HEALTH CARE ASSOCIATED INFECTIONS

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PREDISPOSING FACTORS

- Surgery or other invasive procedures
- Urinary or intravenous catheters, endotracheal tubes, breached barriers, surgery
- Immunocompromised host (e.g. leukemia) or treatments (e.g. immunosuppressive agents - chemotherapy, steroids)
- Effect of antibiotic treatment - colonization by resistant bacteria and fungi
- Exposure to health care workers, other patients, hospital environment (hand washing)
- For all the reasons above ICU patients are particularly susceptible to nosocomial infections

PREVENTION

- ***Two most effective prevention measures on the part of the health-care providers are***
- **HAND WASHING**
- **VACCINATIONS**
- **GOOD PRACTICE INSERTING CATHETERS**
- **MORE THAN 50% PREVENTABLE**

HEALTHCARE STAFF VACCINATIONS IS NOT ONLY HEP B, FLU SHOTS ARE MANDATORY IN MANY COUNTRIES

HEALTHCARE PERSONEL VACCINES

Hepatitis B	IM - 2 doses 4 weeks apart; #3 at 5 months after #2	**All employees at risk** for exposure to blood or body fluids. May be declined by signing OSHA declination.	Pregnancy is not contraindication. Previous anaphylaxis to baker's yeast or previous hep. B vaccine are contraindications.	HBsAb testing at 1-2 months after series. If negative, series repeated or declined.
'Red' **Measles** (rubeola)	Subcut - 2 doses at least 1 month apart, both must be after first birthday & **dated after January 1, 1968**	**All employees.** Acceptable evidence of immunity: 2 documented vaccine doses, or laboratory screening showing immunity. Employee may claim medical (provider note required) or religious/philosophical exemption; form available.	Pregnancy; immunocompromised persons*; anaphylaxis after gelatin ingestion or contact with neomycin; recent administration of Ig. Do not give if hx of anaphylactoid reactions to eggs (allergy to feathers or chickens O.K., vaccine grown in chick embryo).	Killed vaccine available during 1963-1967 was found not to provide long term immunity. **MMRV or component vaccines may temporarily suppress PPD reactivity. Delay PPD 6 weeks if cannot be done before or day of vaccination.**
Mumps	Subcut - 2 doses at least 1 month apart, both must be after first birthday.	**All employees.** Acceptable evidence of immunity: 2 documented vaccine doses, or laboratory screening showing immunity. Employee may claim medical (provider note required) or religious/philosophical exemption; form available.	Pregnancy; immunocompromised persons; anaphylaxis after gelatin ingestion or contact with neomycin. Do not give if hx of anaphylactoid reactions to eggs (allergy to feathers or chickens O.K., vaccine grown in chick embryo).	
Rubella (German measles)	Subcut - 2 doses at least 1 month apart, both must be after first birthday, and **dated after June 6, 1969**	**All employees.** Acceptable evidence of immunity: 2 documented vaccine doses, or laboratory screening showing immunity. Employee may claim medical (provider note required) or religious/philosophical exemption; form available.	Pregnancy; breastfeeding; immunocompromised persons; anaphylaxis after gelatin ingestion or contact with neomycin.	Females are at risk for a generally self-limited arthralgia/arthritis beginning 2-4 weeks after vaccination.
Varicella (chickenpox, zoster, VZV)	Subcut - 2 doses at least 1 month apart, both must be after first birthday.	**All employees.** Immunity: + screening serology or documentation of 2 doses vaccine. Declinations as per above.	As above. Avoid salicylate use for 6 weeks after vaccination (r/t association w/ Reyes & natural infection).	No screening test for post vaccine immunity. 'Catch-up' persons with only 1 documented dose in childhood. D/C for ≥ 24h HSV antivirals, may reduce efficacy of vaccine. **By appt. only**
MCV4 Meningococcal Conjugate Vaccine	IM - 0.5mL, 1 dose Booster doses every 5 years for those who remain at continued risk of exposure.	**Only for microbiology employees who work with N. meningiditis cultures.** Declination available.	Contraindications: allergy to diphtheria toxoid; hx of Guillain-Barre; latex allergy; bleeding disorder; pregnancy category C; breastfeeding risk unknown	**By appt. only** Allocated vaccine so may not be available from pharmacy at all times.

NOTE: all live vaccines, e.g. MMRV, must be given simultaneously or separated by at least 4 weeks.

*from pkg. insert: topical steroid therapy (e.g. eye, nose, skin), and intra-articular, bursal, or tendon injection of corticosteroids are not immunosuppressive. Short-term, (<2w), and inhaled steroids also not a contraindication; see MMWR Vol. 51/RR-2 p. 23 for more info.

