgical scrub properly performed before each surgical procedure (1)

- Keep fingernails short and healthy - do not polish nails

If it is a water and antiseptic soap scrub:

- Turn on and adjusts the water
- Hold hands above the level of the elbow, wet hands thoroughly and apply soap or an antiseptic soap
- Begin at the fingertips, lathers and rubs vigorously
- Wash between all fingers
- Move from fingertips to elbows of one hand and repeat for the other hand
- Use of a brush or sponge is unnecessary
- Wash for 2-5 minutes using **antiseptic soap**
- Rinse each forearm separately, fingertips first, holding hands above level of elbows
- Use a separate clean cloth towel for each hand to wipe from fingertips to the elbow and then discard the towel
- Hold hands above the level of the waist and away from the body without touching anything
- Immediately wear sterile garb/gown

Surgical scrub properly performed before each surgical procedure (2)

If it is hand washing followed by use of a waterless alcohol-based hand rub:

- Turn on and adjusts the water
- Hold hands above the level of the elbow; wet hands thoroughly and applies soap
- Thoroughly wash hands and forearms to the elbow with soap and water for 2 minutes
- Use of a brush or sponge is unnecessary
- Rinse each forearm separately, fingertips first, holding hands above level of elbows
- Dry hand and forearms thoroughly with a clean dry towel or air dry
- Apply 5 ml (about one teaspoonful) of a waterless, alcohol-based hand rub to hands, fingers and forearms, and rub until dry
- Repeat application and rubbing 2 more times for a total of at least 2 minutes, using a total about 15 ml of the hand rub
- Hold hands above the level of the waist and away from the body and avoid touching anything
- Immediately wear sterile garb/gown

The operating room is set up properly before each surgical procedure.

Tables, Mayo stands and ring stands are:

- Organized side by side
  - In an area that is away from the traffic flow
  - At least 46 cm from walls, cabinets and other non-sterile surfaces
- A clean sheet is placed on the OT bed
- A clean leak-proof container for soiled linen is placed away from sterile items
- Puncture-resistant containers to dispose off sharps are placed away from the sterile items
  - A leak-proof plastic bag is placed in each container for waste disposal
- Clean plastic containers with fresh 0.5% chlorine solution are placed in the OT room
- Supplies that are checked and ready to open are placed on the tables
- Mayo stand and other non-sterile surfaces are covered with sterile barrier materials if they are to be used during the procedure

Non-scrubbed personnel follow the aseptic techniques during surgical procedures.

Patient's skin is properly prepped before surgical procedures to prevent infections

- Patient wears a clean gown and is covered with clean linen
- Hair is not shaved around the operative site
  - If hair must be cut, it is trimmed close to the skin surface with scissors immediately before surgery in an area outside of the OT room
- If visibly soiled, the operative area is cleaned with soap and water, and dried before applying an antiseptic
- Sterile gloves are worn for the prepping procedure
- Patient's skin is thoroughly cleaned from the operative site outward for several centimeters in a circular motion
- If prepping contaminated areas (e.g., abdominal-perineal or abdominal-vaginal areas), 2 separate prepping procedures are done using different prep trays, solutions and gloves; the contaminated area is done first, covered with a sterile towel, and then the other area is prepped
- Antiseptic is not allowed to pool underneath the patient's body
- Antiseptic is allowed to dry before beginning the procedure

Sterile field must remains sterile during surgical procedures.

- Sterile fluids, equipment and supplies are opened and delivered to the sterile surface without contacting the edges of the wrapper or container
- Non-scrubbed personnel open wrapped supplies by the wrapper flap farthest away from them first, and then the nearest wrapper flap last
- Sterile items are presented to the scrub person or placed securely on the sterile field
- Solutions are poured slowly into the container held by the scrub person or placed near to the table edge
- Sterile pick up forceps are pre-packed and used to open wraps or to pick up gauze or sterile supplies or instruments for one patient only

Controlled traffic flow during surgical procedures.

Doors to the OT room are kept closed during the entire procedures, except during movement of personnel, patients, supplies and equipment

The number of personnel entering the OT room during the surgical procedure is limited to those necessary to perform the procedure

Instruments, linen and waste are properly disposed after surgical procedures to avoid injuries and cross-contamination.

- Personnel wear gloves when handling soiled instruments, linen and waste
- All waste (e.g. gauze, cotton wool, dressing, etc.) are disposed of in a leak proof container with leak proof plastic bag
- Instruments are placed in a 0.5% chlorine solution for 10 minutes for decontamination
- When using regular needles and syringes these are flushed three times with 0.5% chlorine solution and immediately disposed of in a puncture-resistant container, without removing, recapping or breaking the needle
- All blades and other disposable sharps are disposed of in a puncture-resistant container
- Soiled linen is placed in a leak proof container
- Sterile gloves are removed, after being immersed in a 0.5% chlorine solution, and placed in a leak proof container
- Hand hygiene is performed after removing gloves:
- Wash hands with running water and soap for 10–15 seconds and dry with an individual clean towel, paper towel or allows hands to air-dry

The OT rooms must be properly cleaned after each procedure.

- Housekeeping personnel wear utility gloves and other personal protective equipment during cleaning
- All waste is collected and removed from the room in closed leak proof containers
- Soiled linen is removed in closed leak-proof containers
- Blood and body fluid spills are mopped with 0.5% chlorine solution, and then cleaned with detergent and water
- All horizontal surfaces that have come in immediate contact with a patient or body fluids are cleaned with a disinfectant cleaning solution
- The OT bed is cleaned, and all surfaces and mattress pads are wiped with a disinfectant-soaked, lint-free cloth
- The center of the OT room surrounding the bed is cleaned with a disinfectant cleaning solution (if visibly soiled)

i.e. Two buckets are used:

- One with the disinfectant cleaning solution
- One with clean water for rinsing

After the room is cleaned, hand hygiene is performed after removing gloves:

- Wash hands with running water and soap for 10–15 seconds and dry with an individual clean towel, paper towel or allows hands to air-dry

A disinfectant cleaning solution must be prepared properly.

Cleaning solution is prepared as follows:

- A 0.5% chlorine solution is prepared
- Detergent without an acid, ammonia or ammonium is added to the 0.5% chlorine solution until a mild soapy cleaning solution is made.

The cleaning equipment must be decontaminated, cleaned and dried before reuse or storage.

Mops, buckets, brushes and cleaning cloths are:

- Decontaminated by soaking for 10 minutes in 0.5% chlorine solution or other approved disinfectant
- Washed in detergent and water
- Rinsed in clean water
- Dried completely before reuse or storage

Collection of medical waste must be performed properly to prevent injuries and contamination.

- **Medical waste (e.g. cotton wool, gauze, etc)** must be placed in a washable container with a leak-proof plastic bag
- Containers are closed and collected when ¾ full or daily if not ¾ full

Flow and activity patterns in the CSSD designed to avoid cross-contamination.

- Traffic is limited to authorized personnel only
- Personnel are required to wear surgical attire including head cover
- Receiving/clean-up area separated with a physical barrier (wall and/or door) from the processing area
- **The receiving/clean-up area must have**:
    - A receiving counter
    - At least one sink with running water
    - A counter for instruments to dry

  A clean work area for wrapping/packing with:
    - A large work table
    - Shelves for holding clean package
    - At least an autoclave and/or a dry heat oven
- **Storage area for clean supplies, instruments and equipment with:**
    - Shelves for storing clean equipment
    - Office desk for record keeping
- **Store for sterile and/or high-level disinfected supplies, instruments and equipment with:**
    - Limited access to the storage area
    - Closed cabinets/ or shelves

CSSD cleanness

Absence of blood, dust, soil, debris, trash, insects and spider webs in the following CSSD sites:

1. Floors
2. Walls
3. Ceilings
4. Windows
4. Chairs
5. Sinks for clean-up
6. Tabletops and counters
7. Ledges and any other flat surfaces
8. Trolleys
9. Storage area
10. Toilets and bathrooms

Decontamination of instruments and other articles after use and before cleaning.

