Antimicrobial Locks Pathway v4.1: **Table of Contents**

Stop and **Review**

Inclusion Criteria

- Patient qualifies for Central Line Insertion and line has been placed
  - Tunneled central line
    - Hickman, Broviac, Leonard, single or double
    - Lines immediately post-repair (including outpatient repaired lines)
  - Peripherally inserted central catheter (PICC)
    - >= 3 Fr
    - 21 gauge/red lumen of 2.6 Fr double lumen PICC – inpatient only

Exclusion Criteria

- Patients with critical infusions that cannot be interrupted for lock therapy – inpatient only
- Patients with allergies to vancomycin or gentamicin
  (NOTE: Patients with vancomycin flushing syndrome/vancomycin infusion reaction are eligible for locks)
- Patients with the following catheter types:
  - Temporary non-tunneled central venous catheter
  - Temporary non-tunneled dialysis/(a)pheresis catheter
  - Implanted central venous port (5 different ports)
  - Tunneled dialysis catheter
  - 23 gauge/white lumen of 2.6 Fr double lumen PICC – inpatient only

Antimicrobial Locks Care

Appendix

Last Updated: March 2024
Next Expected Review: November 2028

For questions concerning this pathway, contact:
AntimicrobialLocksPathway@seattlechildrens.org

If you are a patient with questions contact your medical provider, Medical Disclaimer

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Antimicrobial Locks Pathway v4.1: **Inpatient Prophylaxis**

Stop and **Review**

Inclusion Criteria

- Patient qualifies for Central Line Insertion and line has been placed
  - Tunneled central line
    - Hickman, Broviac, Leonard, single or double
    - Lines immediately post-repair (including outpatient repaired lines)
  - Peripherally inserted central catheter (PICC)
    - >= 3 Fr
    - 21 gauge/red lumen of 2.6 Fr double lumen PICC

Exclusion Criteria

- Patients with critical infusions that cannot be interrupted for lock therapy
- Patients with allergies to vancomycin or gentamicin
  (NOTE: Patients with vancomycin flushing syndrome/vancomycin infusion reaction are eligible for locks)
- Patients with the following catheter types:
  - Temporary non-tunneled central venous catheter
  - Temporary non-tunneled dialysis/(a)pheresis catheter
  - Implanted central venous port (5 different ports)
  - Tunneled dialysis catheter
  - 23 gauge/white lumen of 2.6 Fr double lumen PICC
- Patients in the following settings/units:
  - Outpatient (except for lines immediately post-repair)

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Do not order lock for lumens with critical continuous infusions

!

Do not administer if unable to confirm line patency

Identify catheter type and lumen color

- Refer to LDA properties

Primary service orders lock

- Use order panel: Antibiotic Lock Therapy for Central Lines and Central Line Repairs
  - Select Prophylaxis
  - Select catheter type and lumen number
  - Enter lumen color

Administer and remove lock

- Refer to policy: Lock Therapy for Central Lines 10053 (*for SCH only*)
  - See Appendix I: Prophylaxis Lock Work Flow (*for SCH only*)

Line Repair

- Use order panel: Antibiotic Lock Therapy for Central Lines and Central Line Repairs
  - Select Line Repair
  - Select catheter type and lumen number
- For more information, see policy: Central Venous Catheter (CVC) Management 12665 (*for SCH only*)

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If unable to withdraw after dwell time, flush in and notify provider

For questions concerning this pathway, contact:
AntimicrobialLocksPathway@seattlechildrens.org

Antimicrobial Locks Pathway v4.1: **Outpatient Prophylaxis**

Stop and **Review**

Inclusion Criteria

- Patients in the following outpatient settings:
  - Liver and Intestinal Failure
- Patient qualifies for Central Line Insertion and line has been placed
  - Tunneled central line
    - Hickman, Broviac, Leonard, single or double
    - Lines immediately post-repair (including outpatient repaired lines)
  - Peripherally inserted central catheter (PICC)
    - >= 3 Fr

Exclusion Criteria

- Patients with allergies to vancomycin or gentamicin
  (NOTE: Patients with vancomycin flushing syndrome/vancomycin infusion reaction are eligible for locks)
- Patients with the following catheter types:
  - Temporary non-tunneled central venous catheter
  - Temporary non-tunneled dialysis/(a)pheresis catheter
  - Implanted central venous port (5 different ports)
  - Tunneled dialysis catheter

Outpatient LIFT provider orders lock

- Refer to policy: Lock Therapy for Central Lines 10053 (*for SCH only*)
- Use order panel: SC AMB GI CENTRAL LINE PROPHYLAXIS PANEL
- Select antibiotic or non-antibiotic lock depending on patient's home care company
- Prescription Instructions/Patient Sig:
  - Dwell time: during time off of TPN
  - Flush lock at end of dwell time

↓

IRP Nurse

- Send order to home care company
- Provide patient/family education

Outpatient Line Repair

- Use order panel: Central Line Repair
  - Select Prophylaxis
  - Select catheter type and lumen number
- For more information, see policy: Central Venous Catheter (CVC) Management 12665 (*for SCH only*)

For questions concerning this pathway, contact:
AntimicrobialLocksPathway@seattlechildrens.org

Antimicrobial Locks Pathway: **Evidence**

Are antimicrobial locks effective in preventing CLABSIs?