Revision: 4/2014, Reviewed 3/2017, Attachment to Immunization Requirements for Personnel in EMHS Member Organizations (17-017)

HEALTHCARE ACQUIRED INFECTIONS (HAI)

- I. Catheter Associated Urinary Tract Infections (CAUTI) - 40%
- II. Surgical wound infection (SSI)
- III. Intravascular device infections (mainly CLABSI - central line associated blood stream infections)
- IV. Hospital acquired pneumonias and Ventilator-associated pneumonias (HAP, VAP) - 15%

I. Urinary Tract Infections

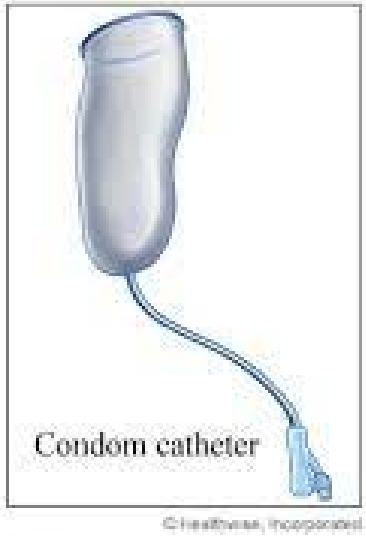
- **Common organisms:** GRAM NEGATIVE bacilli (*E.coli, P. aeruginosa, Klebsiella).* Also *Enteroccocus faecalis*
- **Prevention:** Insert catheter only if necessary, **use aseptic technique**, keep system closed. Treat positive urine cultures in catheterized patients (>10^5 colonies/ml) **only if patient is symptomatic (fever, flank pain)**
- **Risk factors:** diabetes, age, length of catheterization >14 days
- **Diagnosis:** pyuria, urine cx, clinical symptoms
- **Treatment:** REMOVE CATHETER and treat
- **Daily reassessments of catheter necessity should be documented in patient chart**

- **Good reasons for urinary catheter placement**

- Acute urinary retention/obstruction
- Neurogenic bladder
- Continuous bladder irrigation
- Input/output measurements in critically ill /ICU patients
- Existence of open sacral/peritoneal wounds or pressure ulcers
- Hospice/comfort/palliative/end of life care
- Postoperative - catheter should be out in 24 hrs.

- INCONTINENCE AND IMMOBILITY NO GOOD REASON

EXTERNAL CATHETERS - CONDOM (MALE), "PUREWICK" (FEMALE)



ABCDE CAUTI prevention

- **Adhere** to general infection control principles
- **Bladder sonography** to be performed to potentially avoid catheterization
- Use **Condom catheter or intermittent catheterization** when appropriate
- **Do not use indwelling catheter when criteria are not met**
- Remove catheters **Early**