Surgical instruments must be processed according to standardised and validated methods

Liquid chlorine:

- if using JIK (3.5%), 1 part bleach for 6 parts water, **or**
- If using a concentration of 5%, 1 part bleach to 9 parts water, **or**

Powder chlorine:

- if using Calcium hypochlorite (35%), 14 grams bleach powder for 1 liter water, **or**
- if using Calcium hypochlorite (70%), 7 grams bleach powder for 1 liter water

A new chlorine solution is prepared at the beginning of each day or sooner if needed

- Clean containers with fresh 0.5% chlorine solution are used for each surgical procedure
- Instruments and other items are soaked in the 0.5% chlorine solution for 10 minutes
- After 10 minutes, instruments and other items are removed from the chlorine solution; washed in soapy water then rinsed in clean water.

Steps of cleaning instruments and recommendations:

Staff

- **Wears:**
  - Utility gloves
  - Mask and eyewear protection **or** face shield
  - Plastic apron
  - Head cover
  - Gumboots or enclosed shoes
- **Utilizes:**
  - Soft brush
  - Detergent (liquid or powder)
  - Scrubs instruments and other items under the surface of water, completely removing all blood and other foreign matter
  - Disassembles instruments and other items with multiple parts and cleans in the grooves, teeth and joints with a brush
- **Rinses**
  - **rinses instruments and other items** thoroughly with clean water
- **Allows instruments and other items to air-dry, or dries with a clean towel**
- **Washes hands after removing gloves:**
  - Washes hands with running water and soap for 10–15 seconds and dry with an individual clean towel, paper towel or allows hands to air-dry, **or**
  - Rubs hands with 3–5 ml of an alcohol-based solution until the hands are dry (if hands **are not** visibly soiled)

The process of loading the sterilizer.

If using steam sterilization (autoclave):

- Ensure space (around 7-8 cm) between the packages and the walls
- Packs (linen) must rest on their edge, in loose contact with each other
- Bottles, solid metal and glass containers with dry materials are placed on their sides with lids held loosely in place
- Canisters, utensils and treatment trays (if a solid tray) are on their sides
- Instrument trays (mesh or perforated bottom only) are placed flat on shelves
  - Maximum dimensions and weight of packs are: 30 x 30 x 50 cm or 5 kg
- There is sufficient space between packs to allow steam circulation
- Solutions are sterilized in a separated load

AND/OR

If using dry-heat sterilization:

- Ensure space (around 7-8 cm) between the packages and the walls
- Must have enough space between packs and containers (sterilizer is not overloaded)

Packaging process of items to be sterilized.

The instruments should be clean and dry

If packaging items to for steam sterilization (autoclave):

- Cloth items should laundered, dried and have **no** holes
- All jointed instruments **must be in opened or in unlocked position**
- All instruments must be disassembled

The types of materials used for wrapping:

- Cloth wraps, muslin or cotton: double wrapping using two double-thickness wraps (4 layers in all). [Canvas or other waterproof material is **never used** for wrapping]

Packages should be a bit loose to allow steam penetration

AND/OR

If packaging items to be sterilized through dry-heat:

- The types of materials used:
  - Cloth wraps, muslin: double wrapping using two double-thickness wraps (4 layers in all), **or**
  - Metal drum

The sterilization process

Standard conditions to be followed:

- **If steam sterilization (autoclave)**:
  - 20 minutes for unwrapped items or 30 minutes for wrapped items at 121 ºC (250 ºF) in a gravity-displacement sterilizer, **and/or**
  - 4 minutes at 132 ºC (270 ºF), in a pre-vacuum sterilizer, **and/or**
  - Other depending on the type of item, whether it is wrapped or unwrapped and the type of sterilizer (according to the manufacturer's instructions)

AND/OR

- **If dry-heat sterilization**:
  - 170 ºC (340 ºF) for 1 hour after achieving the desired temperature (total cycle between 2–2.5 hours), **and/or**
  - 160 ºC (320 ºF) for 2 hours after achieving the desired temperature (total cycle between 3–3.5 hours)

The process of unloading the sterilizer

If using steam sterilization (autoclave):

- Door is open 12–14 cm after the sterilizing cycle has been completed, and the chamber pressure gauge reaches “0”
- 30 minutes are allowed before unloading the sterilizer, **for pack and instruments to dry** (not applicable if drying cycle is used)
- Packages must be dry before unloading
- If a loading cart is used, the cart is removed from the sterilizer and placed away from open window or fan until it is cool
- If no cart is used, packs are laid out on a surface padded with paper or fabric, away from open windows or a fan until they are cool
- Unnecessary handling of the packs is avoided
- When packs have cooled to room temperature, they are dispensed or placed into a sterile storage area

If using dry-heat sterilization:

- Packs/containers must be laid out on a surface padded with paper or fabric, away from open windows or a fan until they are cool
- Packs/containers cool to room temperature before handling
- Unnecessary handling of the packs/containers is avoided
- When packs/containers have cooled to room temperature, they are dispensed or placed into a sterile storage area

Maintenance routine for sterilizers.

- **Steam sterilization (autoclave)**:
  - Chamber is cooled before any procedure is undertaken (cleaning or loading)
  - Outlet screen is removed and cleaned with detergent and a brush under running water
  - Chamber is cleaned daily using a soft cloth [Abrasive cleanser or steel wool is avoided to clean the autoclave]
  - All doors or lid gaskets are cleaned with a lint-free cloth and defects are checked
  - Defective gaskets are replaced, if necessary
  - Shelves, basket or cart that hold packs are cleaned with a soft cloth with detergent and water

AND/OR

- **Dry-heat sterilization**:
  - The oven is cleaned daily using a soft cloth, detergent and water
- **Every two weeks (observe or check in the records)**:
  - The temperature gauge is checked every two weeks by placing a thermometer in the oven and comparing the reading with the one in the gauge

Storage process for sterile items.

Observe if:

- Clean supplies are stored separated from the sterile items
- Unwrapped items are used immediately
- Sterile packs have sterilization and expiration dates
- There is a rotation and an inventory system to control the use of sterile items
- The packs are free of tears, dampness, dust and gross oil
- The sterile packs are reprocessed ç not used after 14 days

Monitor system for the effectiveness of the sterilization.

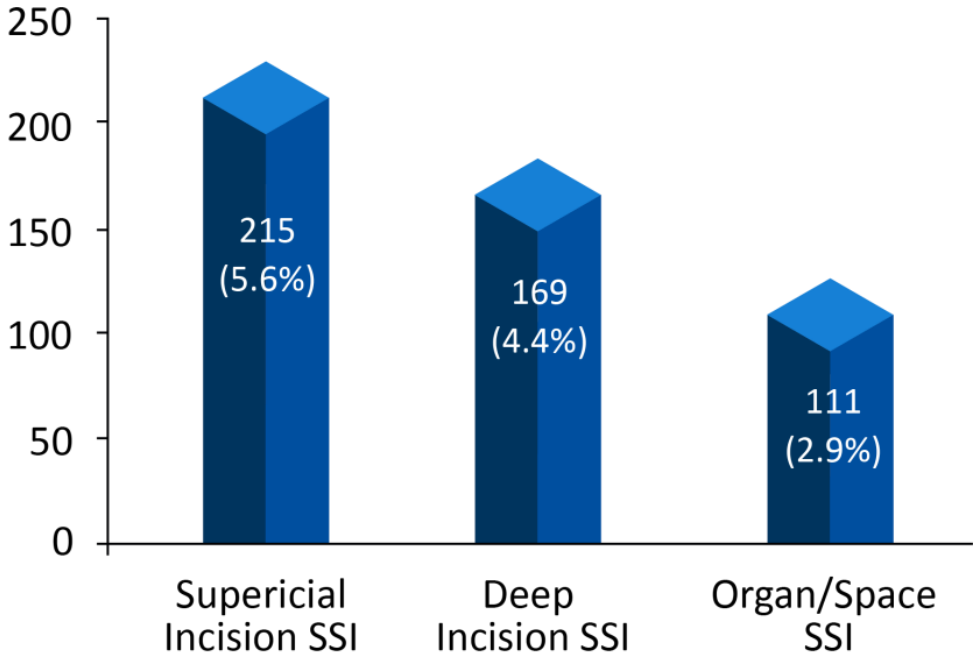
- **Steam sterilization (autoclave)**:
  - There is a manual or automatic recording chart with time, temperature and pressure for each load
  - The chart or log is completed and reviewed after each load

