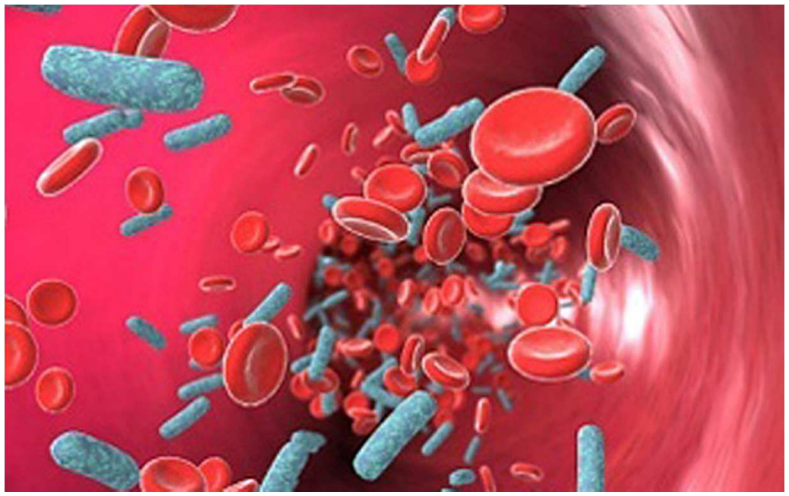
Bloodstream Infections in Dialysis Patients

SKC In-service Feb 2017

Bloodstream Infection

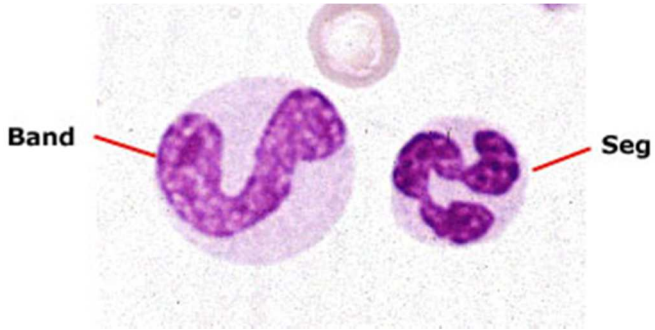


- Also known as
  - Bacteremia
  - Sepsis (= bacteremia + immune response)
  - Septicemia

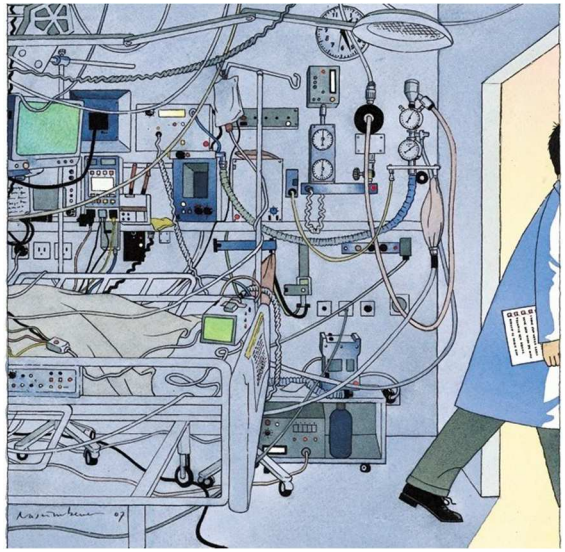
- Occurs when bacterial infection elsewhere in the body, such as in the lungs or skin, enters the bloodstream.

Why is this a problem?

