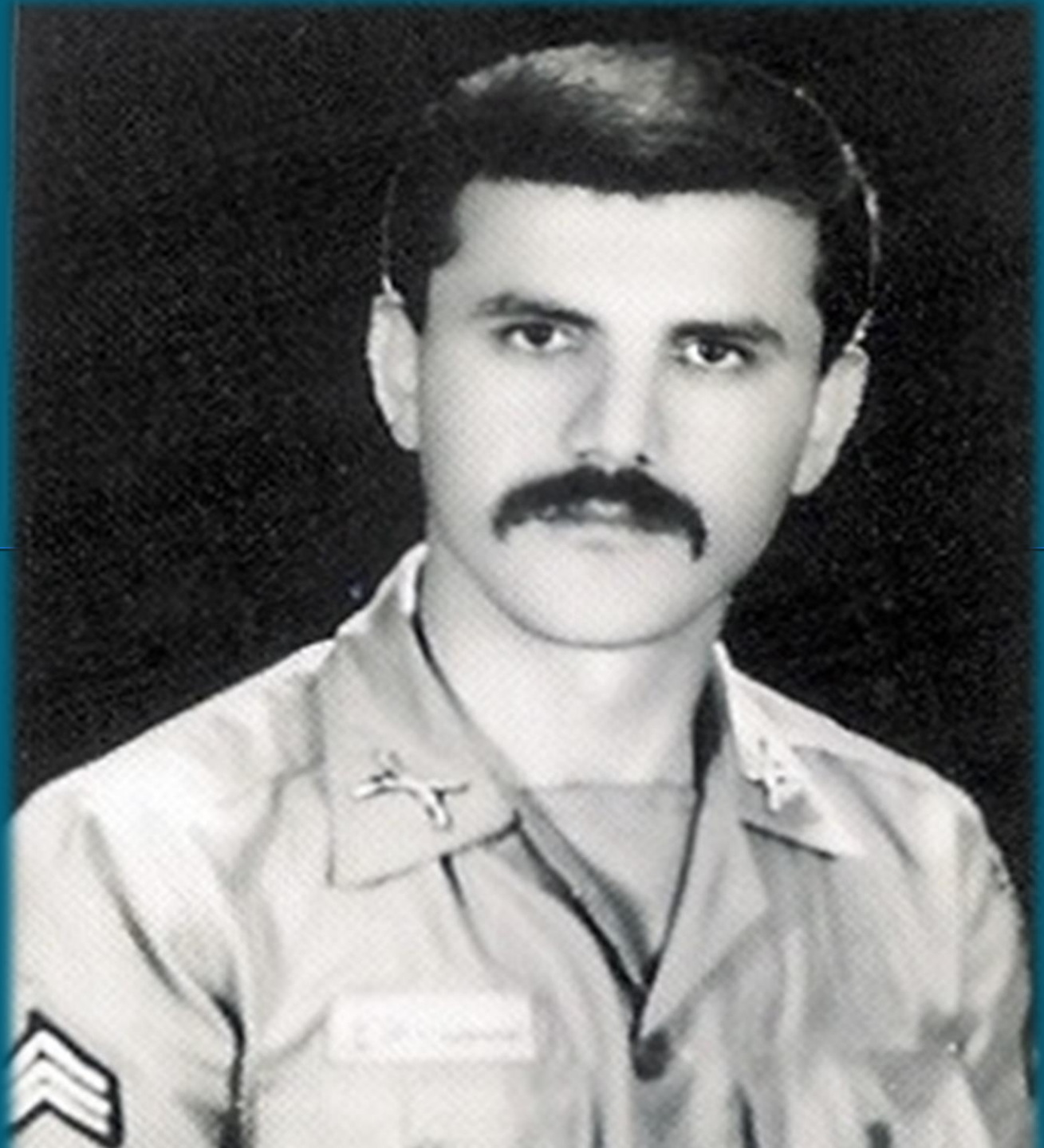
اِنّ اللّه لا يُغَيِّرُ مابِقَومٍ حَتّى يُغَيِّرُ مابِاَنفُسِهِم



Surgical Site Infection

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Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017