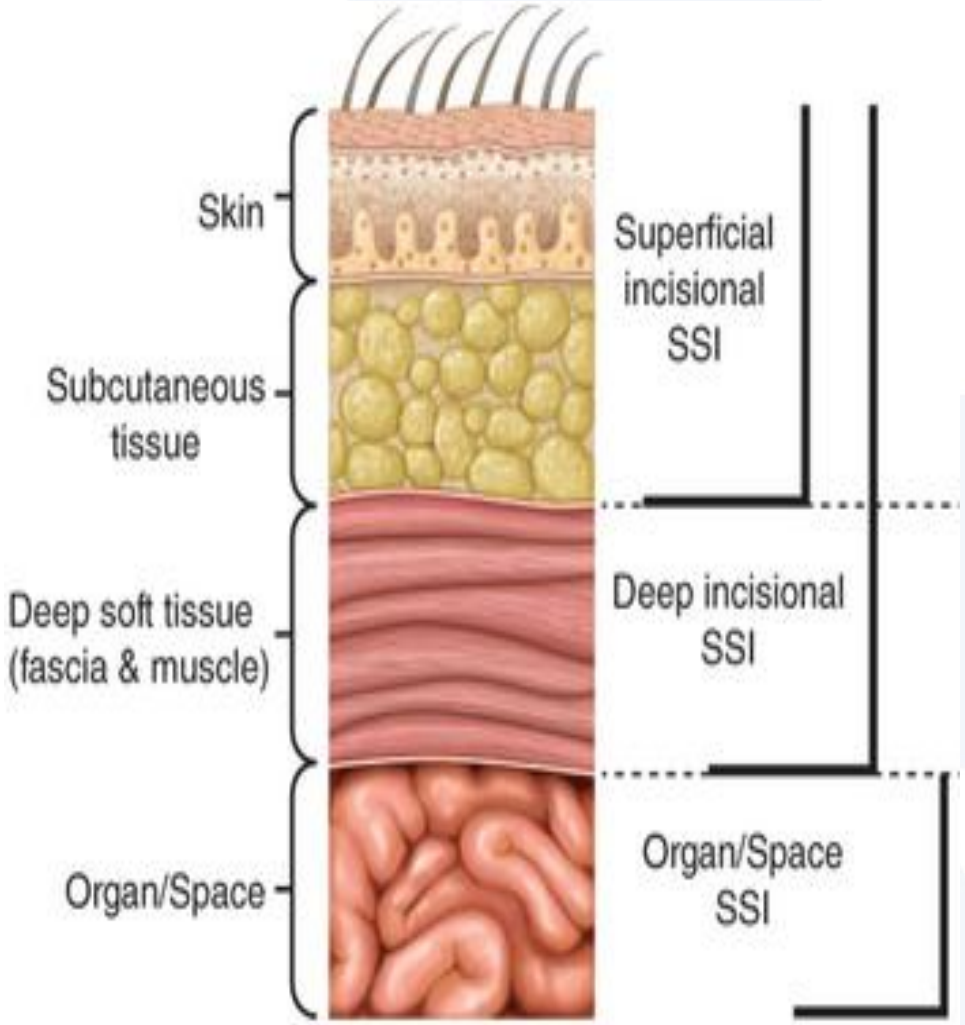
AND/OR

- **Dry-heat sterilization**:
  - Must have a manual or automatic recording chart with time and temperature for each load
  - The chart or log should be completed and reviewed after each load
- **Correcting sterilization failure**: If monitoring indicated a failure in sterilization, the following corrective measures were taken and registered:
  - Equipment should be checked immediately to make sure it has been used correctly
  - If the correct use of the unit has been documented and monitoring still indicates a failure, the use of the unit is discontinued and the unit is serviced
  - Any instrument or other item that has been processed in the unit is reprocessed properly

WHO defines SSI as

- infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue of the incision and/or the deep soft tissue of the incision and/or any part of the anatomy other than the incision that was opened or manipulated during an operation





Onyekwelu I et al. J Am Acad Orthop Surg Glob Res Rev. 2017 Jun; Kumar A et al. Int Surg J. 2017 Sep;4(9):3101-3106; Global guidelines for the prevention of surgical site infection, second edition. Geneva: World Health Organization; 2018.

Table 2. Surveillance Periods for SSI Following Selected NHSN Operative Procedure Categories. Day 1 = the date of the procedure.

30-day Surveillance			
Category	**Operative Procedure**	**Category**	**Operative Procedure**
AAA	Abdominal aortic aneurysm repair	LAM	Laminectomy
AMP	Limb amputation	LTP	Liver transplant
APPY	Appendix surgery	NECK	Neck surgery
AVSD	Shunt for dialysis	NEPH	Kidney surgery
BILI	Bile duct, liver or pancreatic surgery	OVRY	Ovarian surgery
CEA	Carotid endarterectomy	PRST	Prostate surgery
CHOL	Gallbladder surgery	REC	Rectal surgery
COLO	Colon surgery	SB	Small bowel surgery
CSEC	Cesarean section	SPLE	Spleen surgery
GAST	Gastric surgery	THOR	Thoracic surgery
HTP	Heart transplant	THYR	Thyroid and/or parathyroid surgery
HYST	Abdominal hysterectomy	VHYS	Vaginal hysterectomy
KTP	Kidney transplant	XLAP	Exploratory laparotomy
90-day Surveillance			
Category	**Operative Procedure**		
BRST	Breast surgery		
CARD	Cardiac surgery		
CBGB	Coronary artery bypass graft with both chest and donor site incisions		
CBGC	Coronary artery bypass graft with chest incision only		
CRAN	Craniotomy		
FUSN	Spinal fusion		
FX	Open reduction of fracture		
HER	Herniorrhaphy		
HPRO	Hip prosthesis		
KPRO	Knee prosthesis		
PACE	Pacemaker surgery		
PVBY	Peripheral vascular bypass surgery		
VSHN	Ventricular shunt		

Notes:

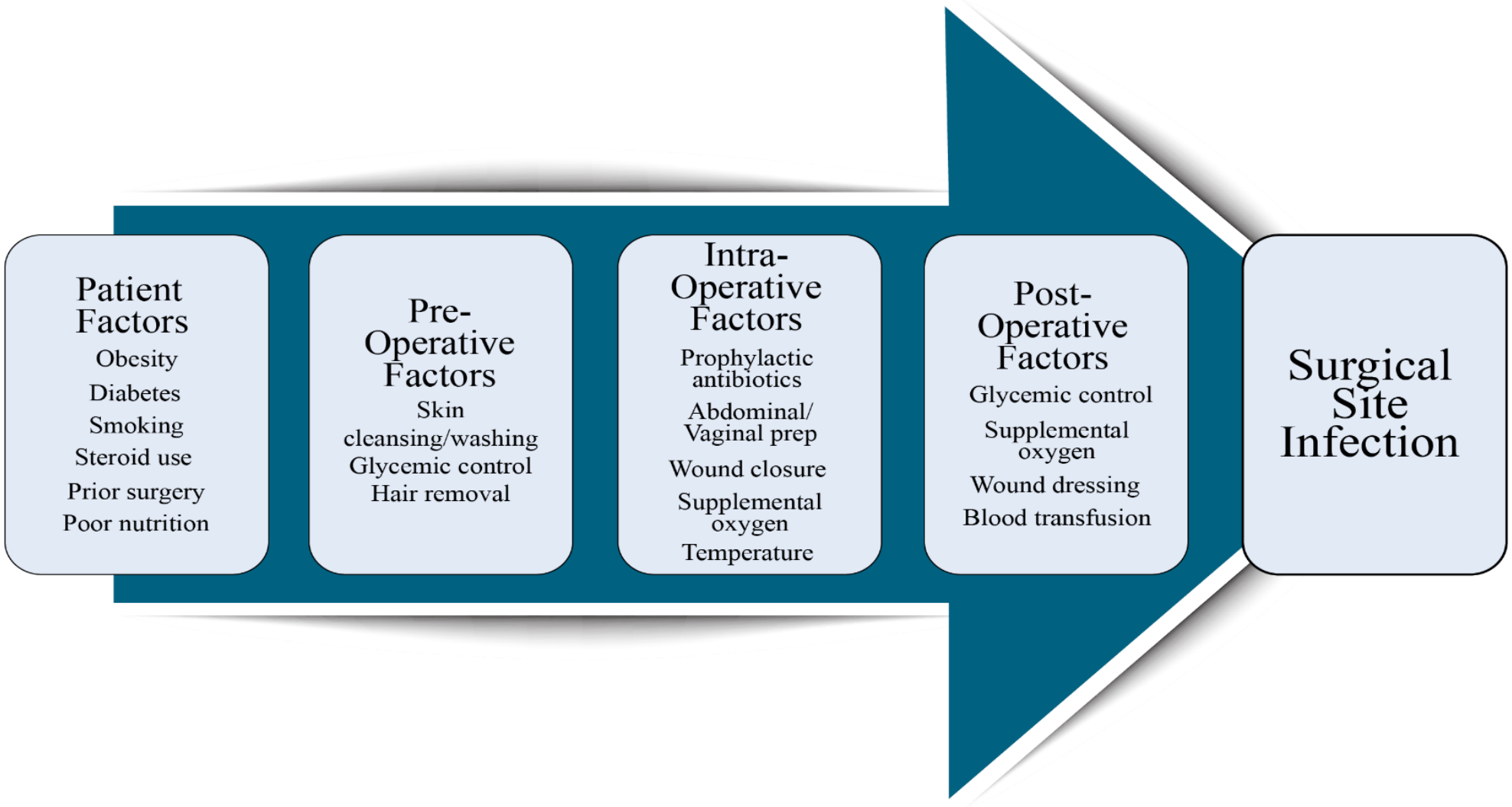
- Superficial incisional SSIs are only followed for a 30-day period for all procedure types.

