

NM Delnor Hospital Antibiotic Lock Therapy (ALT)

Background:¹⁻³

Antibiotic lock therapy is now commonly used in combination with systemic antimicrobial therapy for catheter related bloodstream infections (CRBSI). ALT has grown in popularity over the years due to the increased eradication rates of CRBSI seen when ALT is utilized. Many bacteria that grow in catheters are growing in the presence of a biofilm. Much higher concentrations of antibiotics are needed to kill these bacteria that are growing in the biofilm. ALT allows the administration of suprathreshold concentrations of antibiotics and allows them to dwell in the catheter thus exposing the bacteria to the higher antibiotic concentrations needed for killing. Various studies have looked at durations for ALT and the majority of studies have utilized a 2 week duration. Additionally several antibiotics are stable with heparin which can provide an added benefit due to the fact that many host proteins are used as adhesins in the catheter lumen. (See Table 1 for some common antibiotic and heparin combinations that are stable for ALT)

Below is a summary of recommendations from the IDSA regarding ALT:

- ALT is indicated for patients with CRBSI involving long-term catheters with no sign of exit or tunnel infection
- ALT should be used in combination with systemic antibiotic therapy, lasting 7-14 days
- Dwell times should not exceed 48hrs and should preferably be reinstilled every 24hrs
- Catheter removal is recommended for infections caused by *Staph aureus* or *Candida spp.*
- In patients with multiple positive catheter blood cultures growing coagulase negative *Staph* or gram-negative rods and concurrent negative peripheral blood cultures, ALT can be given without systemic therapy for 10-14 days
- For patients who are undergoing hemodialysis, the lock solution can be renewed after every dialysis session

Patient candidate criteria:

- General lock eligibility:
 - Patients who experience multiple bacterial infections of their central line within a short period of time
 - Patients in which removal or replacement of a CVC is not feasible
 - Check patients for documented allergies to requested antibiotics
 - Check patient for history of heparin-induced thrombocytopenia if heparin is to be used in conjunction with an antibiotic

Lock therapy should be initiated and instilled without dwell disruption for the duration of the therapy. It should not be used as a flush/lock solution concurrently when the central line is being accessed for multiple daily doses of intravenous medications because the patient could receive multiple doses of antibiotic. If patient has a single lumen catheter or port, another line (peripheral or PICC) may need to be placed for IV antibiotic courses. If patient has a double lumen catheter, the lock solution can be placed in one lumen for 24 hours while the other lumen is used for infusions. During the next 24-hour period, the other lumen can be locked with a lock solution “dwell” while first lumen is used for infusions.

Types of catheter:³

- ALT: Hickman, Groshong, Mahukar, Hohn, Broviac, Permcath, Mediport, Port-a-Cath, and PICCs

- Data suggests that ALT is less effective in treating infections in implantable ports than in infections in other types of CVCs.
- Only intraluminal infections are candidates for lock therapy, since lock therapy would be ineffective in extraluminal infection.

Table 1. Common Recommended ALT Formulations^{4-8, 10}

Antibiotic	Heparin, IU/mL	Dwell Time, hours
Vancomycin, 1mg/mL	100	≥ 24
Vancomycin, 1mg/mL	None	≥ 24
Vancomycin, 2mg/mL	10	≥ 24
Vancomycin, 2.5mg/mL	2500 or 5000	≥ 24
Vancomycin, 5mg/mL [#]	0 or 5000	≥ 24
Cefazolin, 5mg/mL	2500	≥ 72
Cefazolin, 10mg/mL	None	72
Gentamicin, 1mg/mL	2500	≥ 72
Gentamicin, 5mg/mL	None	≥ 12
Amikacin, 1mg/mL	None	≥ 24
Vancomycin, 2.5mg/mL + Gentamicin, 1mg/mL	2500	≥ 72

[#] Vancomycin at 5mg/mL is more effective at eradicating *Staph* spp. growing in biofilm when compared to vancomycin 1mg/mL

Catheter Volumes and Dosages:¹⁻³

Doses are determined by the catheter volume with a maximum volume of 5mL. Overall, the literature is consistent in recommending 2 to 5mL lock volumes in adult patients on ALT. Some lines may require up to 20mL for locks, such as Groshong catheters.

Nursing Procedure:

MD generates an order for corresponding antibiotic lock therapy in a patient w/catheter-related infection. Antibiotic lock solution should be used in place of usual heparin-lock solution for routine catheter care when catheter is not in use. Antibiotic lock solution should be withdrawn from the lumen and discarded prior to use of the catheter lumen. Lock therapy should be initiated and instilled without dwell disruption for the duration of the therapy.

