C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

ETHANOL LOCK THERAPY IN PATIENTS ADMITTED TO PEDIATRIC SERVICES

Purpose:
The purpose of this guideline is to establish and disseminate the standards and guidelines used at C.S. Mott Children's Hospital to prescribe and administer ethanol lock therapy (ELT) in the management and prevention of central venous access device (CVAD)-related bloodstream infections.

Definitions:

A. **Ethanol lock therapy (ELT)**: The filling of a lumen of a central venous access device with a high concentration ethanol solution (70%) and leaving the solution in the lumen for a certain dwelling time. Ethanol's properties of both bactericidal and fungicidal activity, as well as being without known clinical resistance, make ethanol an attractive option for prevention of central venous access device-related bloodstream infection (CRBSI) in high-risk patients.

B. **Central Venous Access Device (CVAD)**: a long term, central venous catheter including central tunneled venous access device, non-tunneled central venous access devices such as PICC lines, or implanted ports.

C. **Limited Venous Access**: venous access in patients who will require anticipated long-term (i.e., >6 months) venous access and will be at risk of losing venous access during periods of treatment.

D. **Pediatric Patient**: Patient managed by a Pediatric primary service.

Procedure Actions:

A. **Inclusion for ELT:**

1. At least **one** of the following inclusion criteria must be met for ethanol lock therapy:
    i. Patients on long-term parenteral nutrition who receive ELT as an outpatient
        a. **All** inpatients who qualify for ELT should receive ethanol locks administered three times weekly on Monday/Wednesday/Friday, **regardless** of the frequency of their outpatient ELT regimen
    ii. For new patients with intestinal failure who are starting ELT as an inpatient, a single dose of ELT can be ordered **ONCE** prior to discharge to facilitate transition to home care
2. **All** of the following criteria must be met:
    i. Have a silicone-based CVAD (see table below)
    ii. Must be able to accommodate a minimum of two hours of dwell time for ELT

Examples of Central Venous Access Devices at C.S. Mott Children's Hospital

Type of Central Venous Access Devices	Size	Lumens	Manufacturer	Material
Broviac	2.7Fr	Single	Bard 0600040	Silicone
Broviac	4.2Fr	Single	Bard 0600520	Silicone
Broviac	6.6Fr	Single	Bard 0600540	Silicone
Hickman	7.0Fr	Dual	Bard 0600570	Silicone
Hickman	9Fr	Dual	Bard 600604	Silicone/Antimicrobial
Hickman	9.6Fr	Single	Bard 0600560	Silicone
Leonard	10Fr	Dual	Bard 0600630	Silicone
Hickman	12.5Fr	Triple	Bard 0600650	Silicone
PowerLine	6Fr	Dual	Bard 0700615	Polyurethane
PowerHickman	9.5Fr	Dual	Bard 0805915	Polyurethane

Repair Kit	6.6Fr	Single	Bard 0601620	Silicone
PORTS				
SlimPort Titanium	6Fr	Single	Bard 0605560	Polyurethane
SlimPort Ultralow MRI	6Fr	Single	Bard 0605640	Polyurethane
PowerPort Titanium	6Fr	Single	Bard 1706060	Polyurethane
BardPort Hickman Titanium	6.6Fr	Single	Bard 0606200	Silicone
SlimPort Rosenblatt	7Fr	Dual	Bard 0604970	Silicone
PowerPort Titanium	8Fr	Single	Bard 1708060	Polyurethane
BardPort Hickman Titanium	9.6Fr	Single	Bard 0602210	Silicone
BardPort Hickman MRI	10Fr	Dual	Bard 0615460	Silicone
NeoStar	12.5Fr	Triple	Angio Dynamics CV-332ek	Silicone

B. **Exclusion for ELT:**

1. If **any** of the following criteria are met, patients are ineligible for ELT:
    i. Patients receiving systemic antimicrobials for suspected or documented CVAD-related bloodstream infection
        a. Targeted antimicrobial lock therapy can be used for catheter salvage, if appropriate, once the organism and susceptibility results are confirmed
        b. Consult Pediatric Infectious Diseases for patients with polymicrobial or multidrug resistant CRBSI if there are no available antimicrobial locks that would cover all organisms isolated
    ii. A polyurethane CVAD
    iii. Patients weighing <5 kg
    iv. Patients receiving heparin or citrate through CVAD where ELT would occur
    v. Patients receiving continuous renal replacement therapy (CRRT) due to the anticoagulant citrate used in this process
    vi. Documented allergy to ethyl alcohol or thrombolytic agents
2. Special consideration should be given to the following populations:
    i. Inability to aspirate back the volume infused into the CVAD
    ii. Recovering alcoholics or children of recovering alcoholics
    iii. Caregiver with a history of inability to properly administer IV medications