CDC criteria for classification of surgical wounds

Wound Class	Definition	Risk of SSIs
Clean	Any incision through non-infected material NOT in major tract	≤2%
Clean-contaminated	Baseline in GI, respiratory, reproductive, urinary tracts	5-15%
Contaminated	Dry and active gangrene with inflammation e.g. inflamed non-perforated appendix	>15%
Dirty/infected	Incision through infected material, spilled purulence or fecal material, wet gangrene e.g. inflamed perforated appendix with presence of purulence outside of appendix	>30%

Zinn, J., Swofford, V. (2014. *Wound Care Advisor*. 3(1), 32-38. VanWicklin, S.A., Brubaker, S.A. (2015). *Association of Perioperative Registered Nurses Continuing Education Clinical Issues.* 102(3), 299-303

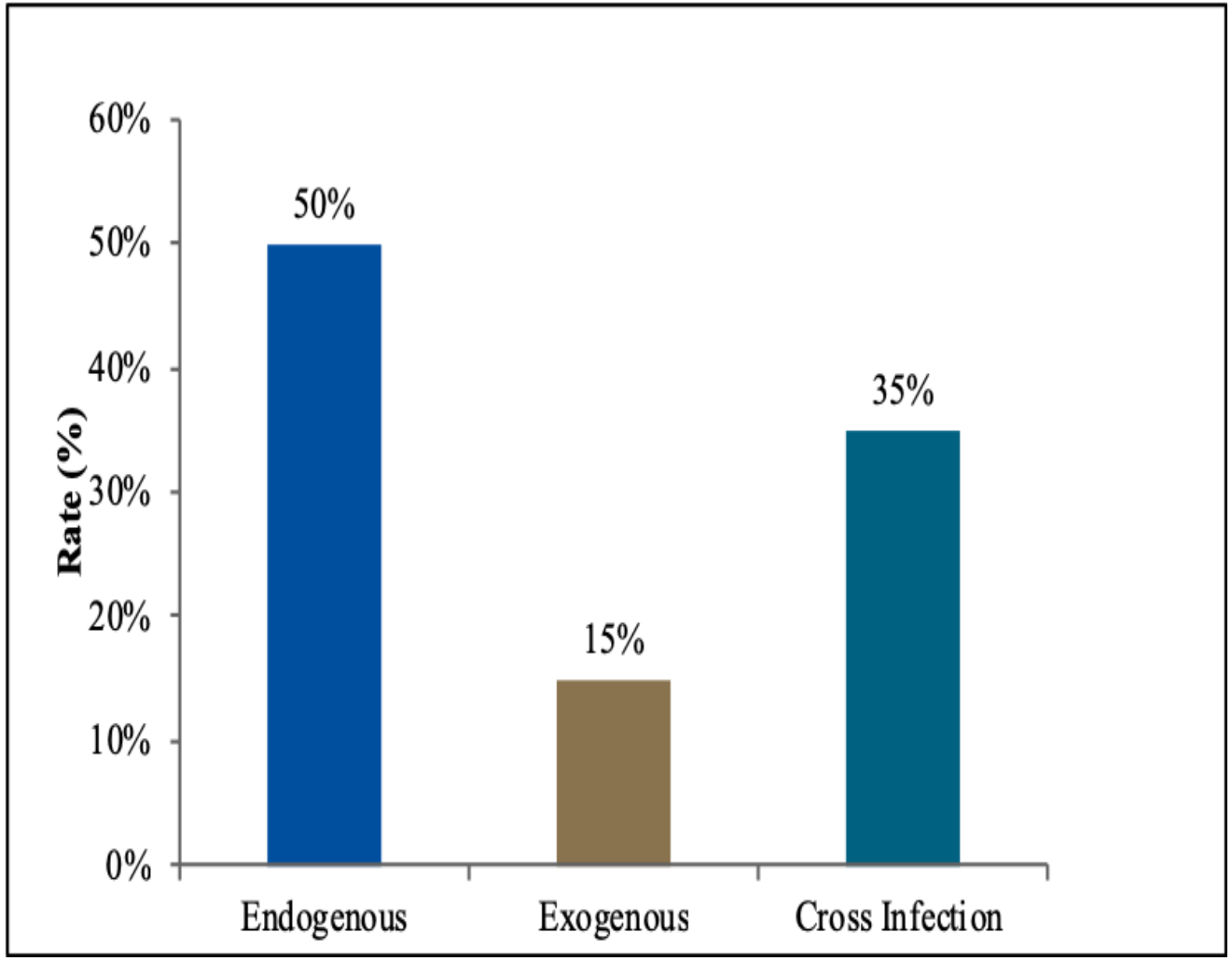
SSIs arise from a complex interaction of several factors



Global guidelines for the prevention of surgical site infection, second edition. Geneva: World Health Organization; 2018. ; Steiner and Strand. Am J Obstet Gynecol. 2017 Aug;217(2):121-128.

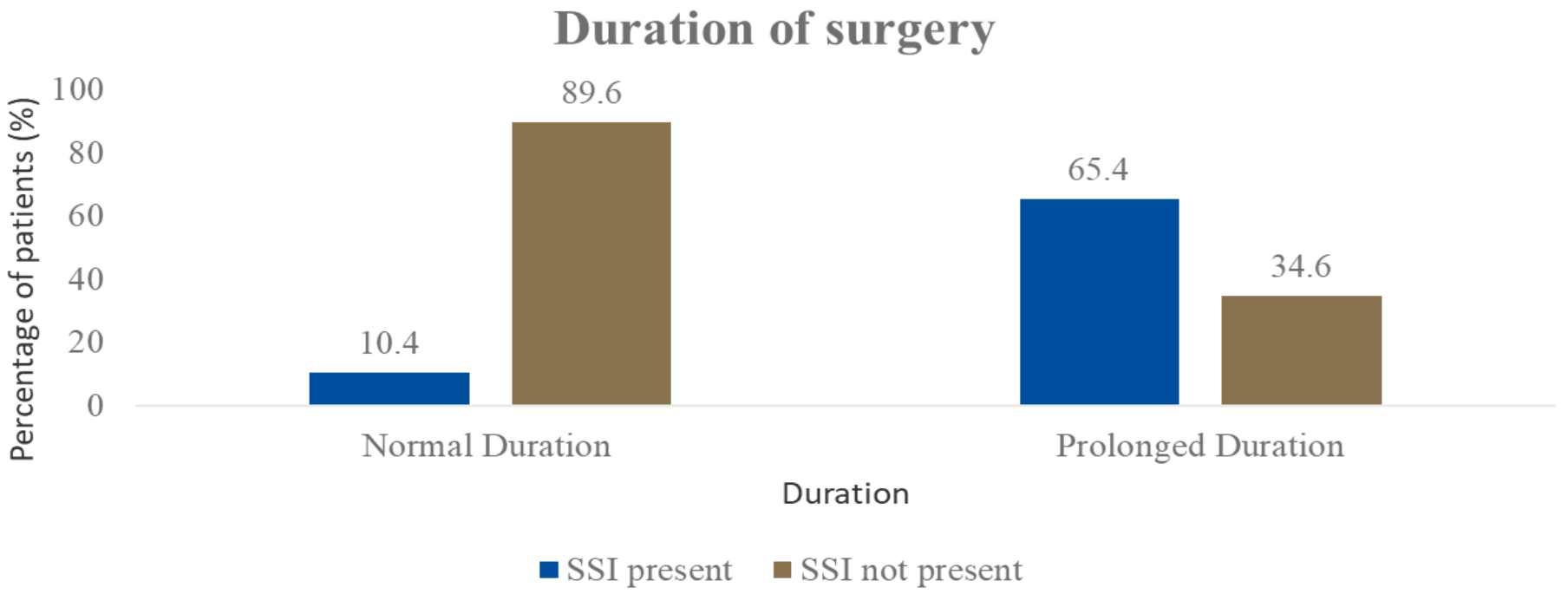
50% of SSIs are caused by exogenous and cross-infection sources of bacteria