- Bacteria can release toxins into the body
- Immune system response can lead to systemic inflammation
- SIRS = Systemic Inflammatory Response Syndrome
  - Temperature > 36C
  - HR > 90
  - RR > 20
  - WBC count < 4 or > 12, or > 10% bands



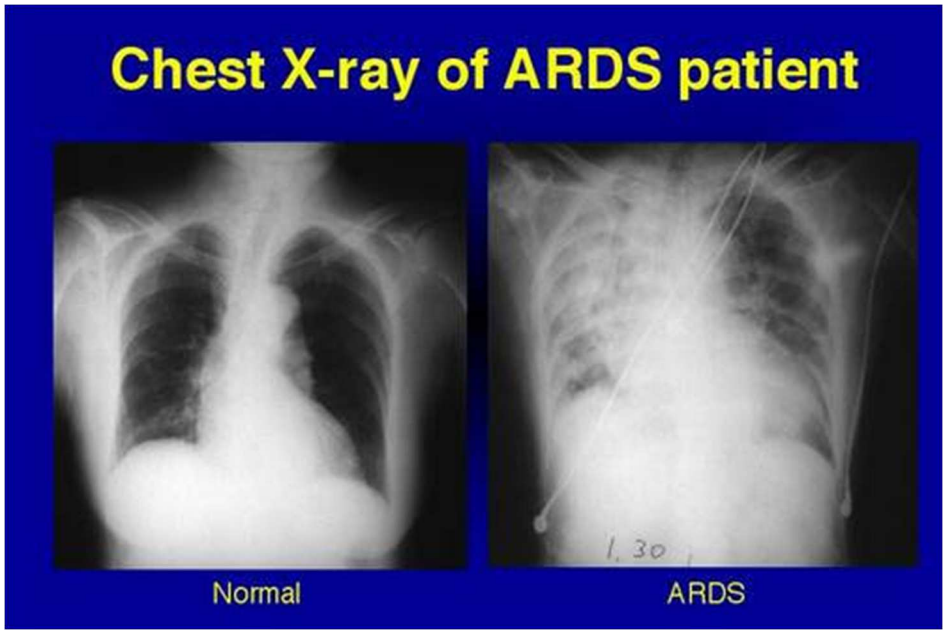
When it gets worse…



- Septic Shock
  - Occurs when sepsis, which is organ injury or damage in response to infection, leads to dangerously low blood pressure and abnormalities in cellular metabolism
  - 25-50% mortality
  - SBP < 90, MAP < 60, not responsive to fluid boluses
  - Usually associated with change in mentation, drop in urine output

When it gets even worse…

- Septic shock with multi-organ failure
  - Respiratory failure → Acute Respiratory Distress Syndrome (ARDS)
  - Acute Kidney Injury
  - Shock Liver
  - Heart Failure
  - ICU delirium /dementia
  - Often results in death



Causes of Bacteremia

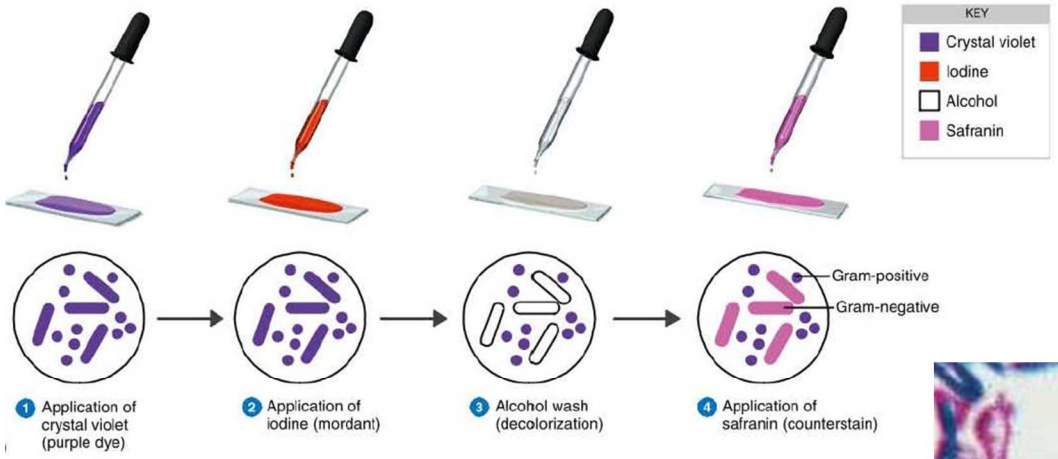
- Dialysis Access – By far the most common culprit in ESRD
  - Skin organisms: Staph, Strep
- Pulmonary
  - Pneumonia: pneumococcus, legionella, mycoplasma, kelbsiella, staph
- Genitourinary
  - Urinary tract infection: E.Coli, klebsiella, proteus
- Other blood stream infections
  - Pseudomonas, enterococcus, candida