Outcome: CLABSI rate

In an Clinical-Effectiveness-sponsored unpublished meta-analysis of 9 RCT (n = 99,322 line days) comparing antimicrobial locks (antibiotic and non-antibiotic) to control (saline or heparin), antibiotic locks probably decrease CRBSI compared to control [event rates 0.05% versus 0.16%, RR 0.31 (95% CI: 0.17 to 0.59)]. *The +3 moderate certainty of this subgroup is downgraded for risk of bias*.

Grouping studies by frequency of administration suggests a dose-response with a trend toward a greater magnitude of effect when administered 1 to 3 times daily [RR 0.38 (95% CI: 0.18 to 0.80)] and less effect when administered less than once daily [RR 0.60 (95% CI: 0.36 to 1.02)]. *The +2 low certainty is downgraded for risk of bias and inconsistency in the 1 to 3 times daily subgroup and risk of bias and imprecision in the less than once daily subgroup*.

The duration of antibiotic dwell time suggests a trend toward a greater magnitude of effect with a dwell time of ≤ 2 hours [RR 0.31 (95% CI: 0.2 to 0.46)] and less effect when no time limit was specified [RR 0.66 (95% CI: 0.49 to 0.89)]. *The +3 moderate certainty of the ≤ 2 hours subgroup is downgraded for imprecision. The +1 very low certainty of the subgroup with no time limit is downgraded for risk of bias and imprecision*.

What is the risk of developing resistance if antibiotic locks are employed?

Antibiotic resistance - Surveillance Cultures

Surveillance cultures were performed in two studies and no antimicrobial resistance was detected. There were no vancomycin-resistant microorganisms detected by skin or rectal culture at study entry or at the time the catheter was discontinued and there were no isolates of Gram-positive bacteria recovered from skin, catheter, or blood cultures that showed a minimal inhibitory concentration >2 micrograms/mL. Additionally, no amikacin-resistant organisms were recovered from any surveillance skin cultures.

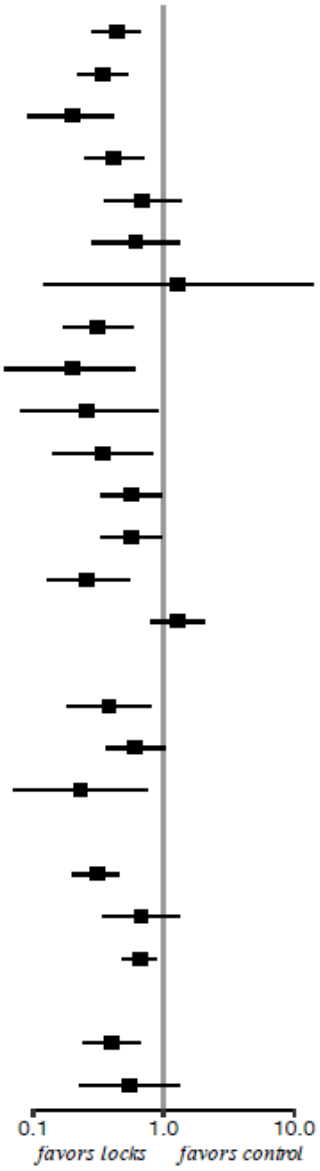
Antibiotic resistance –Cultures from infected patients

Development of resistant organisms was assessed in three studies. In adult populations, one study found no vancomycin resistant coagulase negative staphylococcus (CoNS) or commensal isolates in the group receiving vancomycin-heparin locks. In two other studies, no vancomycin resistance organisms were found in patients with bacteremia.