Endogenous (50%) - Auto-Infection
Exogenous infection (15%) - Greatest source of potential danger is Environment (Air-5%; Instruments-10%)
Cross Infection (35%) - Healthcare associated infections (Patient/Staff)



Zeyad A. Sallami. Sch. J. App. Med. Sci. 2016; 4(8E):3066-3070.

Increase in duration of surgery is associated with increased incidence of SSI



In modified radical mastectomy, where surgery is prolonged SSI rate was 100%, where as in normal duration it was 14.3%.

Pujar PS et al. Int Surg J. 2018 Aug;5(8):2899-2903

Bacterial load determines the severity of SSI

- If a surgical site is contaminated with >100,000 microorganisms per gram of tissue, the risk of SSI is markedly increased.
- The dose of contaminating microorganisms required to produce infection may be much lower when foreign material is present at the site (i.e., 100 staphylococci per gram of tissue introduced on silk sutures).

$$\textbf{SSI Risk} = \frac{\textbf{Dose of bacterial contamination x Virulence}}{\textbf{Host resistance}}$$

Mangram, Alicia et al. Amer Jour Inf Cont, Vol. 27. No.2, 1999.

A microbiological analysis from India: Staph aureus is the most common pathogen isolated from SSI

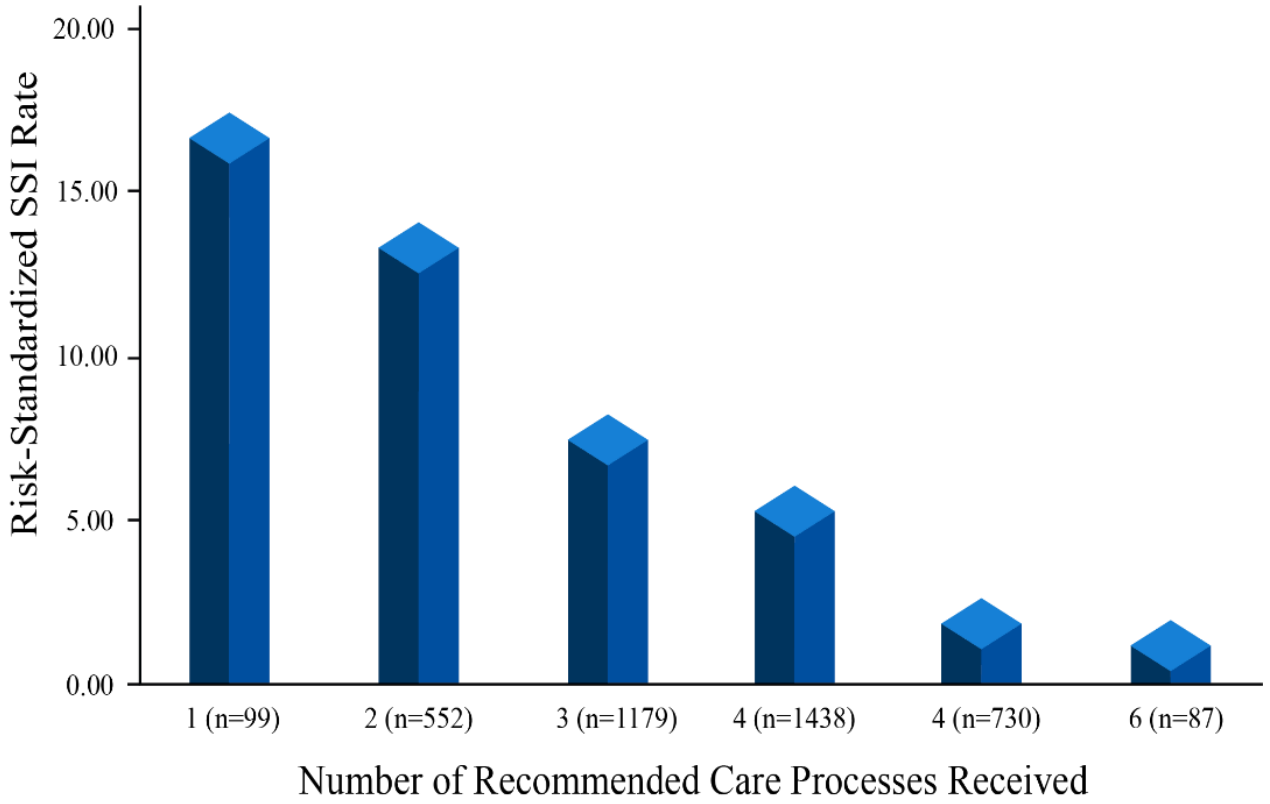
Table 1: Isolated organisms from patients.

Organism	Isolates (n = 208)
Staphylococcus aureus	46 (22.1%)
Coagulase negative staphylococci (CoNS)	34 (16.3%)
E. coli	29 (13.9%)
Pseudomonas aeruginosa	22 (10.5%)
Klebsiella pneumonia	16 (7.6%)
Enterococcus spp	13 (6.2%)
Citrobacter freundii	12 (5.7%)
Enterobacter spp	9 (4.3%)
Proteus mirabilis	8 (3.8%)
Proteus vulgaris	6 (2.8%)
Acinetobacter spp	6 (2.8%)
Citrobacter diversus	4 (1.9%)
Streptococcus spp	3 (1.4%)

- In many SSIs, the responsible pathogens originate from the patient's endogenous flora
- Most commonly isolated organisms are Staphylococcus aureus, Coagulase negative staphylococci and Escherichia coli.

Bhave PP et al. Int J Res Med Sci. 2016 Jul;4(7):2630-2635

SSI rates decreases with the increase in number of recommended care processes followed



Recommended care processes

- Appropriate selection of prophylactic antibiotics
- Prolonged surgical antibiotic prophylaxis postoperatively has no benefit in reducing SSI after surgery
- Post-operative normothermia (T>98.6ºF)
- Oral antibiotics with mechanical bowel prep
- Post-operative day 1, glucose ≤ 140 mg/dL
- Minimally invasive approach
- Short operative time <100 minutes

Steiner and Strand. Am J Obstet Gynecol. 2017 Aug;217(2):121-128.

Preoperative recommendations to prevent SSIs

Surgical practices	WHO 2018	CDC 2017	NICE 2017
Antiseptic showers	Advise patients to shower with either a plain or antimicrobial soap before surgery	Advise patients to shower with soap before surgery	Advise patients to shower with soap before surgery
Hair removal	Should not be removed or, if absolutely necessary, use clipper. Strongly discourages the use of razors	-	Use electric clippers on day of surgery
Skin preparation solutions	Use alcohol-based antiseptic solutions based on CHG	Skin preparation in the operating room should be performed using an alcohol-based agent unless contraindicated.	Use either povidone iodine or CHG solution with or without alcohol
Antibiotic prophylaxis	Antimicrobial sealants should not be used after surgical site skin preparation	Administer preoperative antimicrobial agents only when indicated based on published clinical practice guidelines	Give it to patients before clean, clean-contaminated and contaminated surgery
Hand decontamination or hygiene	Either by scrubbing with a antimicrobial soap and water or using a suitable ABHR before donning sterile gloves	-	The operating team should remove hand jewellery, artificial nails and nail polish before operations
Nasal decontamination		-	Do not use nasal decontamination with topical antimicrobial agents
Mechanical bowel preparation	Should be used in combination with preoperative oral antibiotics patients undergoing elective colorectal surgery	-	Do not use it routinely to reduce the risk of surgical site infection

1. WHO Global Guidelines for the Prevention of Surgical Site Infection, 20168 2. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017.JAMA Surgery 3. Leaper et al., BMJ. 2008 Oct 28;337:a1924.