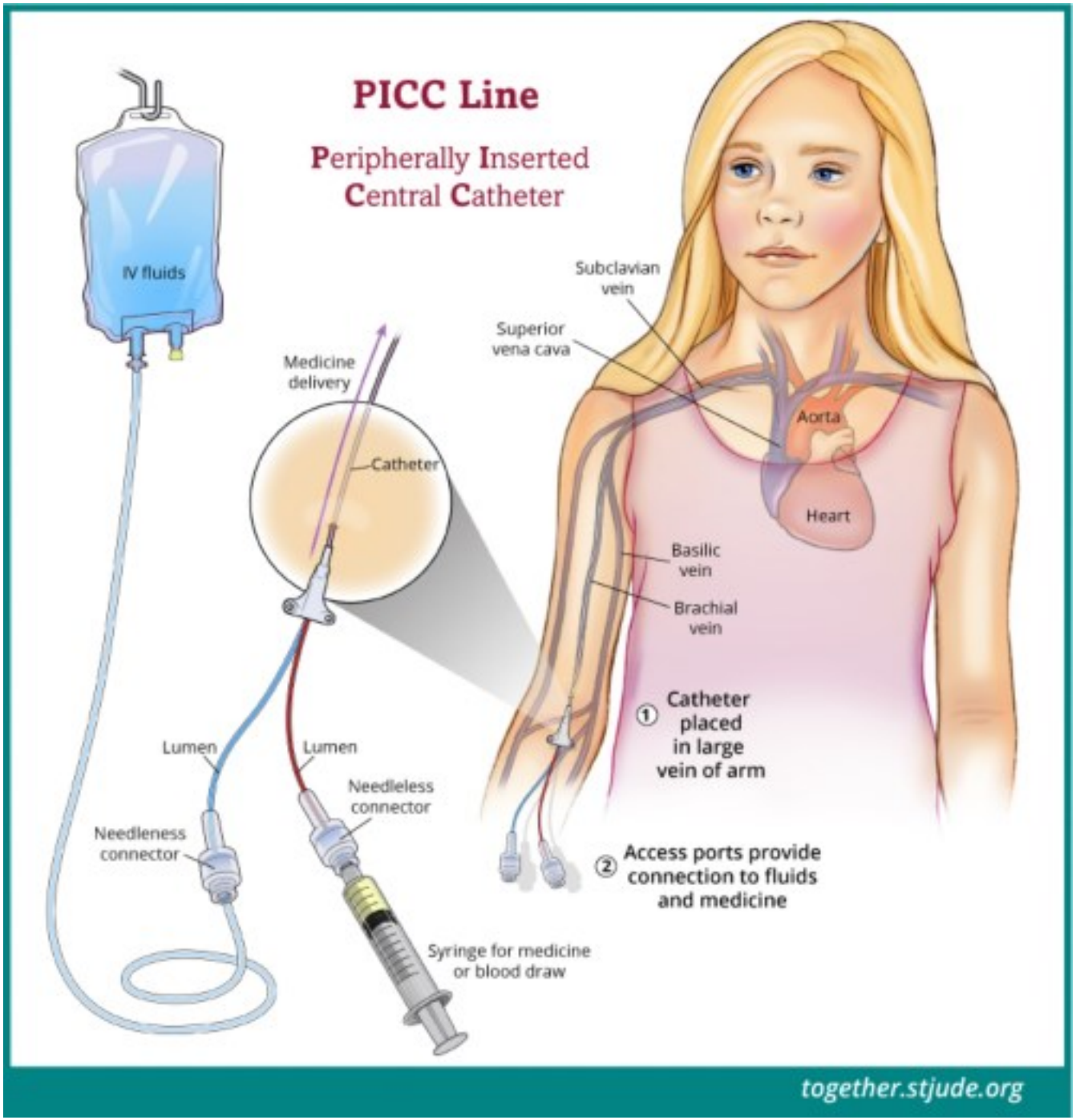
II. Nosocomial Bloodstream Infections

- **C**entral **L**ine **A**ssociated **B**loodstream **I**nfections most common
- **Can result in sepsis, endocarditis, quick death**
- **Common organisms: GRAM POSITIVES…S. aureus, S.epi, Enterococcus faecium**
- **GRAM NEGATIVES…… Pseudomonas, Klebsiella, Enterobacter, E.coli**
- **FUNGI….CANDIDA**

II. Nosocomial Bloodstream Infections prevention

- **Central IV lines** – preferable site of inception is **subclavian followed by internal jugular.** Highest risk is femoral site.
- U**se sterile technique, full barrier precautions (sterile draping, gowns, masks)**
- **CHLORHEXIDINE for skin prep.**
- **Minimize manipulations with catheters.**
- **Watch for periferal lines as well.**
- **Think long-term devices if central access needed more than 10-14 days**