Antimicrobial Locks Pathway: **Evidence**

Subgroup analyses of CRBSI rates

Subgroup	Treatment (n = 123191) *no. of infections/no. of line days*	Control n = (124509) *no. of infections/no. of line days*	Risk Ratio (95% CI)	I^2	GRADE
All patients	109/123191	217/124509	0.44 (0.28-0.67)	59%	$+2^{1,4}$
Child	51/94635	142/94138	0.34 (0.22-0.53)	33%	$+3^{1}$
Critically ill neonates	9/2437	38/1904	0.20 (0.09-0.41)	0%	$+3^{1}$
Cancer	42/92198	104/92234	0.41 (0.25-0.70)	36%	$+3^{1}$
Adult	58/28556	75/30371	0.69 (0.35-1.37)	57%	$+2^{3,4}$
Cancer	52/25004	70/26441	0.61 (0.28-1.32)	63%	$+3^{3}$
Other	6/3552	5/3930	1.29 (0.12-14.04)	67%	$+1^{1,3,4}$
Antibiotic	26/49586	82/49736	0.31 (0.17-0.59)	39%	$+3^{1}$
Amikacin/heparin	4/1111	12/652	0.20 (0.06-0.60)	-	$+3^{2}$
Fusidic acid	3/456	13/522	0.26 (0.08-0.92)	-	$+1^{1,3}$
Vanco/hep ± Cipro, Ami	19/48019	57/48562	0.34 (0.14-0.83)	50%	+4
Non-antibiotic	83/73605	135/74772	0.56 (0.33-0.96)	64%	$+1^{1,4}$
Ethanol	39/41447	66/40337	0.57 (0.33-0.97)	31%	$+2^{1,3}$
Taurolidine	9/24733	35/25147	0.26 (0.13-0.55)	0%	$+2^{1}$
Citrate	35/7425	34/9288	1.29 (0.80-2.06)	-	$+2^{2,3}$
Frequency					
Applied 1-3 times per day	30/23371	75/24476	0.38 (0.18-0.80)	57%	$+2^{1,4}$
Applied less than once a day	74/63874	118/65379	0.60 (0.36-1.02)	57%	$+2^{1,3}$
Unspecified frequency	5/35946	24/34654	0.23 (0.07-0.75)	23%	$+1^{1,4}$
Duration					
≤ 2 hours	30/25409	86/23637	0.31 (0.20-0.46)	0%	$+3^{3}$
≤ 2 hours (IP), 1-3X/wk (OP)	14/16478	21/16140	0.67 (0.34-1.31)	0%	$+2^{1,3}$
No time limit	65/81304	110/84732	0.66 (0.49-0.89)	70%	$+1^{1,3}$
Quality					
Moderate to high	92/107953	183/109169	0.40 (0.24-0.67)	65%	-
Low	17/15238	34/15340	0.55 (0.23-1.33)	47%	-



Summary of Version Changes

- **Version 1.0 (5/3/2021):** Go live for Hematology-Oncology Pilot.
- **Version 2.0 (1/10/2022):** Renamed “Hematology-Oncology Pilot” to “Prophylaxis”. Changed inclusion and exclusion criteria: included tunneled central lines and PICCs. Removed need to identify catheter length and volume. Changed lock solution. Added information for line repair. Added alert for “unable to confirm line patency”. Added detail to identify dwell time. Added alert for “unable to withdraw”.
- **Version 3.0 (3/7/2022):** Added alert and bullet for “lumens with critical continuous infusions”.
- **Version 4.0 (11/14/2023):** Full approval go live. Renamed “Prophylaxis” to “Inpatient Prophylaxis.” “2.6 Fr double lumen PICC (21 gauge/red lumen)” added to the Inpatient Prophylaxis Inclusion Criteria. Added “Patients with critical infusions that cannot be interrupted for lock therapy” to Inpatient Prophylaxis Exclusion Criteria. Removed medication dosing information from Administer and Remove Lock in Inpatient Prophylaxis phase and included link to Prophylaxis Lock Work Flow in P&P. Added “Outpatient Prophylaxis” phase to expand scope to outpatient Liver and Intestinal Failure patient population. Medication dosages reviewed and approved by Pharmacy and Therapeutics Committee on 7/18/2023.
- **Version 4.1 (3/8/2024):** Added 23 gauge/white lumen of 2.6 Fr double lumen PICC to inpatient exclusion criteria.

Approval & Citation

Approved by the CSW Antimicrobial Locks Pathway team for November 14, 2023, go-live

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Retrieval Website: https://www.seattlechildrens.org/pdf/antimicrobial-locks-pathway.pdf

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Evidence Ratings

This pathway was developed through local consensus based on published evidence and expert opinion as part of Clinical Standard Work at Seattle Children's. Pathway teams include representatives from Medical, Subspecialty, and/or Surgical Services, Nursing, Pharmacy, Clinical Effectiveness, and other services as appropriate.