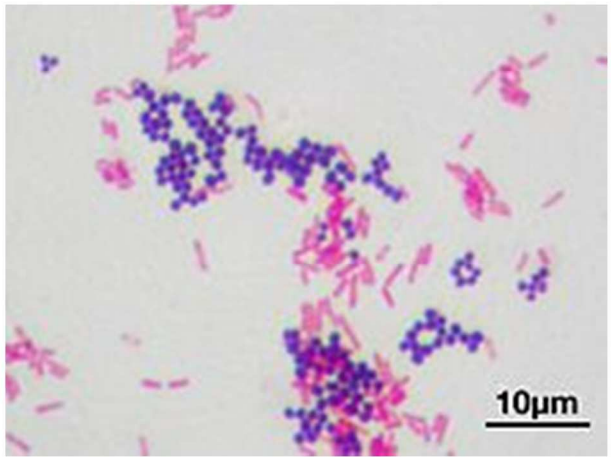
Diagnostic Techniques

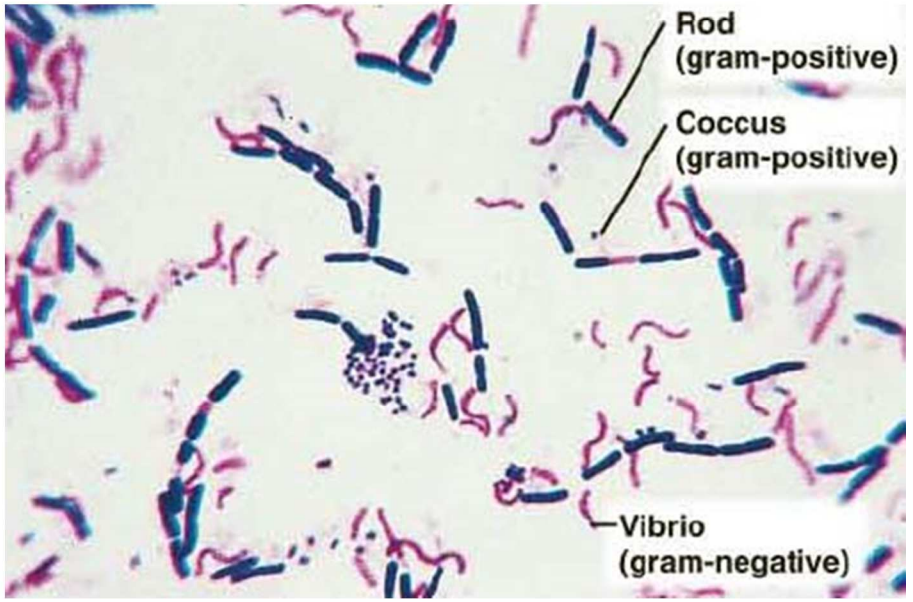
- History and physical; Find the source!
- Blood Culture
- Gram Stain
- Antibiotic sensitivity

Gram Stain

- Tells you what shape of bacteria are present, can give clues about the type of bacteria. Available before culture comes back and can help guide initial antibiotic choice.