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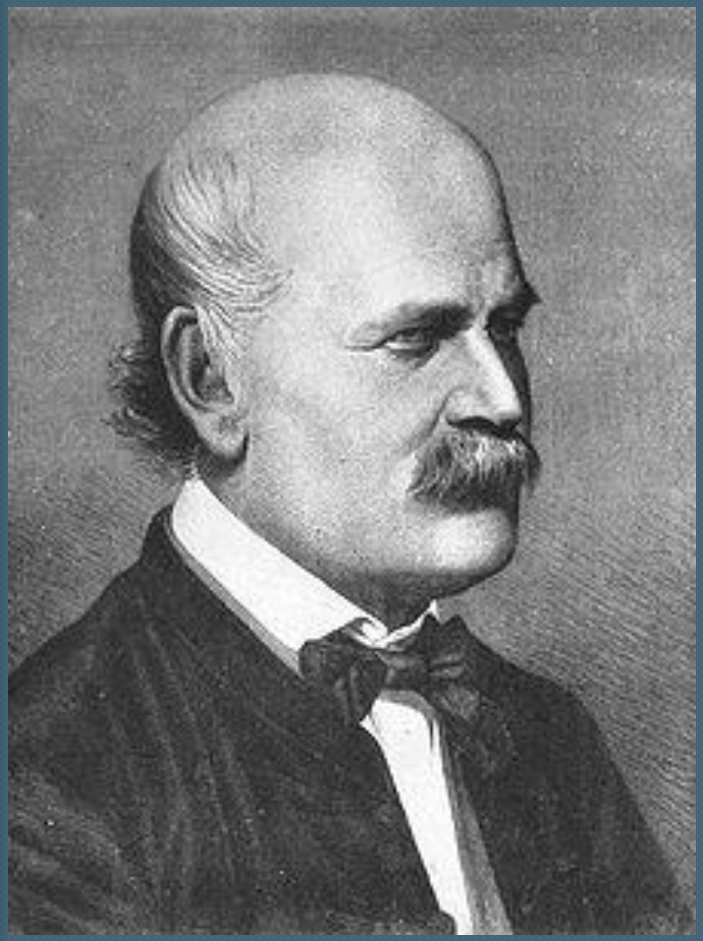
GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION

What is a Surgical Site Infection?

- SSI's can be defined as an infection that **is present up to 30 days after a surgical procedure if no implants are placed**, and **up to one year if an implantable device was placed in the patient**
- The majority of SSIs will occur during the **first 2-3 weeks** after surgery
- 38% of all nosocomial (hosp. acquired) infections in surgical patients are SSI
- **2 to 5% of operated patients will develop a SSI**

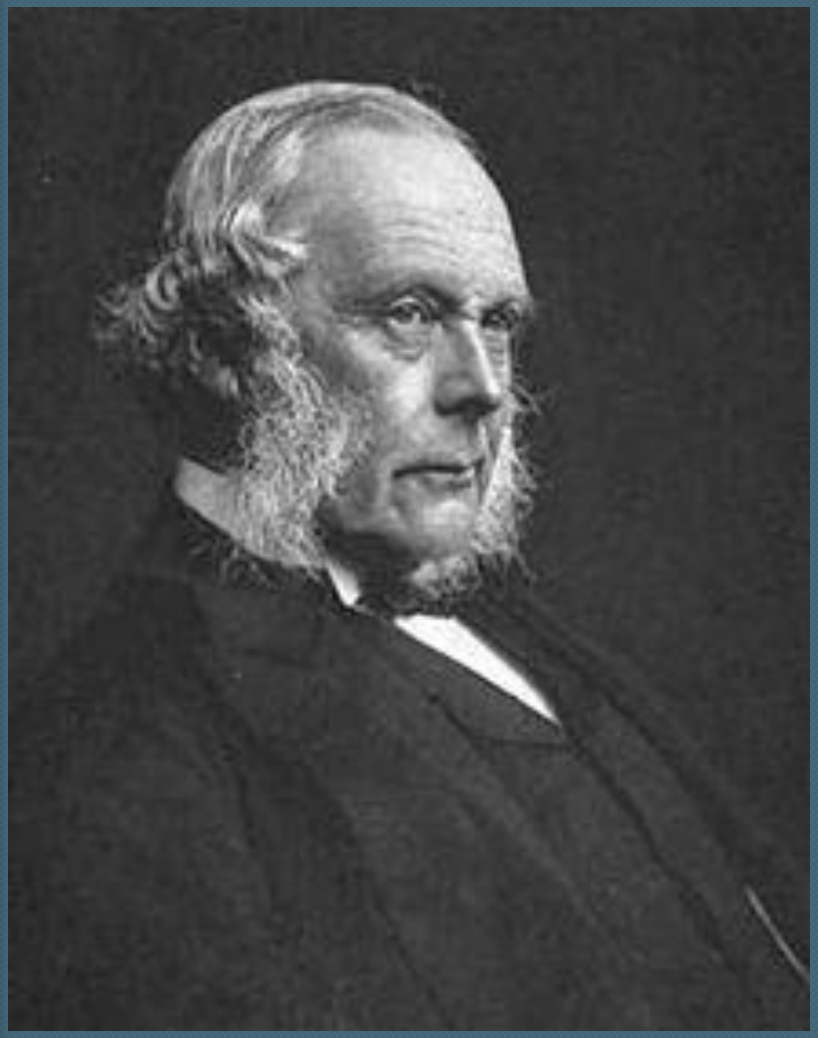
Ignaz Semmelweis



1847

Realized that washing hand with a chlorinated lime solution decreased incidence of newborn death from “puerperal fever’.