C. **Prescribing Procedures and Requirements for ELT**

1. If patient does not meet the inclusion criteria listed in section A above, ELT approval must be obtained from the Antimicrobial Stewardship team or Pediatric Infectious Diseases service prior to ordering.
2. An electronic order-set for ethyl alcohol 70% syringe will contain the following:
    i. Acknowledgement of ELT requirements (if the statements are not acknowledged by the prescriber, the order will not be processed)
        a. I verify that the patient's catheter/port is ethanol compatible
        b. I verify that I have reviewed the policy of ethanol lock therapy, that an allergy to heparin and citrate containing compounds has been entered, and that the patient is not allergic to ethanol
    ii. Select appropriate indication for ELT:

a. Continuation of outpatient ELT (should be given three times weekly on Mon/Wed/Fri for ALL inpatients regardless of outpatient regimen frequency)
b. Once dose for new ELT patients prior to discharge
c. Other – Select approving Antimicrobial Stewardship or Pediatric Infectious Diseases provider from dropdown list

iii. Lumen to lock
iv. Line location

3. When prescribing parenteral nutrition (PN) for patients on ELT, the prescriber will delete the heparin and citrate from the PN to avoid incompatibility issues.
4. An allergy for "Heparin and citrate containing compounds" should be entered into the electronic medical record stating incompatible with ethanol lock. Once ELT is discontinued, this allergy alert shall be removed provided no true allergy exists.

D. **Measurement of the Line for Ethanol Lock Administration**

1. To estimate the volume of the CVAD:
   i. Prepare a 3 mL syringe filled with 1 mL of normal saline.
   ii. Attach syringe to needleless hub on the end of the catheter (hub must be connected directly to the end of the venous access device without extension tubing).
   iii. Draw back on plunger until drops of blood enter the syringe.
   iv. Subtract 1 mL from the volume on the syringe when blood enters the syringe (for example, if the finishing volume on the syringe is 1.2 mL after blood enters the syringe, the catheter volume would be 0.2 mL).
   v. Clamp tubing and record this volume.
   vi. Flush tubing.
   vii. Document findings in the electronic medical record via the Lines/Drains/Airways (LDA) section of the chart.
   viii. Communicate volume to ordering prescriber.
2. Additional volume will be added to ensure the ELT covers the entire length of the CVAD, with maximum volume of 2 mL.
   i. An order should be written to inform caregivers of the estimated volume.
   ii. Weight-based additional volume:

	Volume to be added to measured volume	MAXIMUM volume of ethanol lock: 2 mL
<15 kg	0.1 mL	
≥15 kg	0.2 mL	

3. If unable to determine the volume of the venous access device using the method mentioned above, the following tables can be used if the length of the venous access device is known:

Type of venous access device	Catheter size	Number of lumens	Length (cm)	Lock measurement (mL/cm)	Volume (mL)
Broviac	2.7 French	Single	74.87	0.00334	0.25
Broviac	4.2 French	Single	74.27	0.00512	0.38
Broviac	6.6 French	Single	95.2	0.00966	0.92

Data constructed by measurements performed by Petrea Cober, PharmD.

4. If still unable to determine the volume of the venous access device (excluding implanted ports) using the methods mentioned above, the following table may be used to estimate the volume of the venous access device:

Weight of patient (kg)	Volume of ethanol lock if unknown venous access device volume
5-9.9	0.2 mL
10-14.9	0.3 mL
15-19.9	0.4 mL
20-24.9	0.5 mL
25 or greater	0.7 mL

5. Documentation of lumen volume is completed on the LDA for the CVAD being measured (note, only the volume of the lumen is recorded for dosing; an additional 0.1 or 0.2 mL must be added based on the patient's weight).

E. Ethanol Lock Administration Procedures

1. ELT will be administered once a day during the longest period of time the patient is off IV medications and PN.
    i. Minimum dwell time of 2 hours, and for a maximum dwell time of 24 hours.
    ii. Inpatients will have a task on the Medication Administration Record (MAR) for installation, removal, or flushing at 24 hours of dwell time.
2. If the patient has a CVAD with more than one lumen, ELT will be alternated between each of the lumens.
    i. A separate order for each lumen must be entered into Epic.
    ii. When ELT is not instilled in the other lumen(s), the lumen(s) should contain a saline lock or other administered fluid as decided by the primary team.
3. Flush CVAD with 10 mL of normal saline prior to instilling ELT.
4. Withdraw ELT and flush with 10 mL of normal saline prior to medication or PN administration.
5. The ethanol lock is **INCOMPATIBLE** with heparin and citrate. A warning label sticker printed by unit nursing will be placed on the patient's CVAD (see Exhibit F).
    i. NOTE: if heparin is accidentally co-infused with ethanol lock: immediately aspirate the heparin from the central venous catheter. Then, flush with normal saline. Additionally, contact the prescriber immediately.
6. If the patient is being switched from a heparin-containing lock to ethanol lock therapy, flush the CVAD with 10 mL of normal saline after removing the heparin-containing lock and prior to instilling ELT. It is NOT necessary to administer a thrombolytic agent (alteplase) to clear the line unless the line is occluded, sluggish, or has no blood return.
7. Document instillation of ethanol lock in the MAR.