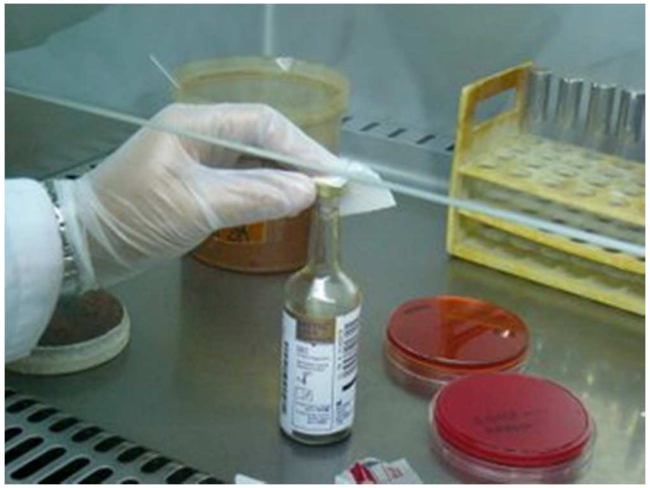




Blood Culture

- Obtained via blood culture bottles
- Incubated
- Once growth determined, gram stain performed
- Gram stain helps guide further culture techniques to identify organism
- Sensitivity testing with various antibiotics

Bottles with culture media, dye in bottom reacts with CO2 causing flourescence allowing machine to detect if a bottle is growing bacteria



A sample can then be taken from bottle for gram stain, culture and sensitivity

NKC method of Blood Cultures

SUPPLIES

PPE (Personal Protective Equipment)
2 sets of blood cultures (4 bottles)
Bact/ALERT SN anaerobic blood (Purple)
Bact/ALERT SA aerobic blood culture bottle (Blue)
Linen saver (Blue pad)
20 ml syringe
Alcowipes and Chlorascrub Swab Pads
Transfer device

Procedure	Key Points
1. Refer to Standing Orders.	1. Blood cultures: • for patient with a central line and with fever >100° F(38.2° C) draw 2 sets of blood cultures from the access/bloodlines at least 5 minutes apart. NotifyMD. • for patient without central line but with fever >100°F (38.2° C), call MD for orders.
2. Wash hands. Don PPE.	

Procedure	Key Points
IF DRAWN PRE HEMODIALYSIS: 1. a. Cannulate access per usual NKC procedure. Draw blood culture using a 20 ml syringe before any other blood draw or NS instillation. **OR** b. Draw 4-5 ml of blood from the arterial lumen of the catheter and check for clots. c. Attach 20 cc syringe and fill it with blood.	1. • Remove caps from blood culture bottles and clean with a Chloroscrub Swab. Allow solution to dry and then remove it with an alcohol wipe so Chloroscrub is not injected into culture.
3. a. Using a transfer device inject 10 ml of blood into the aerobic bottle. Switch to the anaerobic bottle and fill it with the remaining 10 mls of blood, . b. Mix the blood and the culture broth by inverting the bottles 3 to 4 times.	3 • Aerobic Bottle:Blue label Bac/AlertSA • Anaerobic Bottle: Purple label Bac Alert SN
4. a. Draw the second set of cultures from the access or the arterial bloodline port, if the patient is now on dialysis. At least 5 minutes must elapse between blood draws. b. Mix the blood and the culture broth well by inverting the bottles 3 to 4 times.	4. • See section below "If Drawn During Hemodialysis".

Procedure	Key Points
IF DRAWN DURING HEMODIALYSIS: 1. Place linen saver under the arterial blood port.	1. Blood samples are drawn from the arterial port because this blood has not been immediately affected by the dialyzer.
2. Disinfect the Streamline port if the plug is not in place.	2.
3. Remove the flip caps from the culture bottles and disinfect them with Chloroscrub Swab. Allow them to dry. Remove the Chloroscrub with an alcohol wipe and allow the alcohol to dry.	3. • To make sure that Chloroscrub it not injected into the culture medium, it is removed after it has been allowed to dry ensuring appropriate contact time.
4. a. Attach a 20 cc syringe to the arterial port and withdraw 20cc's of blood. b. Attach the syringe to a blood transfer device.	

5. a. Inject 10 ml of blood into the aerobic culture bottle (blue label). b. Inject the other 10 ml of blood into the anaerobic culture bottle (purple label).	5. • Be careful not to contaminate the device and syringe as you transfer the blood sample between bottles. • <u>Do not</u> change the device between bottle injections. That could introduce air into the anaerobic bottle • The optimum amount of blood for these culture bottles is 10 ml. See Points to Emphasize #4.