Joseph Lister



- 1883-1897
- British surgeon
- Used Carbolic Acid (Phenol) to clean hands, instruments and wipe on surgical wounds drastically decreased infections.

Wound Classification

according to the degree of contamination

Wound class	Definition	Example	Infection rate (%)
Clean	Nontraumatic, elective surgery. GI tract, respiratory tract, GU tract not entered	Mastectomy Vascular Hernias	2%
Clean-contaminated	Respiratory, GI, GU tract entered with minimal contamination	Gastrectomy Hysterectomy	$\leq$ 10%
Contaminated	Open, fresh, traumatic wounds, uncontrolled spillage, minor break in sterile technique	Rupture appy Emergent bowel resect.	20%
Dirty	Open, traumatic, dirty wounds; traumatic perforation of hollow viscus, frank pus in the field	Intestinal fistula resection	28-70%

SSI – Wound Classification

- Class 1 = Clean
- Class 2 = Clean contaminated
- Class 3 = Contaminated
- Class 4 = Dirty infected

Prophylactic antibiotics indicated

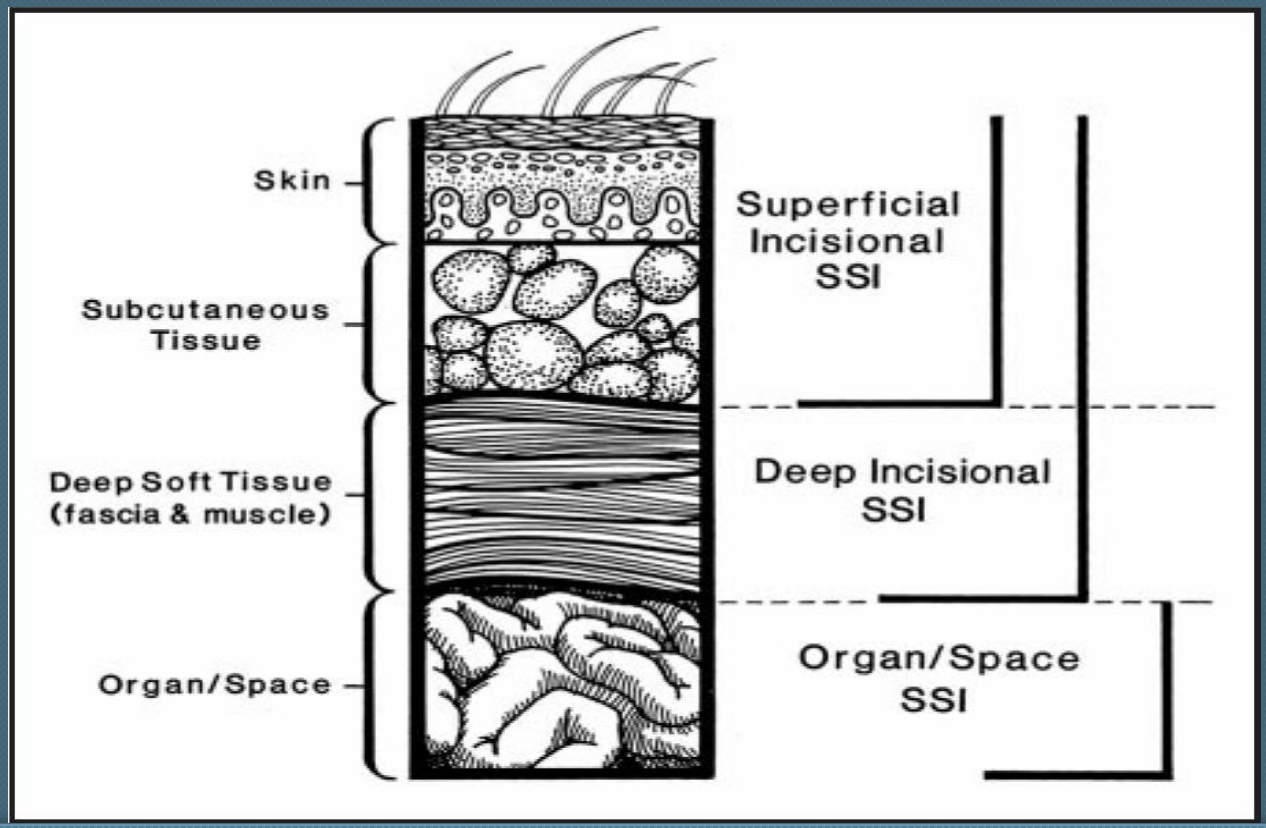
Therapeutic antibiotics

Mangram AJ et al. *Infect Control Hosp Epidemiol.* 1999;20:250-278.