Intraoperative recommendations to prevent SSIs

Surgical practices	WHO 2018	CDC 2017	NICE 2017
Glycemic control	Suggest use of protocol for intensive blood glucose control	Blood glucose target levels <200 mg/dL	Do not give insulin routinely to patients who do not have diabetes
Wound irrigation	Insufficient evidences to recommend for or against saline irrigation Use aqueous PVP-I solution before closure Antibiotic irrigation before closure should not be used	Consider intraoperative irrigation of deep or subcutaneous tissues with aqueous iodophor solution	Do not use wound irrigation
Surgical hand gloves	Insufficient evidences	-	Double gloves recommended
Nasal decontamination	Recommend mupirocin 2% ointment	-	-
Maintaining patient homeostasis	Use warming devices	Maintain normothermia	Maintain patient temperature in line with 'Inadvertent perioperative hypothermia
Gowns	Sterile, disposable, non-woven or sterile, reusable woven drapes and surgical gowns can be used during surgical operations	-	Operating team should wear sterile gowns during the operation
Hand decontamination		-	hands should be washed using either an alcoholic hand rub or an antiseptic surgical solution.
Wound dressing	Use wound protector devices	-	Cover surgical incisions with an appropriate interactive dressing at the end of the operation

1. WHO Global Guidelines for the Prevention of Surgical Site Infection, 20168 2. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017.JAMA Surgery 3. Leaper et al., BMJ. 2008 Oct 28;337:a1924.

Postoperative recommendations to prevent SSIs

	WHO, 2016	CDC, 2017	NICE, 2017
Changing dressings			Use an aseptic non-touch technique for changing or removing surgical wound dressings
Topical antimicrobial agents for wound healing by primary intention	Perioperative antibiotic prophylaxis should not be continued in the presence of wound drain	Do not apply local antimicrobial agents to the surgical incision	Do not use topical antimicrobial agents for surgical wounds
Dressings for wound healing by secondary intention	Don't use any type of advanced dressing over a standard dressing on primarily closed surgical wounds	-	Do not use Eusol and gauze, or moist cotton gauze or mercuric antiseptic solutions Use an appropriate interactive dressing Refer to a tissue viability nurse for advice on appropriate dressings
Debridement	-	-	Do not use Eusol and gauze, or dextranomer or enzymatic treatments
Specialist wound care services	-	-	a structured approach to care is required

1. WHO Global Guidelines for the Prevention of Surgical Site Infection, 2018 2. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017.JAMA Surgery 3. Leaper et al., BMJ. 2008 Oct 28;337:a1924.

Summary: 7 “S” Bundle to Prevent SSI

SAFETY – is your OPERATING ROOM safe?

SCREEN – are you screening for risk factors and presence of MRSA & MSSA

SHOWERS – do you have your patients cleanse their body the night before and morning of surgery with CHLORHEXIDINE (CHG)?

SKIN PREP – are you prepping the skin with alcohol based antiseptics such as CHG or Iodophor?

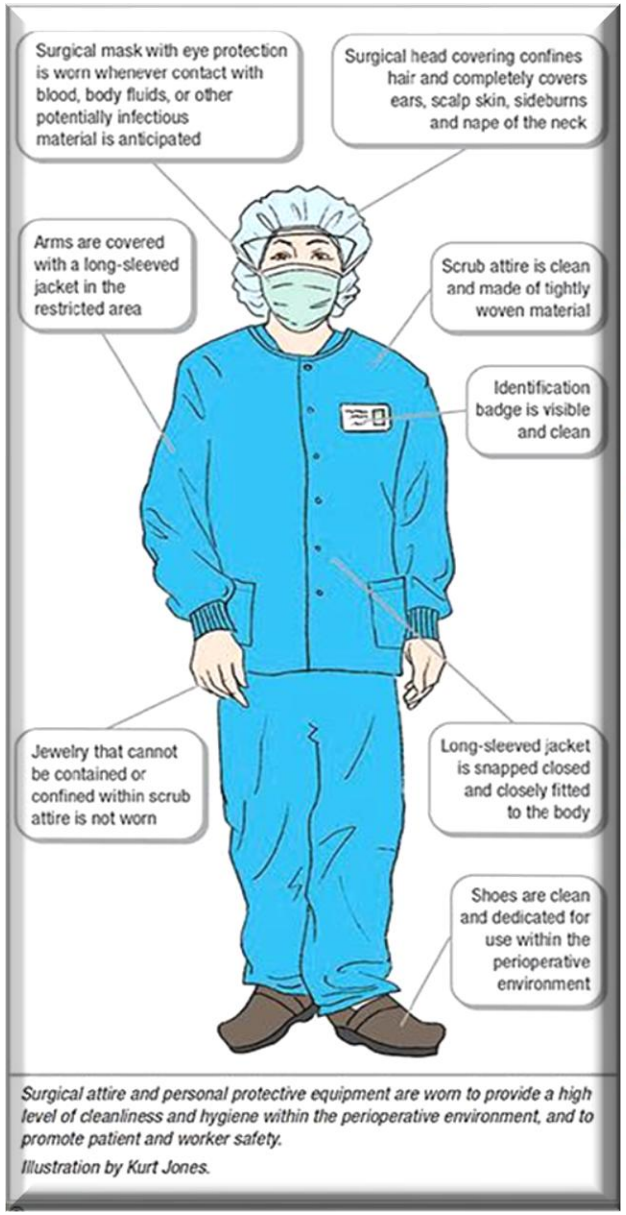
SOLUTION - are you irrigating the tissues prior to closure to remove exogenous contaminants? Are you using CHG?

SUTURES – are you closing tissues with antimicrobial sutures?

SKIN CLOSURE – are you sealing the incision or covering it with an antimicrobial dressing to prevent exogenous contamination?

Nolan MB et al. JAMA Surg. 2017;152(5):476-483.

When entering the OR or C/SP, dress for the occasion!



Hand Hygiene Inside the OR

Comparison of Two Environmental Standards for C/SP

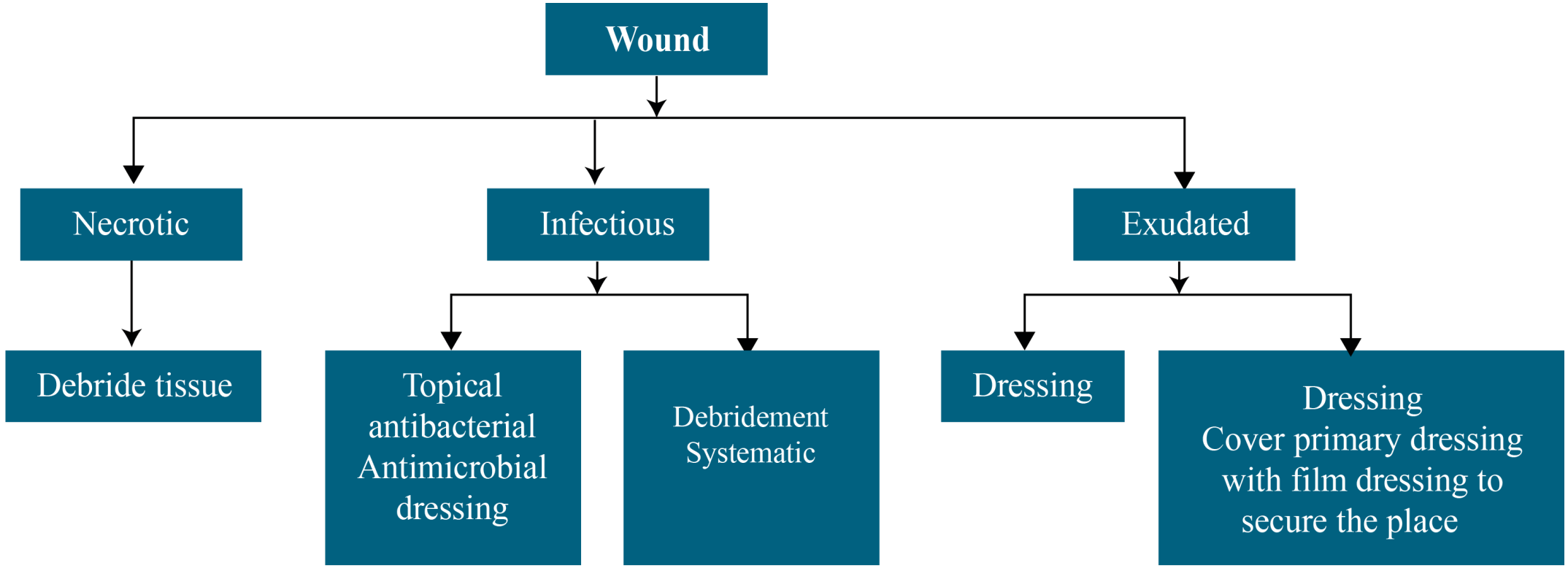
Temperature, Relative Humidity, and Air Handling Requirements for C/SP Areas: AAMI ST79, 2013