Procedure	Key Points
6. Label the culture bottles with the following information: a. Patient's name. b. Social Security number. c. Date and time drawn d. The number of the culture if in a series. e. Where culture was obtained.	6. • DO NOT cover the barcode labels. Leave a space on back of bottle where both can be seen.
7. Fill out NKC/PACLAB lab slip with the following information: a. Patient's name. b. Social Security number. c. Date and time drawn d. Where culture was drawn. e. Type of culture f . Physician g. All initial blood cultures and antibiotic orders must use ICD9 Code 780.60.	7. • ICD-9 Code 996.62 can only be used when the infection access related. **(See Points to Emphasize # 7. ICD-9 Codes and the Infection Algorithm)**
8. Send culture to Pac lab.	8. Keep at room temperature.

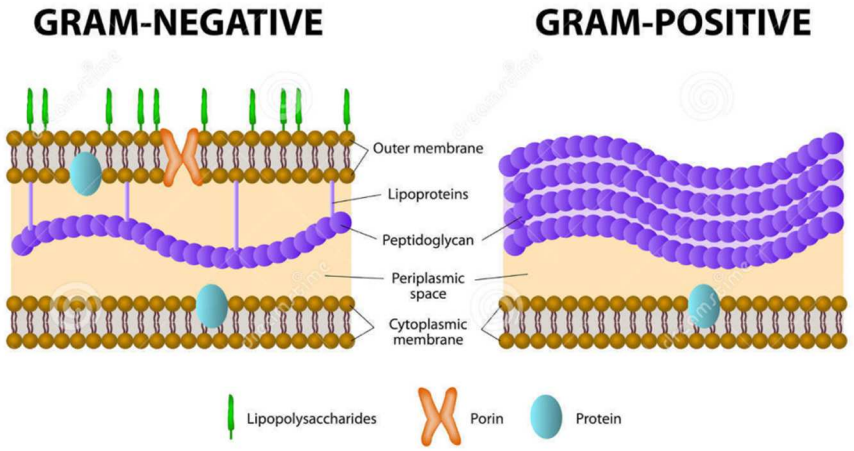
Notes

- Blood cultures are drawn aseptically. Be extremely careful to avoid contamination of the needle or culture bottle top with either the patient's or staff member's normally occurring skin organisms.
- **Blood Culture Bottle Inspection:** Blood culture bottles which have hazy, grossly turbid, or discolored fluid should not be used. Return to Pac Lab. Always check expiration date before using.
- The physician should determine the length of time between the series of cultures. See Standing Orders or call MD. Make sure that the bottles and lab slips indicate that the culture is part of a series #1 and #2.
- **Filling Blood Culture Bottles:** Ten cc of blood is optimum for these culture bottles.
  - a. Underfilling the bottles prevents dilution of the anticoagulant, which prevents fastidious bacteria from growing.
  - b. Overfilling can result in inadequate oxygenation of aerobic bottles and can cause insufficient growth of some organisms. The bottle may also crack due to increased pressure.
- 5. **Bottle Inversion:** Do not draw directly from the arterial port by inverting the bottles into a vacutainer transfer device. Any possible injection of small amounts of the culture medium into the patient could result in a serious problem such as DIC (Disseminated Intravascular Coagulopathy). This is especially true of the aerobic medium that contains charcoal.
- 6. **Drawing Peripheral Blood Cultures:** Peripheral samples may be drawn using a butterfly needle. Verify MD order. For accuracy reasons, the MD might not want to use a central line but a peripheral vein. See Procedure: Blood draw from peripheral vein.
- 7. **ICD-9 Codes and the Infection Algorithm (IC-I6000A):** ICD-9 Code 780.60 is used for all initial blood cultures and antibiotic orders. If the culture comes back positive the Care Manager will call the physician for the correct ICD-9 Code. That Code is then assigned in the EMR to the Problem List so it can be used for future medication orders.
- 8. **Two sets of Blood Cultures:** All blood cultures must have 2 sets of culture bottles which is 4 bottles. A set consists of one anaerobic and one aerobic bottle. Drawing only **one** set **is not an acceptable** practice and alters the results.