Pharmacy Preparation and Dispensing:¹¹

- The antibiotic lock solutions listed below are available to order in Epic. The order defaults to 5mL, but larger volumes may be selected.
- Antibiotic lock solutions will be compounded and dispensed daily
- Pharmacy will prepare 5 mL of the solution in 10 mL syringes and send the syringe(s) to the floor each day. One 10 mL syringe with 5mL of antibiotic lock solution will be sent for each dwell time. Syringes will be labeled with 24-hour expiration.
 - If 20mL volume selected, it will be dispensed in a 30mL syringe or larger and sent at least daily.
- Label: "For catheter lock use only. Do not infuse into patient. Do not use if precipitate seen."
- Expiration: 24 hours.
- Specific pharmacy compounding instructions as follows:

Antibiotic Final Concentration (total quantity 5mL or 20mL)	Pharmacy Preparation
Ampicillin 10 mg/mL + heparin 100 units/mL	<ol style="list-style-type: none"> 1. Reconstitute 500 mg vial ampicillin injection with 10 mL of NS (conc= 50 mg/mL). 2. W/D 6 mL ampicillin solution (300 mg) and inject into empty 30 mL sterile vial. 3. Add 3 mL of 1000 unit/mL heparin (3000 units) to sterile vial. 4. Add 21 mL of normal saline to sterile vial (final ampicillin concentration 10 mg/mL, heparin concentration 100 units/mL). 5. Withdraw 5 mL in a 10 mL syringe or 20 mL in a 30 mL syringe for final product. 6. Label expiration 24 hours from time of preparation at room temperature.
Cefazolin 10 mg/mL + heparin 10 units/mL	<ol style="list-style-type: none"> 1. Double the below recipe if 20 mL volume ordered. 2. Reconstitute a 1 gram vial of cefazolin with 10 mL NS (conc= 100 mg/mL). 3. Withdraw 1 mL of cefazolin solution (100 mg) and inject into empty 30 mL sterile vial. 4. W/D 0.1 mL of 1000 units/mL heparin concentration (100 units) and add to vial. 5. QS with 8.9 mL normal saline to a final volume of 10 mL. 6. Withdraw 5 mL in a 10 mL syringe or 20 mL in a 30 mL syringe for final product. 7. Label expiration 24 hours from time of preparation at room temperature.
Ceftazidime 0.5 mg/mL + heparin 100 units/mL	<ol style="list-style-type: none"> 1. Double the below recipe if 20 mL volume ordered. 2. Reconstitute a 1 gram vial of ceftazidime with 10 mL normal saline (conc=of 100 mg/mL). 3. Withdraw 0.5 mL normal saline from a 10 mL vial and discard. Then withdraw 0.5 mL of ceftazidime solution (50 mg) and add to 9.5mL saline left in vial to make 5 mg/mL ceftazidime stock solution (total volume 10 mL). 4. W/D 1 mL of ceftazidime stock solution (5 mg) and inject into empty 30 mL sterile vial. 5. Withdraw 1 mL of 1000 units/mL heparin concentration (1000 units). Add to vial. 6. QS with 8.0 mL normal saline to a final volume of 10 mL. 7. Withdraw 5 mL in a 10 mL syringe or 20 mL in a 30 mL syringe for final product. 8. Label expiration 24 hours from time of preparation at room temperature.
Gentamicin 2 mg/mL	<ol style="list-style-type: none"> 1. Use gentamicin 40 mg/mL vial. 2. Withdraw 1.5 mL (60 mg) from vial and inject into empty 30 mL sterile vial. 3. GENTAMICIN IS INCOMPATIBLE WITH HEPARIN. DO NOT USE HEPARIN. 4. Add 28.5 mL of NS to sterile vial. (final gentamicin concentration 2 mg/mL). 5. Withdraw 5 mL in a 10 mL syringe or 20 mL in a 30 mL syringe for final product. 6. Label expiration 72 hours from time of preparation under refrigeration.

Vancomycin 2 mg/mL + Heparin 100 units/mL	<ol style="list-style-type: none"> 1. Double the below recipe if 20 mL volume ordered. 2. Reconstitute 500 mg vial of vancomycin injection with 5ml NS (conc=100 mg/mL). 3. Withdraw 0.2 mL of vancomycin solution (20 mg) and inject into a 10 mL heparin 100 units/mL flush vial. If the solution becomes visually incompatible →discard. 4. Withdraw 5 mL in a 10 mL syringe or 20 mL in a 30 mL syringe for final product. 5. Label expiration 72 hours from time of preparation under refrigeration
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