Types of Surgical Site Infections

- According to the tissue involved:

1. Superficial
2. Deep incisional
3. Organ/space



According to the etiology

- ***Primary SSI*** :the wound is the primary site for infection
- ***Secondary SSI*** :infection arise following a complication that is not directly related to the wound

According to the time

- ***Early*** with in 30 days
- ***Intermediate*** 1-3 months
- ***Late*** more than 3 months

According to Severity

- ***Minor SSI*** :discharge without cellulites or deep tissue destruction
- ***Major SSI*** :pus discharge with tissue breakdown, partial or total dehiscence or systemic illness

Source of SSI Pathogens

1. Endogenous flora of the patient
2. Operating theater environment
3. Hospital personnel (doctors/nurses/staff)
4. Seeding of the operative site from distant focus of infection (prosthetic device, implants)

SSI transmission

- Exogenous
  - Surgeons, nurses and other staff
  - Medical equipment
  - Other patients
- Endogenous
  - Skin flora
  - Other infections in patient
  - Blood transfusion (rare)

Risk factors

1. surgical factors
    A. Type of procedure
    B. Degree of contamination
    C. Duration of operation
    D. Urgency of operation

Patient Risk Factors

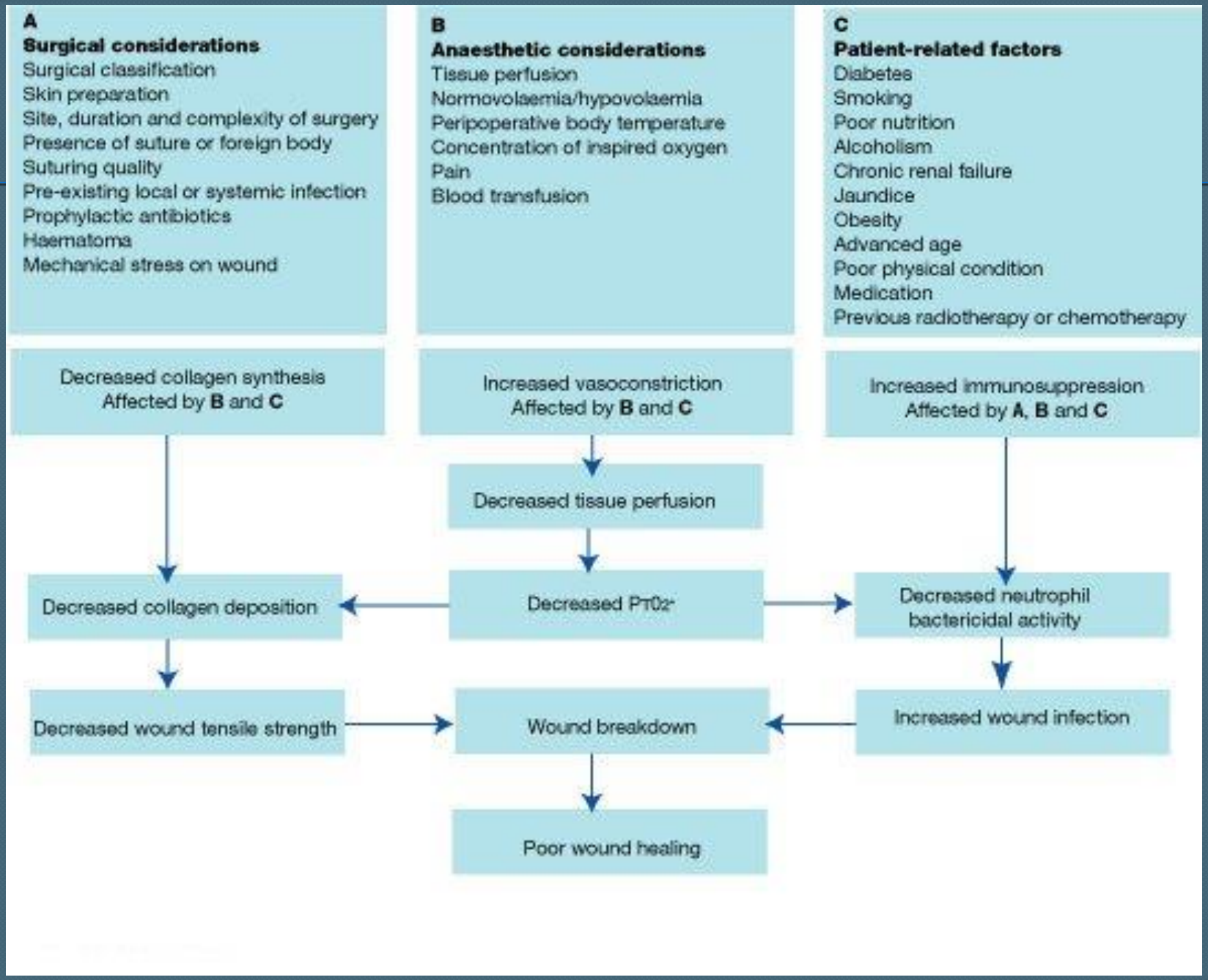
- **Local:**
  - High bacterial load
  - Wound hematoma
  - Necrotic tissue
  - Foreign body
  - Obesity
- **Systemic:**
  - Advanced age
  - Shock
  - Diabetes
  - Malnutrition
  - Alcoholism
  - Steroids
  - Chemotherapy
  - Immuno-compromise