Area of C/SP	Temperature (degrees F/C)	Relative Humidity (%)	Air Pressurization to Adjacent Areas	Air Exchanges per Hour (all air exhausted directly outdoors)
Decontamination	60-65 F/16-18 C	30-60%	Negative	10 (Yes)
Preparation and Packing, Sterilizer Loading/Unloading	68—73 F/20-23 C	30-60%	Positive	10 (No)
Sterilizer Equipment Access Room	75-85 F/24-29 C	30-60%	Negative	10 (Yes)
Sterile Storage	68-75 F/20-24 C	30-70%	Positive	4 (No)

Temperature, Relative Humidity, and Air Handling Requirements for C/SP Areas: ANSI/ASHE/ASHRAE Standard 170-2013

Area of C/SP	Temperature (degrees F/C)	Relative Humidity (%)	Air Pressurization to Adjacent Areas	Air Exchanges per Hour (all air exhausted directly outdoors)
Decontamination	72-78 F/22-26 C	30-60%	Negative	6(2)
Preparation and Packaging	72-78 F/22-26 C	30-60%	Positive	4(2)
Sterilizer Equipment Access Room	N/A	N/A	Negative	10(none)
Sterile Storage	72-78 F/22-26 C	30-70%	Positive	4 (2)

Choice of dressing depends on the type and status of wound



Foam, Alginate and Hydrofiber dressings are indicated for wet wound with exudate
For dry wounds, hydrocolloid/transparent film dressings are suitable
Infected wounds require antibiotic impregnated dressing

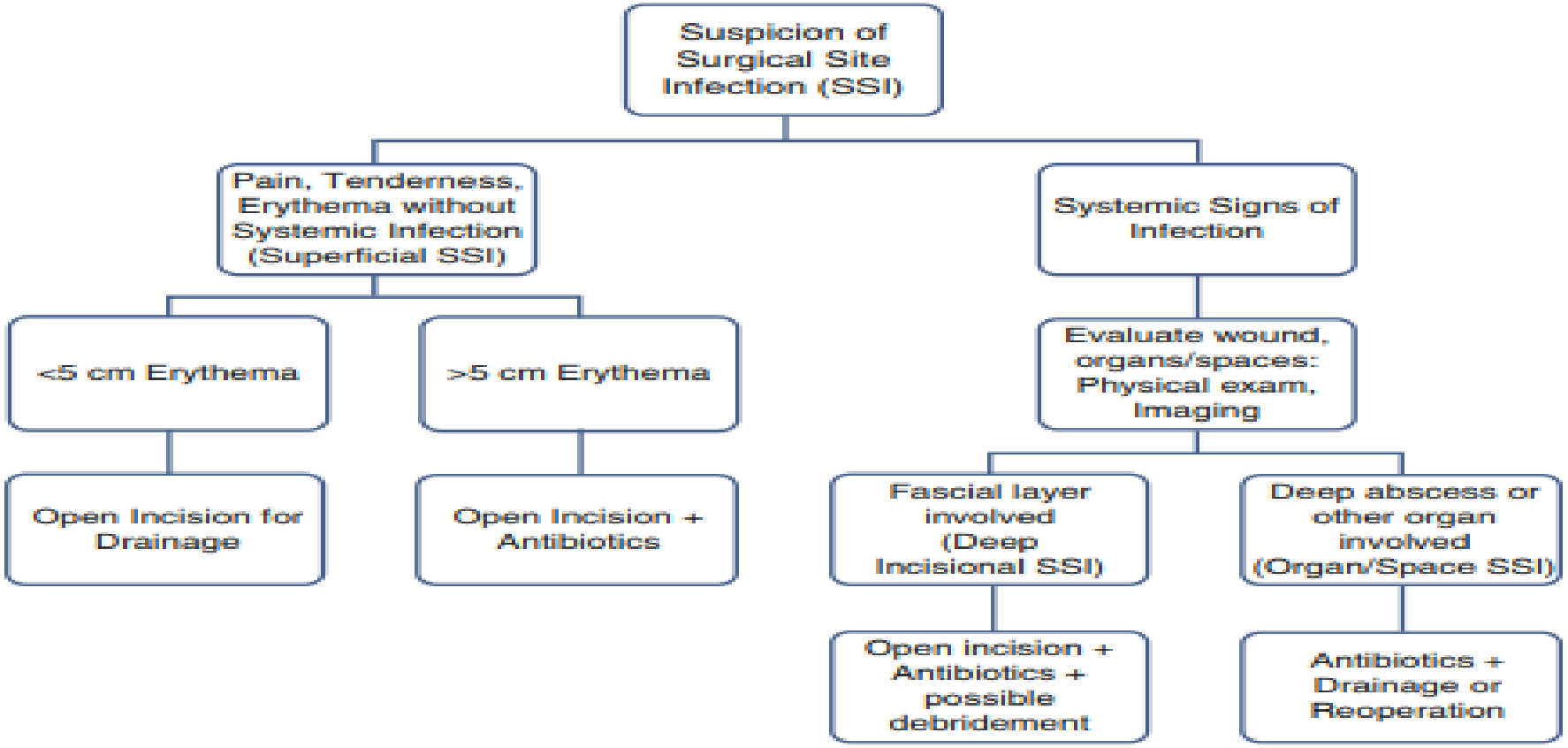
Broussard KC et al. Am J Clin Dermatol. 2013;14(6):449–59

Transparent film dressings allow postoperative wound inspection without disturbance of the dressing

- Waterproof, Sterile Barrier - Impervious To Liquids, Bacteria and Viruses
- Low adherence - Relatively painless and easy removal
- Breathable - Lets oxygen in and moisture vapor out and maintain an optimal moist wound environment
- Prevent further contamination

Leaper et al., BMJ. 2008 Oct 28;337:a1924.

SSI treatment algorithm: source control is the basic principle of management



Moore LJ, Turner KL, Todd SR, editors. Common problems in acute care surgery . R. Mario Vera, author. Management of Surgical Site Infections. pp.139-144; Springer; 2013 Mar 12.

NABH CHECKLIST FOR OT

Schedule

- Operation Schedule – Check the OT schedule for the Surgery / Procedure Posted today and yesterday.
- Do you have a list of the postings for the next day? Do you display the list?
- Adherence to schedule – evidenced?
- Surgeries posted without prior information recorded

Checklist, Preparation, Patient's Right and Responsibility

- What protocol is followed to check Right Patient, Right Site? Is the surgical site marked?
- Is there exception list for marking site?
- Is there an alternative for patients who are allergic to ink used for marking sites?
- How the staff does records when site is marked or not marked? Is it documented?
- Check if the patients come with the ID band on the wrist. Is the identification of the patient documented?
- Is the identification of the patient verified & confirmed at least by 2 different personnel from OT?