LONG TERM INTRAVENOUS DEVICES - PICC LINE


PICC Line
Peripherally Inserted
Central Catheter
IV fluids
Medicine delivery
Catheter
Lumen
Lumen
Needleless connector
Needleless connector
Syringe for medicine or blood draw
Subclavian vein
Superior vena cava
Aorta
Heart
Basilic vein
Brachial vein
1 Catheter placed in large vein of arm
2 Access ports provide connection to fluids and medicine
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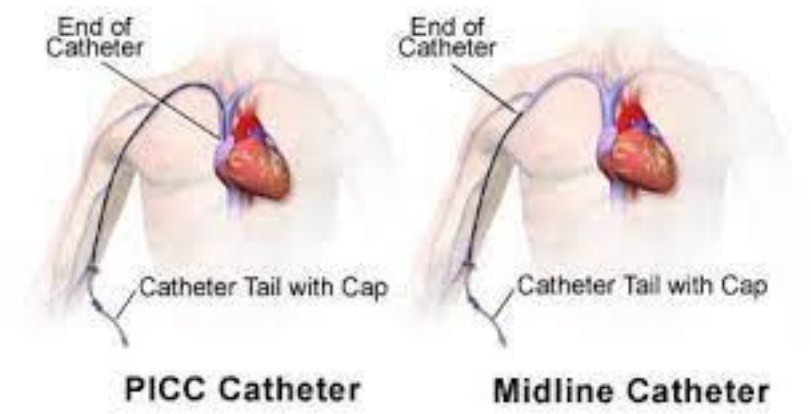
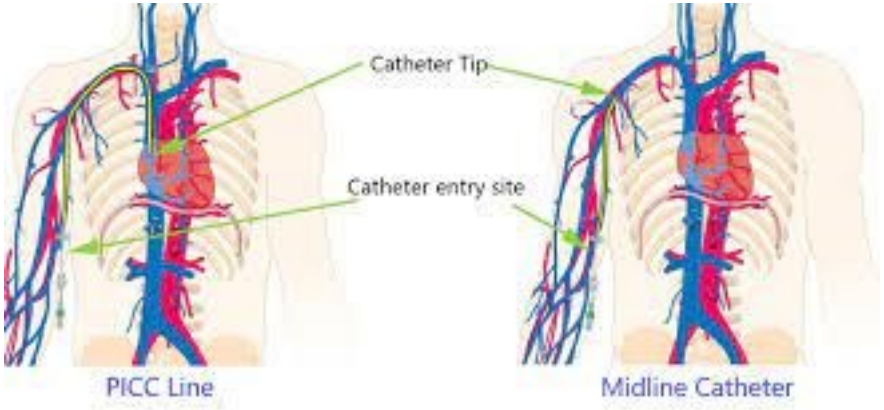
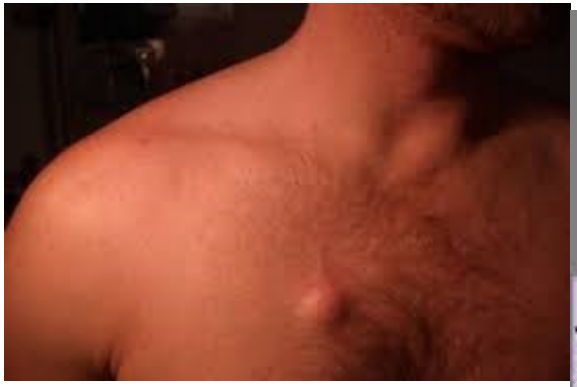
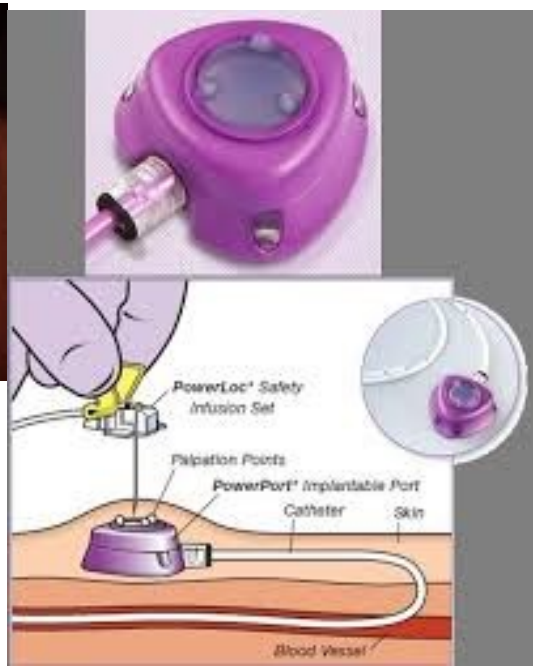
PICC LINE vs MIDLINE





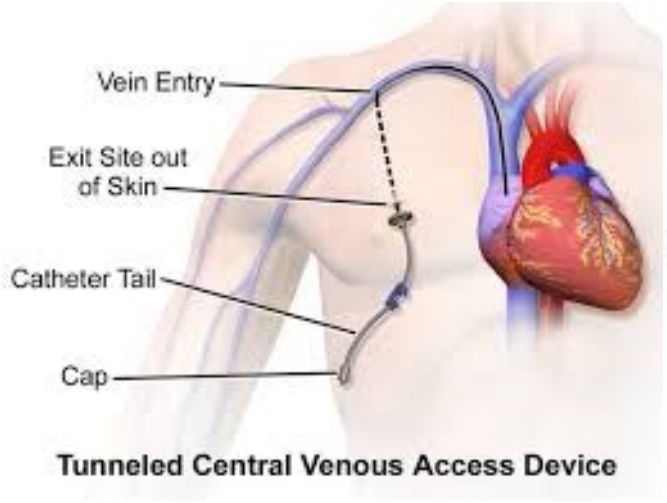
LONG TERM INTRAVENOUS DEVICES PORT-A-CATH