So I got the blood culture now what?

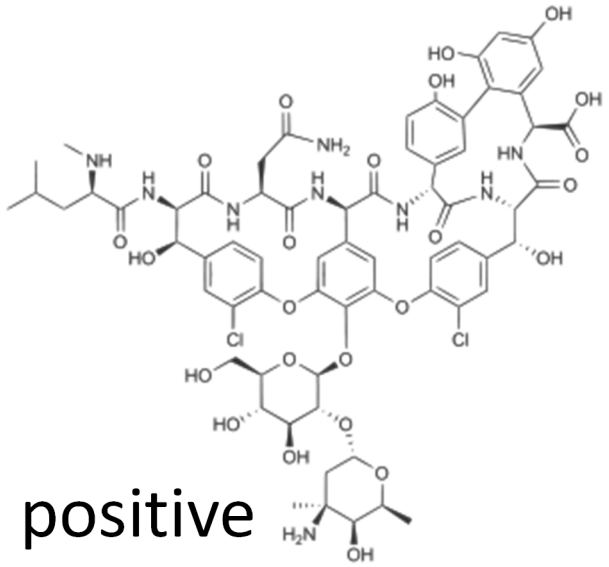
- Treatment plan is dependent upon the clinical situation, suspected source, suspected bug. Consult the nephrologist for advice
- In general, fever and suspected bacteremia with indwelling catheter in place will receive broad spectrum antibiotics while waiting for culture results
- Fever and suspected bacteremia without indwelling intravascular device may also receive broad spectrum antibiotics or may be monitored while waiting for culture results depending upon the clinical situation
- Patients that meet SIRS or septic shock criteria need to go to the hospital

Common Dialysis Antibiotics



- Cefazolin:
  - B lactam antibiotic.
  - Causes cell lysis by interfering with cell wall peptidoglycan.
  - Coverage for most gram positive organisms.
  - Preferred for Staph (excluding resistant strains like MRSA).
  - Dose in TIW dialysis 2g/2g/3g.

Common Dialysis Antibiotics



- Vancomycin:
  - Inhibits cell wall synthesis in gram positive organisms (bacteriostatic).
  - Drug of choice for B lactam resistant staph (MRSA).
  - Convenient dosing for dialysis by serum level.
  - Usual goal level is 15-20 but this can change based upon the MIC of the bacteria.
  - Bigger molecule (MW ~1400), not as easily cleared by dialysis

Common Dialysis Antibiotics

- Ceftazidime:
  - Inhibits cell wall enzyme PBP3
  - Effective mostly against gram negative bacteria
  - Useful for initial broad spectrum coverage
  - Dose 1-2g with dialysis, depending on size and indication
  - ESBL bacteria may be resistant to this medication

Antibiotics in Bloodstream Infections

- Typical duration is 14 days
- Intravenous administration is preferred
- Source of infection should be found and controlled
- Presence of endovascular seeding or involvement usually warrants a longer course (6-8 weeks)
- Antibiotics should always be narrowed from broad spectrum to specific antibiotic once the culture and sensitivity is known
- Narrowing antibiotics is often overlooked by busy providers, case managers and nurses can help to make sure this happens!

Reporting

- All blood stream infections need to be reported and tracked for QAPI process
- Determinations should be made if access or non access related. If a definitive source is not found consult medical director for advice (usually it is access related)
- It is important that our recorded rates of infection are accurate so that we can focus our infection control efforts

Take Home Points

- Blood stream infections are serious events for dialysis patients and should be taken seriously
- Finding the source of infection and controlling the source is very important
- Ensure all culture results are followed up and antibiotics are narrowed or modified based upon sensitivity results
- All infections in dialysis patients should be tracked and well described to help us focus our quality efforts