F. Procedure for the Removal of ELT:

1. Withdraw the ethanol lock solution (equal to the volume initially instilled in the venous access device until a blood return is observed).
2. Flush with 10 mL of normal saline (if volume restricted, 5 mL flush volume may be appropriate).
3. Administer the ordered medication or parenteral nutrition, if indicated.
4. Flush with 10 mL of normal saline (if volume restricted, 5 mL flush volume may be appropriate).
5. Instill the new ethanol lock solution or leave saline locked until catheter is needed again.
6. Ensure the patient has the ethanol lock warning label sticker attached to the patient's CVAD.

G. Procedure for Flushing of ELT:

1. Verify the patient meets one of the following criteria:
    i. The caregiver is unable to withdraw the ELT from the CVAD
        a. If the caregiver is unable to withdraw fluid, blood, or ELT from the CVAD, notify the House Officer on-call. The House Officer on-call will inform the ordering attending/fellow of the inability to withdraw from the CVAD and receive further

instructions for the management of the patient's CVAD. If a line does not draw back, an update to the active medication list in Epic should be made. In a patient whose order includes withdrawing the ELT, whose line will not draw, it is appropriate to flush the ELT.

ii. Flushing ELT is the prescribed route of removing the ELT from the CVAD for this patient

2. Flush with 10 mL of normal saline (if volume restricted, 5 mL flush volume may be appropriate).
3. Administer the ordered medication or parenteral nutrition, if indicated.
4. Flush with 10 mL of normal saline (if volume restricted, 5 mL flush volume may be appropriate).
5. Instill the new ethanol lock solution or leave saline locked until catheter is needed again.
6. Ensure the patient has the ethanol lock warning label sticker attached to the patient's CVAD.

Displays:

A. A poster indicating that the patient is on ethanol lock therapy (Exhibit A) will be placed on the door of the patient's hospital room for all inpatients receiving ethanol lock therapy.

Patient Education:

A. Patient education materials for outpatient use of ethanol lock therapy and an instruction sheet are located in Exhibit B and Exhibit D.

Exhibits:

A. Door Poster Indicating Patient is on Ethanol Lock Therapy
B. Patient Education Materials for Outpatient Use of Ethanol Lock Therapy and Instruction Sheet
C. Health-Care Provider Information Sheet for Ethanol Lock Therapy
D. Home Instruction Sheet for Ethanol Lock Therapy
E. Patient Identification Card
F. Warning Label Stickers for Inpatient Use

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Exhibit A: Door Poster for Patients Receiving Ethanol Lock Therapy

Patient Receiving Ethanol Lock Therapy

No HEPARIN OR CITRATE to be infused or flushed into catheter

For use only in Broviac or Hickman catheters and approved Mott ports

Exhibit B: Patient/Parent Information Sheet – Ethanol Lock Therapy

1. **What is ethanol lock therapy?**
   The ethanol lock is a solution that can be placed in your child's IV catheter to prevent or treat an IV catheter infection.

2. **How is ethanol lock therapy given to my child?**
   The ethanol lock is placed in your child's IV catheter and is allowed to sit in the catheter while your child is not receiving other IV medications or Parenteral Nutrition (PN) in order to kill any bacteria in the catheter. The ethanol solution will be taken out of your child's IV catheter prior to giving other IV medicines or PN.

3. **What happens if the ethanol lock is accidentally pushed into my child's IV catheter?**
   If the ethanol lock solution cannot be taken out of your child's IV catheter or if you have been directed by your providers to flush with the ethanol lock, it will have to be given to your child. Your child should be watched for the following signs and symptoms: tiredness, headaches, dizziness, nausea, and light-headedness. If you see a change in your child's behavior or activity level, call your doctor's office immediately.

4. **What are adverse effects of the ethanol lock therapy?**
   As with the use of all IV medicines, entering your child's IV catheter does increase the risk of infection. However, if this is done under clean conditions, the risk is lowered. If the ethanol lock is infused into your child, watch for the following signs and symptoms: tiredness, headaches, dizziness, nausea, and light-headedness.

5. **Can the ethanol lock therapy be used at home?**
   Yes. You will be trained on how to give and remove the ethanol lock, storage of the ethanol lock, and possible side effects.