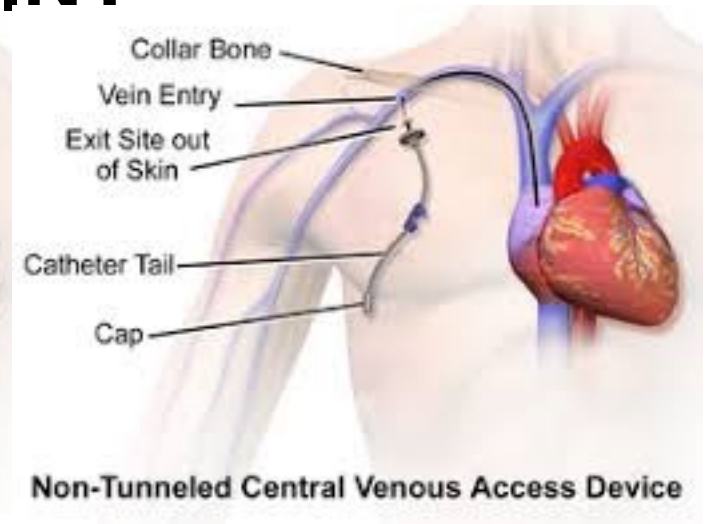


CENTRAL VENOUS LINES - TUNNELED AND NON-TUNNELED ACCESS

» **TUNNELED DEVICES ARE SAFER FROM THE INFECTION CONTROL POINT**



Tunneled Central Venous Access Device

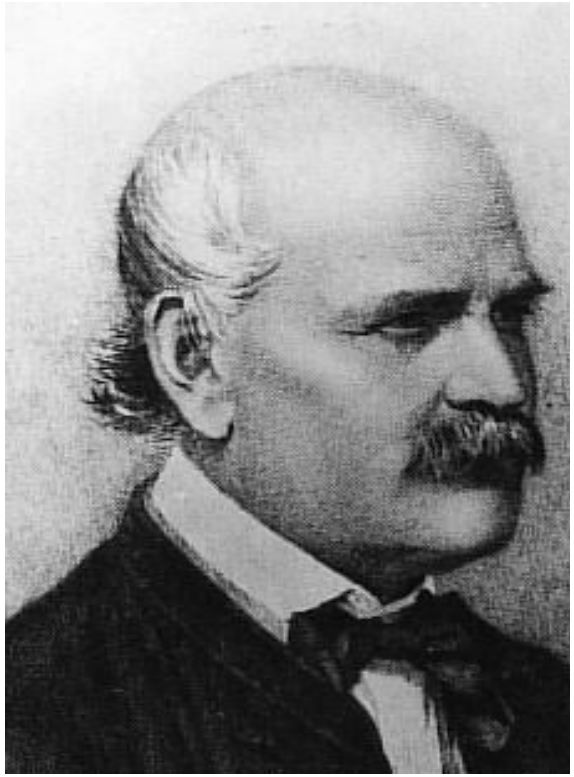


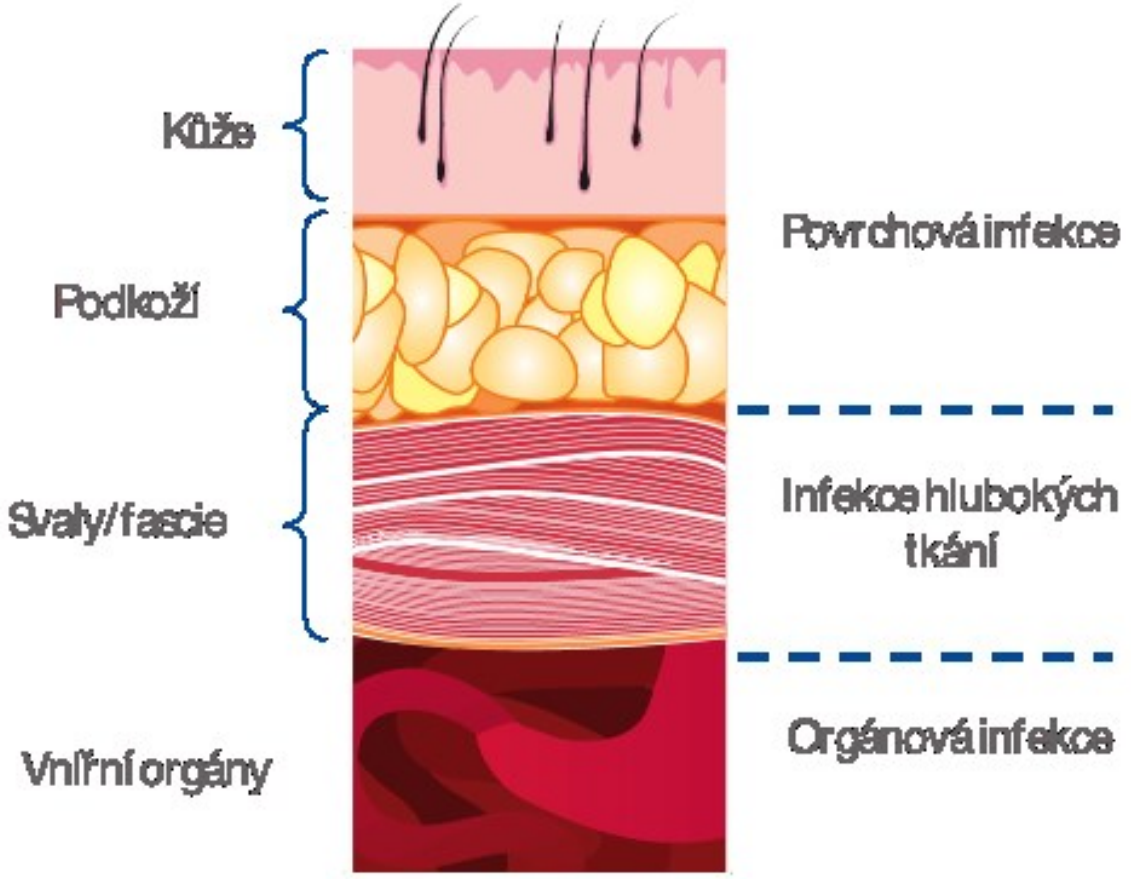
Non-Tunneled Central Venous Access Device