Host Risk Factors

- Diabetes mellitus
- Hypoxaemia
- Hypothermia
- Leukopenia
- Nicotine (tobacco smoking)
- Immunosuppression
- Malnutrition
- Poor skin hygiene

Perioperative Risk Factors

- Operative site shaving
- Breaks in operative sterile technique
- Improper antimicrobial prophylaxis
- Prolonged hypotension
- Contaminated operating room
- Poor wound care postoperatively
- Hyperglycemia
- Wound closure technique


A
Surgical considerations
Surgical classification
Skin preparation
Site, duration and complexity of surgery
Presence of suture or foreign body
Suturing quality
Pre-existing local or systemic infection
Prophylactic antibiotics
Haematoma
Mechanical stress on wound
B
Anaesthetic considerations
Tissue perfusion
Normovolaemia/hypovolaemia
Peripoperative body temperature
Concentration of inspired oxygen
Pain
Blood transfusion
C
Patient-related factors
Diabetes
Smoking
Poor nutrition
Alcoholism
Chronic renal failure
Jaundice
Obesity
Advanced age
Poor physical condition
Medication
Previous radiotherapy or chemotherapy
Decreased collagen synthesis
Affected by B and C
Increased vasoconstriction
Affected by B and C
Increased immunosuppression
Affected by A, B and C
Decreased tissue perfusion
Decreased collagen deposition
Decreased PtO2
Decreased neutrophil bactericidal activity
Decreased wound tensile strength
Wound breakdown
Increased wound infection
Poor wound healing

Prevention of SSI

1. Preoperative planning
2. Intra operative technique
3. Preventive antibiotic therapy
4. Enhancement of host defense

SSI: surgical site infection; PICO: Population, Intervention, Comparison, Outcomes; CHG: chlorhexidine gluconate; SAP: surgical antibiotic prophylaxis; OR: operating room; ESBL: extended-spectrum beta-lactamase; PVP-I: povidone-iodine; NA: not applicable.

Preoperative measures				
Preoperative bathing	1. Is preoperative bathing using an antimicrobial soap more effective in reducing the incidence of SSI in surgical patients compared to bathing with plain soap? 2. Is preoperative bathing with CHG-impregnated cloths more effective in reducing the incidence of SSI in surgical patients compared to bathing with antimicrobial soap?	It is good clinical practice for patients to bathe or shower prior to surgery. The panel suggests that either plain soap or an antimicrobial soap may be used for this purpose. The panel decided not to formulate a recommendation on the use of CHG-impregnated cloths for the purpose of reducing SSI due to the very low quality of evidence.	Conditional	Moderate

Decolonization with mupirocin ointment with or without CHG body wash for the prevention of *Staphylococcus aureus* infection in nasal carriers	Is mupirocin nasal ointment in combination with or without CHG body wash effective in reducing the number of *S. aureus* infections in nasal carriers undergoing surgery?	The panel recommends that patients undergoing cardiothoracic and orthopaedic surgery with known nasal carriage of *S. aureus* should receive perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash.	Strong	Moderate
		The panel suggests considering to treat also patients with known nasal carriage of *S. aureus* undergoing other types of surgery with perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash.	Conditional	Moderate

Optimal timing for preoperative SAP	How does the timing of SAP administration impact on the risk of SSI and what is the precise optimal timing?	The panel recommends that SAP should be administered prior to the surgical incision when indicated (depending on the type of operation).	Strong	Low
		The panel recommends the administration of SAP within 120 minutes before incision, while considering the half-life of the antibiotic.	Strong	Moderate

Mechanical bowel preparation and the use of oral antibiotics	Is mechanical bowel preparation combined with or without oral antibiotics effective for the prevention of SSI in colorectal surgery?	The panel suggests that preoperative oral antibiotics combined with mechanical bowel preparation should be used to reduce the risk of SSI in adult patients undergoing elective colorectal surgery.	Conditional	Moderate
		The panel recommends that mechanical bowel preparation alone (without administration of oral antibiotics) should **not** be used for the purpose of reducing SSI in adult patients undergoing elective colorectal surgery.	Strong	Moderate

Hair removal	1. Does hair removal affect the incidence of SSI? 2. What method and timing of hair removal is associated with the reduction of SSI?	The panel recommends that in patients undergoing any surgical procedure, hair should either **not** be removed or, if absolutely necessary, it should be removed only with a clipper. Shaving is strongly discouraged at all times, whether preoperatively or in the OR.	Strong	Moderate
Surgical site preparation	Should alcohol-based antiseptic solutions or aqueous solutions be used for skin preparation in surgical patients and, more specifically, should CHG or PVP-I solutions be used?	The panel recommends alcohol-based antiseptic solutions based on CHG for surgical site skin preparation in patients undergoing surgical procedures.	Strong	Low to moderate