- Is the Surgery consent form signed / completely filled up
- Are the consent forms used in Local Language for those who don’t understand English?
- Is the patient/ family’s involvement in decision making evident in the consent form?
- Has the doctor used illustration/ diagrammatic representation to explain the procedure (only where applicable)?
- Are the specific risks/ complications or any other unanticipated outcomes are mentioned in the consent form?
- High Risk consent taken where found necessary?
- Criteria to categorize “High Risk” defined?
- Check if patient is cleared for surgery

- Check if there is any protocol available for handling patient valuables (Dentures, old reports)?
- Is there a checklist for the same?
- Is the Pre Procedure checklist filled out completely by both ward and or OT nurse?
- Checklist of OT filled Before Start of First Case
- Checklist of OT filled in-between two Case
- Before induction of anaesthesia or when the patient is awake, do the doctors/ any other staff talk among themselves ignoring the presence of a patient?
- Is the patient confidentiality maintained? Do the doctor/ nurses discuss patient's details when the other patient/s is awake?

Anaesthesia

- Pre Anaesthetic Evaluation completed before the patient brought to OR?
- Is there an immediate pre op anaesthesia evaluation done?
- Is the Anaesthesia Plan documented?
- Check if the Anaesthesia consent is filled and signed?
- In the minor OT – consent is taken for both surgery & anaesthesia
- The person performing the procedure is different than the person administering the sedation?
- After sedation, patient is monitored continuously
- Anaesthesia Notes – written

Medicine

- Pre medication orders filled up?
- What is the defined time limit for antibiotic prophylaxis?
- Antibiotic prophylaxis – is it last given within the time frame?
- Is the prophylaxis as per the antibiotic policy of the hospital?
- Medicines- who checks and updates the availability of the medicines?
- Inventory of the medicines – checked daily?
- High risk medicines – anaesthetic, narcotic drugs kept under lock
- Sound Alike Look Alike medicines are labeled, stored separately? Staffs are aware of the importance of color coding?
- Is there a checklist for medication given/stored?

Patient's Case Sheet

- Check the case sheet of a patient posted today for Surgery / Ongoing Surgery.
- Operation notes – written
- Are the Serology investigations carried out?
- If any specific precautions need to be undertaken e.g. infected cases (HBsAg, HIV)
- How do you prepare patients for operation and are there a protocol / document for the same?
- Is surgery safety checklist completed for all cases?
- Is there a facility to store blood bags? Temperature monitored?
- Is there a protocol to discard blood bags, which were not used?
- Is this recorded in the patient's file?

- Are the details of implants used mentioned in the master log book with the sticker?
- Observe one on-going operation and check the following;
- Following all protocol – pre / intra / post operation
- Surgery Safety (Time-out) checklist filled?
- How do you ensure that the instruments are not accidentally displaced inside the patient?
- Is there a time period defined to complete the operative notes in writing & for the typed out?
- Are the operating notes complete in all aspects? procedure details, post operative care plan, specimen details, etc?
- Patient's file has post operative care plan mentioned after recovery of Patient (In the Recovery Room)?
- Recovery Room notes are written in anaesthesia record?
- Before transferring the patient out of the Recovery Room, Alderete Score recorded in the Anaesthesia Record?

- Is there any documented plan of care while handing over the patient to ICU or Ward Staff?
- Does the plan specify nursing interventions also?
- If there is a Discharge to Home, is there a Discharge Summary handed over to the patient/ family?
- Is that summary & follow up advice explained to the Patient/ Family?
- Discharge Criteria from Recovery Room displayed?
- Staff aware of these criteria?
- Evidence for these criteria being carried out for discharge from Recovery Room?

- How is the postoperative handing over of the patients done? How is it planned and documented.
- Is the pain management protocol followed as per organizational pain management policy?
- Specimen containers are labeled before placing the specimen?
- Labeling is done appropriately?
- Who takes the decision if there is any tissue requires to be discarded? Is there a written policy for the same?
- Is there an appropriate signage where specimen is stored?
- Is there similar containers kept for tissues/ parts to be discarded?

Infection Control Measures

- How are the infection control measures implemented in OT?
- Did the OT In Charge allow you to enter without OT attire?
- Were you asked to wash hands before entering the OR
- Was there hand wash facility after you removed your footwear?
- Was there hand wash facility before you could enter OT?
- Check for the marked area / display beyond which patient is to be handed over to the OT
- Is there cris-crossing of the sterile, unsterile and soiled items?
- What are the different zones in OT and how do you ensure aseptic conditions of the same.

- Is the Pre-holding room is utilized for patients’preparation?
- Changing area and how is it maintained if there is place to sit, hang clothes, sleepers etc?
- Does the OT staff know the scrubbing technique?
- Is it displayed where necessary / in the wash area??
- Observe scrubbing procedure for 1 or 2 staff.
- Check if all the steps followed for the recommended duration.
- How stringent is the dress code?
- Does the staff restrict their movements in the scrub suit?

- How do you handle waste generated? Waste segregation – appropriately done?
- Is the staff aware of the color-coding is it displayed anywhere?
- What is the protocol for ensuring OT is ready between 2 surgeries
- Is there surface cleaning done after every case?
- Can we see the records for the same above all?
- Is rodent control performed in the OT?
- Is the staff immunized who ensures the same?

Equipments

- Is there a list of equipments?
- Where & how are the equipments kept after every use?
- Is there a checklist to ensure the availability of the equipments and materials prior to the surgery
- Is there a checklist for instruments for specific procedures and is it available for reference?
- How do you keep the chitels forceps after every use?
- How do you determine the sterility of equipments?
- Who checks the viability / condition of the instruments?
- Are the oxygen cylinders checked for any leakage?
- In case of a sudden power breakdown is there any plan of action? UPS
- Does anybody check the lights in OT prior to the surgery?
- Maintenance of machines
- Is the Calibration of equipments done and who is responsible for the same?
- Are any precautionary measures listed for the dept?
- Check the PM – Preventive Maintenance sheet? Calibration sticker on Boyle’s Apparatus

Emergency

- Emergency Cases handling- Is there a provision for performing emergency surgery (unscheduled)?
- Does the schedule accommodate such cases?
- In case of an emergency during operation is a note made later and reasons looked into and documented
- Is there emergency set of equipments available?
- What is the procedure to ensure availability of blood in Emergency?
- Cardiac arrests in Operating/Recovery Room analyzed using Event Recorder?
- Who breaks bad news? Are they trained for breaking bad news?
- Crash cart, intubation tray, oxygen available in the Minor OT?

Quality Indicator

- Statistics prepared by every month?
- Check if the following Quality Indicators monitored; raw data available
- Is analysis for surgeries performed per month done and the failure case analyzed?
- Re-exploration Rate
- Anaesthesia Adverse Events
- Change/ modification of anaesthesia plan
- Anaesthesia related mortality rate
- Antibiotic prophylaxis given 60 minutes prior to incision
- Time gap between 2 surgeries
- Time taken for the histopath specimen to reach lab
- Rate of OT utilization (per OT)

- How often the corrective and preventive actions taken?
- For ordering OT consumables is there a reorder level determined for commonly used materials?
- HEPA filters efficiency checked? Next due date?
- How do you ensure sterility of the air in the OT (laminar air flow)
- Are the audits of the following done OR are the following factors monitored?
- Post operative glucose levels
- Post Operative hypothermia
- Biomedical Waste disposal
- Antibiotic usage
- Post op Pain Management
- Post Op Hypoxia
- Post op Nausea & Vomiting
- Post Op MI
- Post Op Headache
- Awareness under Anaesthesia

Conclusion

- SSIs are the most common complication of surgical procedures
- In India, SSI rate rise from ~3-4% in clean to >40% in dirty wounds
- SSIs result in prolonged hospital stay and increased hospital associated cost
- SSIs arise from a complex interaction of several factors including exogeneous source, cross-contamination, diabetes, smoking and bacterial infections
- Staph aureus is the most common pathogen implicated in SSI
- Practices like patient hygiene, skin preparation with alcohol based solutions, antibiotic prophylaxis, aseptic precautions during surgery are important for preventing SSI
- The main purposes of a surgical dressing (by primary intention) are to control any postoperative bleeding, absorb exudate if anticipated, ease pain and provide protection for newly formed tissue.
- Choice of dressing is governed by type of surgical wound
- Transparent dressing promotes wound healing by providing optimal conditions and allowing visual check

Thank You..