Blood stream central line infections

- **Sources of infection:** 1. Contamination at the catheter insertion site 2. Contamination of the catheter hub or tubing junction during opening 3. Contaminated IV fluids
- **Management:**
- **1.** Obtain two sets of blood cultures from different sites, at least one periferal.
- **2.** Remove catheter, obtain G-stain and cultures form any purulent drainage and culture the catheter tip.
- **3.** Treatment depends on the cultured organism, 7-14 days i.v. abx therapy is indicated (**up to 4 weeks for S. aureus even after catheter removal and endocarditis rule-out**).

III. Surgical site infections





PATHOGENS

- **St. aureus cca 20%**
- **Coag. negative Staph cca 14%**
- **Enterococcus cca 12%**
- **E. coli 8%**
- **Pseudomonas 8%**
- **Enterobacter 7%**
- **Proteus, Klebsiella...**

1. Superficial SSI - definition

- **Infection occurs within 30 days after the operation and infection involves only skin or subcutaneous tissue of the incision and at least one of the following:**
- **Purulent drainage from the superficial incision.**
- **Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.**
- **Pain or tenderness, localized swelling, redness, or heat and superficial incision is deliberately opened by surgeon, unless incision is culture-negative.**

- **Diagnosis of superficial incisional SSI by the surgeon or attending physician.**