Antimicrobial skin sealants	Should antimicrobial sealants (in addition to standard surgical site skin preparation) be used in surgical patients for the prevention of SSI compared to standard surgical site skin preparation only?	The panel suggests that antimicrobial sealants should **not** be used after surgical site skin preparation for the purpose of reducing SSI.	Conditional	Very Low
Surgical hand preparation	1. What is the most effective type of product for surgical hand preparation to prevent SSI? 2. What is the most effective technique and ideal duration for surgical hand preparation?	The panel recommends that surgical hand preparation should be performed by scrubbing with either a suitable antimicrobial soap and water or usng a suitable alcohol-based handrub before donning sterile gloves.	Strong	Moderate

Maintaining normal body temperature (normothermia)	Should systemic body warming vs. no warming be used for the prevention of SSI in surgical patients?	The panel suggests the use of warming devices in the OR and during the surgical procedure for patient body warming with the purpose of reducing SSI.	Conditional	Moderate
Use of protocols for intensive perioperative blood glucose control	1. Do protocols aiming to maintain optimal perioperative blood glucose levels reduce the risk of SSI? 2. What are the optimal perioperative glucose target levels in diabetic and non-diabetic patients?	The panel suggests the use of protocols for intensive perioperative blood glucose control for both diabetic and non-diabetic adult patients undergoing surgical procedures to reduce the risk of SSI. The panel decided not to formulate a recommendation on this topic due to the lack of evidence to answer question 2.	Conditional	Low
Maintenance of adequate circulating volume control/ normovolemia	Does the use of specific fluid management strategies during surgery affect the incidence of SSI?	The panel suggests the use of goal-directed fluid therapy intraoperatively to reduce the risk of SSI.	Conditional	Low

Drapes and gowns	1. Is there a difference in SSI rates depending on the use of disposable non-woven drapes and gowns or reusable woven drapes and gowns? 1.1. Is there a difference in SSI rates depending on the use of disposable non-woven or reusable woven drapes? 1.2. Is there a difference in SSI rates depending on the use of disposable non-woven or reusable woven gowns?	The panel suggests that either sterile, disposable non-woven or sterile, reusable woven drapes and gowns can be used during surgical operations for the purpose of preventing SSI. No specific evidence was retrieved to answer to questions 1.1 and 1.2.	Conditional	Moderate to very low
	2. Does the use of disposable, adhesive, incise drapes reduce the risk of SSI?	The panel suggests **not** to use plastic adhesive incise drapes with or without antimicrobial properties for the purpose of preventing SSI.	Conditional	Low to very low

Wound protector devices	Does the use of wound protector devices reduce the rate of SSI in open abdominal surgery?	The panel suggests considering the use of wound protector devices in clean-contaminated, contaminated and dirty abdominal surgical procedures for the purpose of reducing the rate of SSI.	Conditional	Very low
Incisional wound irrigation	Does intraoperative wound irrigation reduce the risk of SSI?	The panel considered that there is insufficient evidence to recommend for or against saline irrigation of incisional wounds before closure for the purpose of preventing SSI.	NA	NA
		The panel suggests considering the use of irrigation of the incisional wound with an aqueous PVP-I solution before closure for the purpose of preventing SSI, particularly in clean and clean-contaminated wounds.	Conditional	Low
		The panel suggests that antibiotic incisional wound irrigation should **not** be used for the purpose of preventing SSI.	Conditional	Low

Prophylactic negative pressure wound therapy	Does prophylactic negative pressure wound therapy reduce the rate of SSI compared to the use of conventional dressings?	The panel suggests the use of prophylactic negative pressure wound therapy in adult patients on primarily closed surgical incisions in high-risk wounds for the purpose of the prevention of SSI, while taking resources into account.	Conditional	Low
Use of surgical gloves	1. When is double-gloving recommended? 2. What are the criteria for changing gloves during an operation? 3. What type of gloves should be used?	The panel decided not to formulate a recommendation due to the lack of evidence to assess whether double-gloving or a change of gloves during the operation or the use of specific types of gloves are more effective in reducing the risk of SSI.	NA	NA

Changing of surgical instruments	At the time of wound closure, is there a difference in SSI when instruments are changed for fascial, subcutaneous and skin closure using a new set of sterile instruments?	The panel decided not to formulate a recommendation on this topic due to the lack of evidence.	NA	NA
Antimicrobial -coated sutures	Are antimicrobial-coated sutures effective to prevent SSI? If yes, when and how should they be used?	The panel suggests the use of triclosan-coated sutures for the purpose of reducing the risk of SSI, independent of the type of surgery.	Conditional	Moderate
Laminar flow ventilation systems in the context of OR ventilation	1. Is the use of laminar air flow in the OR associated with the reduction of overall or deep SSI?	The panel suggests that laminar airflow ventilation systems should **not** be used to reduce the risk of SSI for patients undergoing total arthroplasty surgery.	Conditional	Low to very low
	2. Does the use of fans or cooling devices increase SSIs?	The panel decided not to formulate a recommendation on these topics due to the lack of evidence to answer questions 2 and 3.	NA	NA
	3. Is natural ventilation an acceptable alternative to mechanical ventilation?			