6. **How do I store the ethanol lock therapy at home?**
   The ethanol lock is flammable so it should be treated like any other flammable item. You should store your child's ethanol lock supply in the same refrigerator you store IV medicine or home PN solutions. No one should smoke around the ethanol lock.

7. **Are there any restrictions in my child's activity while on ethanol lock therapy?**
   If your child is old enough to drive, he/she should not drive while taking the ethanol lock therapy.

Exhibit C: Healthcare Provider Information Sheet – Ethanol Lock Therapy

1. **What is ethanol lock therapy?**
   Ethanol lock is a solution that can be instilled in an IV catheter to prevent IV catheter related infections. It is similar to an antibiotic lock (an antibiotic solution placed in the IV catheter) but does not have the problem of antibiotic resistance for particular pathogens.

2. **How is ethanol lock therapy given to a patient?**
   Ethanol lock is injected into the end cap of an IV catheter. It is allowed to dwell in the catheter when not receiving other IV medications or parenteral nutrition (PN) in order to kill any bacteria present in the catheter. The ethanol solution will be withdrawn from the IV catheter prior to administration of other IV medications or PN. Ethanol lock therapy can only be used with IV catheters made of silicone (e.g., Broviac, Hickman).

3. **Are there compatibility and stability issues with the ethanol lock?**
   Ethanol is INCOMPATIBLE with heparin and citrate, so DO NOT use heparin flushes or citrate if a patient is on ethanol lock therapy. Ethanol lock solutions are stable for 14 days at room temperature.

4. **What happens if the ethanol lock is accidentally flushed into a patient's catheter?**
   Ethanol infusions are fairly safe. Studies have shown that the use of the ethanol lock had no significant adverse effects to infants and children. If you are unable to withdraw the ethanol, you will need to flush it through the catheter. This may cause: tiredness, headaches, dizziness, nausea, and light-headedness.

5. **What are adverse effects of the ethanol lock therapy?**
   As with the use of all IV medications, entering an IV catheter does increase the risk of infection. However, if this is done under clean conditions, the risk is greatly reduced, and the ethanol lock is actually used to prevent infections. If the ethanol lock is infused into the catheter, observe for tiredness, headaches, dizziness, nausea, and light-headedness. If there are changes in behavior or activity level, the caregiver should be instructed to contact their doctor immediately.

6. **Can ethanol lock therapy be used at home?**
   Yes. Parents/caregivers need to be trained on proper administration and removal of the ethanol lock, storage of the ethanol lock, and possible adverse effects that need to be monitored. Prior to using in the home, the patient's home infusion provider and visiting nurse agency should be contacted to determine if they provide ethanol lock therapy.

7. **How should the ethanol lock therapy be stored in the hospital or at home?**
   The ethanol lock is flammable so it should be treated like any other flammable item. The current recommendation is to store in the refrigerator. No smoking should be permitted around the ethanol lock.

8. **Are there any restrictions in a patient's activity while on ethanol lock therapy?**
   If the child is old enough to drive, he/she should not drive while taking the ethanol lock therapy.

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Exhibit D:

Home Instruction Sheet for Ethanol Lock Therapy

1. After finishing other IV medications/PN, flush the patient's line with ____ mL of normal saline. **(DO NOT USE HEPARIN or CITRATE)**

2. Inject ____ mL of 70% ethanol lock into the patient's IV catheter.

3. Allow the ethanol lock to dwell in the patient's line for 2 to 24 hours.

4. Prior to administration of other IV medications/PN, withdraw ____ mL of ethanol from the patient's catheter. (You should draw back enough volume to begin to see the first drops of blood in the syringe.)

5. Flush the patient's line with ____ mL of normal saline. **(DO NOT USE HEPARIN or CITRATE)**

6. Administer other IV medications/PN.

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Exhibit E: Patient Identification Card

I have a central access device which contains an ethanol lock.

FLUSH WITH NORMAL SALINE ONLY!

NO HEPARIN
NO CITRATES

Please contact the Vascular Access Department
Michigan Medicine
Phone: (734) 936-9786
Pager: (734) 936-6266 (X2957)

I have a central access device which contains an ethanol lock.

FLUSH WITH NORMAL SALINE ONLY!

NO HEPARIN
NO CITRATES

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Exhibit F: Ethanol Lock Warning Label Stickers

ETHANOL LOCK CATHETER
Ethanol Instilled/Removed (circle one) on ___/___/____ Time______
Use only Saline
No Heparin or Citrate

ETHANOL LOCK CATHETER
Ethanol Instilled/Removed (circle one) on ___/___/____ Time______
Use only Saline
No Heparin or Citrate

ETHANOL LOCK CATHETER
Ethanol Instilled/Removed (circle one) on ___/___/____ Time______
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