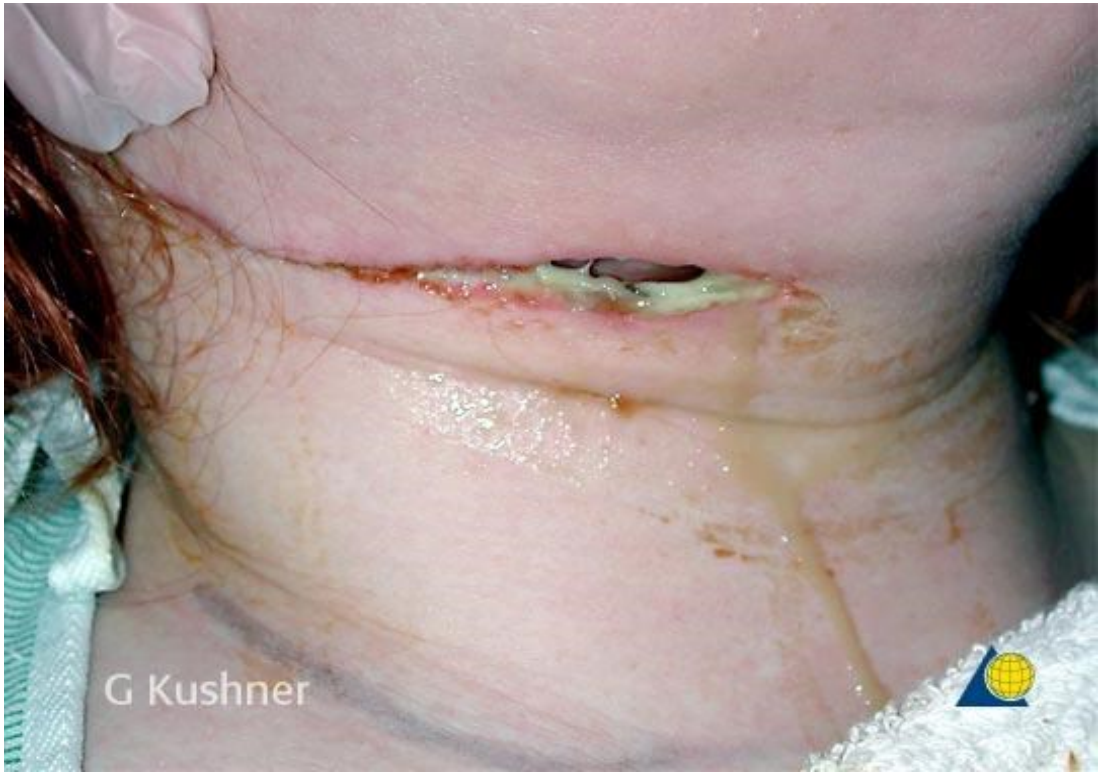
2. Deep incisional SSI

- **Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves deep soft tissues (e.g., fascial and muscle layers) of the incision and at least one of the following:**
- **Purulent drainage from the deep incision but not from the organ/space component of the surgical site.**
- **A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38°C), localized pain, or tenderness, unless site is culture-negative.**
- **An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopatologic or radiologic examination.**
  Diagnosis of a deep incisional SSI by a surgeon or attending physician.

3. Organ space SSI

- **Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves any part of the anatomy (e.g., organs or spaces), other than the incision, which was opened or manipulated during an operation and at least one of the following:**
- **Purulent drainage from a drain that is placed through a stab wound into the organ/space.**
- **Organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.**
- **An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination**

SSI



SSI – RISK FACTORS

- **Attention to basic infection control strategies**
- **Surgical technique**
- **Prolonged duration of surgery**
- **Operating room environments and sterilization**
- **Preoperative and perioperative management**

Risk factors

- Incorrect hair removal
- Excessive use of electrosurgical cautery units
- Presence of prosthesis or other foreign body
- Degree of tissue trauma
- Need for blood transfusion
- Hypothermia

Patient at risk

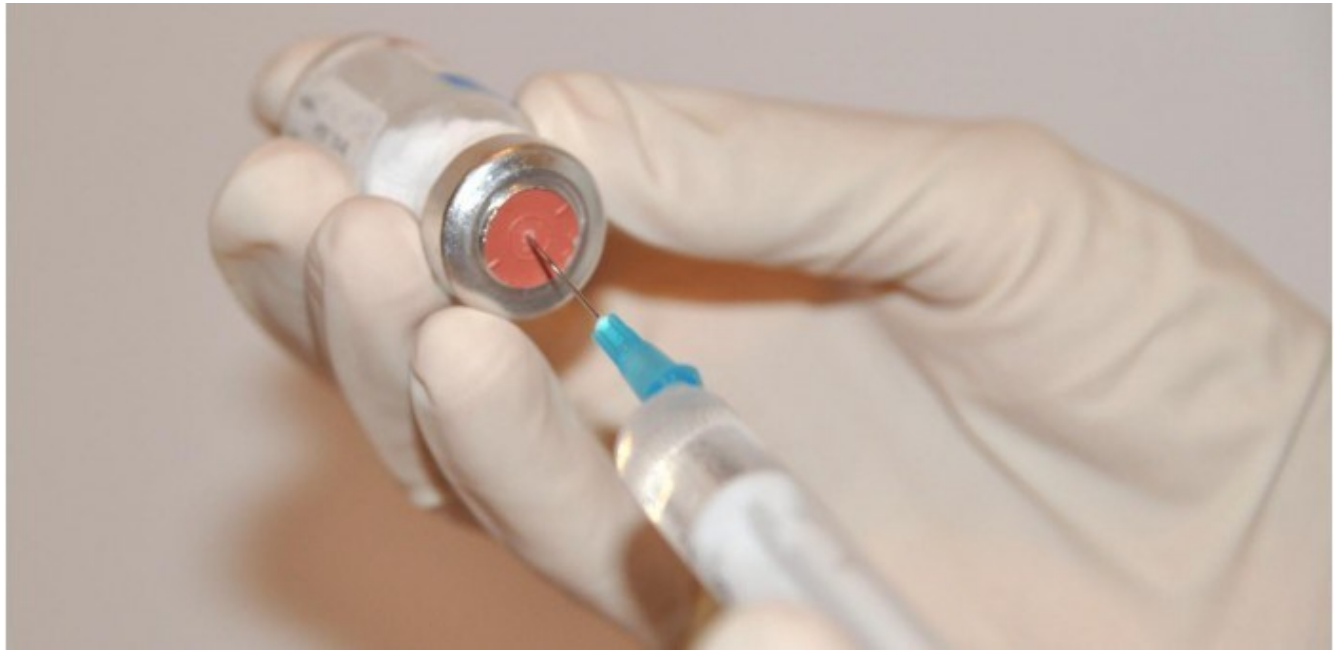
- **DIABETES**
- **NICOTINE**
- **STEROID USE**
- **MALNUTRITION**
- **PROLONGED HOSPITAL STAY**
- **S. aureus COLONIZATION**