Enhanced nutritional support	In surgical patients, should enhanced nutritional support be used for the prevention of SSI?	The panel suggests considering the administration of oral or enteral multiple nutrient-enhanced nutritional formulas for the purpose of preventing SSI in underweight patients who undergo major surgical operations.	Conditional	Very Low
Perioperative discontinuation of immunosuppressive agents	Should immunosuppressive agents be discontinued perioperatively and does this affect the incidence of SSI?	The panel suggests not to discontinue immunosuppressive medication prior to surgery for the purpose of preventing SSI.	Conditional	Very Low
Perioperative oxygenation	How safe and effective is the perioperative use of an increased fraction of inspired oxygen in reducing the risk of SSI?	The panel recommends that adult patients undergoing general anaesthesia with endotracheal intubation for surgical procedures should receive an 80% fraction of inspired oxygen intraoperatively and, if feasible, in the immediate postoperative period for 2-6 hours to reduce the risk of SSI.	Strong	Moderate

SAP prolongation	Does continued postoperative SAP reduce the risk of SSI compared with preoperative and (if necessary) intraoperative prophylaxis only?	The panel recommends **against** the prolongation of SAP after completion of the operation for the purpose of preventing SSI.	Strong	Moderate
Advanced dressings	In surgical patients, should advanced dressings vs. standard sterile wound dressings be used for the prevention of SSI?	The panel suggests **not** using any type of advanced dressing over a standard dressing on primarily closed surgical wounds for the purpose of preventing SSI.	Conditional	Low
Antimicrobial prophylaxis in the presence of a drain and optimal timing for wound drain removal	1. In the presence of drains, does prolonged antibiotic prophylaxis prevent SSI?	The panel suggests that preoperative antibiotic prophylaxis should **not** be continued in the presence of a wound drain for the purpose of preventing SSI.	Conditional	Low
	2. When using drains, how long should they be kept in place to minimize SSI as a complication?	The panel suggests removing the wound drain when clinically indicated. No evidence was found to allow making a recommendation on the optimal timing of wound drain removal for the purpose of preventing SSI.	Conditional	Very low

Smoking cessation 30 d before operation

Evidence

- Class II data

References

- Anderson DJ, Kaye KS, Classen D, et al. Strategies to prevent surgical site infections in acute care hospitals. Infect Control Hosp Epidemiol 2008

Use higher dosages of prophylactic antibiotics for morbidly obese patients

Evidence

- Limited Class II data

References

- Springer R. The Surgical care improvement project-focusing on infection control.Plast Surg Nurs 2007

Procedure	Antimicrobial Agent	Dose	Timing	Duration
Dental	Cephalexin, cephradine, amoxicillin	2 gm PO	1 hour prior to procedure	Discontinued within 24 hours of the procedure. For most outpatient/office-based procedures a single pre-procedure dose is sufficient.
Ophthalmic	Gentamicin, tobramycin, ciprofloxacin, gatifloxacin, levofloxacin, moxifloxacin, ofloxacin, or meomycin-gramicidin-polymyxin B cefazolin	Multiple drops topically over 2 to 24 hours or 100 mg subconjunctivally	Consult ophthalmologist or pharmacist for dosing regimen	
Orthopaedic†	Cefazolin Cefuroxime OR Vancomycin	1-2 g IV 1.5 g IV 1 g IV	Begin dose 60 minutes prior to procedure	
Vascular	Cefazolin OR Vancomyin	1-2 g IV 1 g IV	Begin dose 60 minutes prior to procedure	
Gastrointestinal				
Esophageal, gastroduodenal	Cefazolin	1 -2 g IV	Begin dose 60 minutes prior to procedure	
Biliary tract	Cefazolin	1-2 g IV		
Colorectal	Neomycin + erythromycin base (oral)	1 g	Dependent on time of procedure, consult with GI physician and/or pharmacist	
	OR metronidazole (oral)	1 g		
Head and neck	Clindamycin + gentamicin OR cefazolin	600-900 mg IV 1.5 mg/kg IV 1-2 g IV	Begin dose 60 minutes prior to procedure	
Obstetric and gynecological	Cefoxitin, cefazolin Ampicillin/sulbactam	1-2 g IV 3 g IV	Begin dose 60 minutes prior to procedure	
Genitourinary	Ciprofloxacin	500 mg PO or 400 mg IV	1 hour prior to procedure Begin dose 60 minutes prior to procedure	