Perioperative control measures

- **Skin antisepsis…chlorhexidine superior to povidone-iodine and iodine-alcohol**
- **Hair removal** – **clippers** preferred
- **S. aureus decolonization**

ANTIBIOTIC PROFYLAXIS

- **Correct antibiotic choice**
- **Good timing**
- **NO MORE THAN 24 hours**
- **NO ABX AFTER WOUND CLOSURE**



Other important points

- **S. aureus decolonization and screening - NO stardardized decolonization regiments**
- **Many studies used nasal MUPIROCIN**
- **(twice daily for five days) and CHLORHEXIDIN bathing (daily for 5 days)**
- **Chlorhexidine bathing.. Still considered an unresolved issue**

IV. Pneumonia: HAP and VAP

- **HAP-** Hospital Acquired Pneumonia - pneumonia occurring more than 48 hrs after admission

- **VAP -** Pneumonia occurring more than 48 hours after endotracheal intubation
- **A. VAP - early onset <5 days - sensitive organisms (S.pneumo, H.flu, S. aureus)**
- **B. VAP- late onset >5 days - resistant organisms- MDRO**

Ventilator-associated pneumonia

- **Clinical findings:** fever, purulent tracheal aspirate, decreased O2 saturation

- **Diagnosis:** difficult, no reliable tests, sputum or endotracheal aspirate cultures (non-invasive sampling) usually enough, **chest X ray**, lab findings. Although samples could be obtained bronchoscopically, **studies showed no advantage of invasive strategies**
- Etiology often not identified. **Empiric coverage of S.aureus and PSAE often necessary**
- **Length of treatment: 7 days. In case of PSAE (P.aeruginosa) or Acinetobacter longer**

VAP prevention

- **Use noninvasive ventilation when possible**
- **Minimize sedation**
- **Elevate the head of the bed to 30-45 degrees**
- **Daily oral care with chlorhexidine**
- **Daily subglottic suctioning**
- **Peptic ulcer disease prevention** -avoid PPI if possible
- **Deep venous thrombosis prevention** with heparin
- **Use orogastric rather then nasogastric tubes**

HAI Responsible Microorganisms

1. MRSA

- ***Resistance of S. aureus differs country from country***
- **Screening debatable (nose swabs)** - recommended only for patients **PRIOR TO SURGERY**
- **ISOLATION** of patients with MRSA - **ONLY OPEN WOUNDS THAT CAN NOT BE CONTAINED - CONTACT PRECAUTIONS**
- **Mupirocin and chlorhexidine baths prior to surgery** are the means for MRSA decolonization for patients undergoing surgeries (**open heart, orthopedic - joint replacements**)

2. MDRO - MULTIDRUG RESISTENCE ORGANISMS
Predominantly Gram negatives

- **Dramatic increase in resistance in the last 10 years**
- **Klebsiella pneumoniae/oxytoca**
- **Pseudomonas (PSAE)**
- **Acinetobacter**
- **Serratia**
- **ESBL G minus**
- **Stenotrophomonas, Burkholderia**
- **Candida, E.fecalis, MRSA**

3.Clostridium difficile

- Causes **Pseudomembranous colitis**
- Diarrhea, fever, abdominal cramps.
- Marked leucocytosis, fever, abdominal tenderness, dehydration
- Most offending agents are **cefalosporins** because of their high rates of use, abx with the highest incidence of pmc is **clindamycin** (10%), also **fluroquinolones**
- **Treatment: Discontinue antibiotic and PPI if possible, hydration**
- **P.O. Vancomycin, Fidaxomicin, less Metronidazol, i.v. TIGECYCLIN**
- **Stool transplant**
- **Surgery** - Colectomy with abx if toxic megacolon develops
- **Infection control - Contact precautions and hand washing with soap!**

3. OTHERS

- **Legionella - air conditioners, water supply, showers**
- **Fungi - Candida and Aspergillus**
- **VIRUSES - INFLUENZA, RSV**
- **ROTAVIRUS, NOROVIRUS, ADENOVIRUS - NOSOCOMIAL DIARRHEA**

Infection control - ISOLATION

- **STANDART precautions** – for all patients
- **AIRBORN precautions** (particles <5 um) - transmitted by airborn droplet nuclei like ***Varicella, measles, TB***. Place patient in negative pressure room, wear N 95 mask (tightly sealed)
- **DROPLET precautions** – (>5 um) - transmitted by large-particle droplets like *Neisseria meningitidis, Influenza.* Regular masks only.
- **CONTACT precautions** – organisms transmitted by direct contact like *C. difficile, VRE, MRSA*. Own stethoscopes assigned to each patient, visitors wear gowns and gloves. Masks not necessary.

THANK YOU