Carefully handle tissue, eradicate dead space, and adhere to standard principles of asepsis

Evidence

- Class III

References

- Anderson DJ. Strategies to prevent surgical site infections in acute care hospitals. Infect Control Hosp Epidemiol 2008;

Maintain serum glucose levels <200 mg/dL on PO

Evidence

- Class II data

References

- Anderson DJ. Strategies to prevent surgical site infections in acute care hospitals. Infect Control Hosp Epidemiol 2008

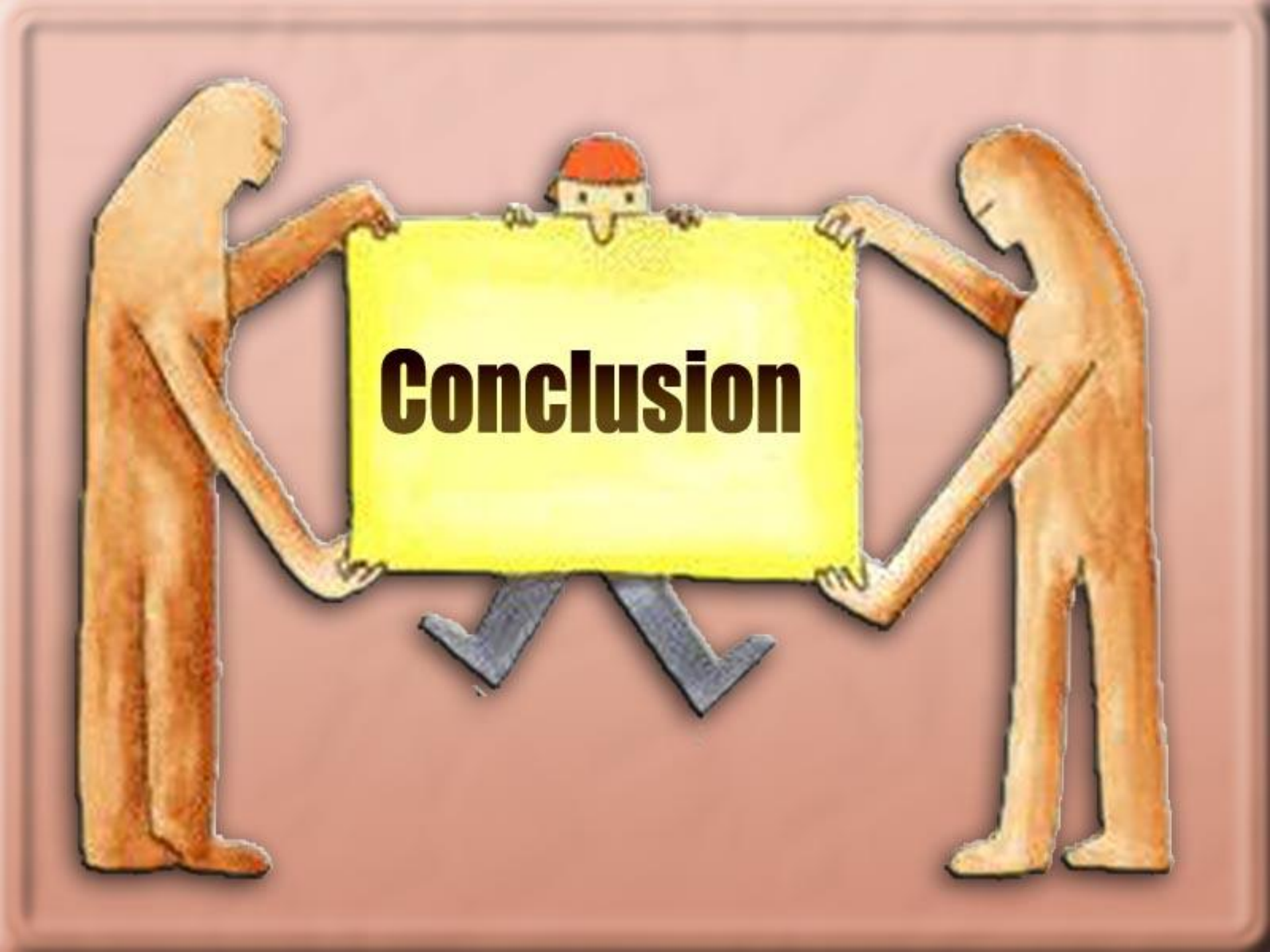
Monitor wound for the development of SSI postoperative days 1 and 2d

Evidence

- Class III data

References

- Anderson DJ. Strategies to prevent surgical site infections in acute care hospitals. Infect Control Hosp Epidemiol 2008


Conclusion

Post-Operative Infections

- Fever After Surgery
- The "Five W's"
  - Wind: Atelectisis
  - Water: UTI
  - Walking: DVT
  - Wonder Drug: Medication Induced
  - Wound: Surgical Site Infection

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?