When possible, we used the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (from: Guyatt G et al. J Clin Epidemiol. 2011;4:383-94, Hultcrantz M et al. J Clin Epidemiol. 2017;87:4-13.):

Quality ratings are *downgraded* if studies:

- Have serious limitations
- Have inconsistent results
- If evidence does not directly address clinical questions
- If estimates are imprecise OR
- If it is felt that there is substantial publication bias

Quality ratings are *upgraded* if it is felt that:

- The effect size is large
- If studies are designed in a way that confounding would likely underreport the magnitude of the effect OR
- If a dose-response gradient is evident

Certainty of Evidence

✪✪✪✪ High: The authors have a lot of confidence that the true effect is similar to the estimated effect
✪✪✪○ Moderate: The authors believe that the true effect is probably close to the estimated effect
✪✪○○ Low: The true effect might be markedly different from the estimated effect
✪○○○ Very low: The true effect is probably markedly different from the estimated effect
Guideline: Recommendation is from a published guideline that used methodology deemed acceptable by the team
Expert Opinion: Based on available evidence that does not meet GRADE criteria (for example, case-control studies)

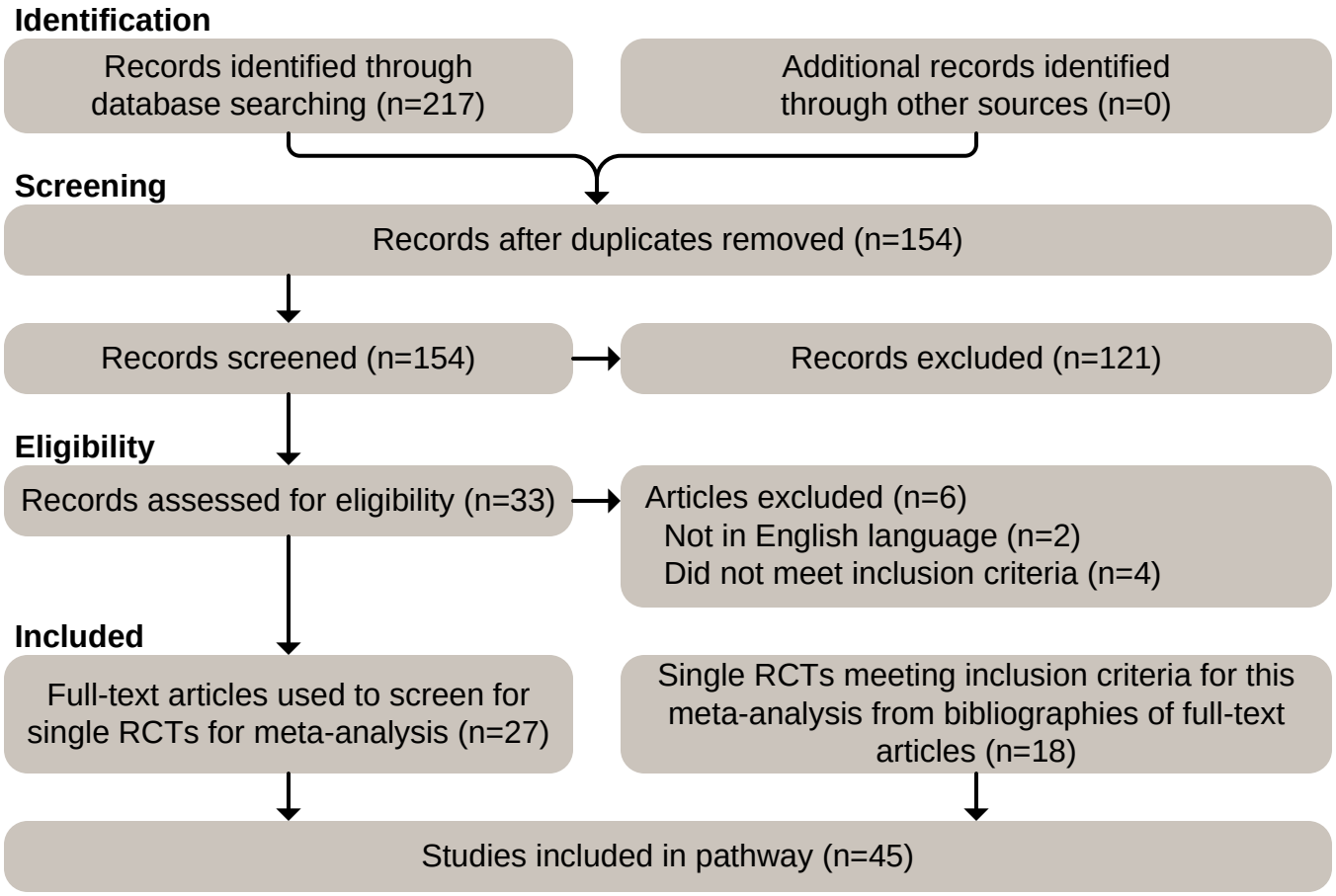
Bibliography

Literature Search Methods
In all databases, concepts specific to central line locks and antimicrobial agents were searched from 2010 to current. All results were limited to English language and the CSW Synthesis strategy for identifying synthesis literature. The search was conducted in Ovid Medline, Embase, CDSR and TRIP. Full documentation of the search strategy and number of results has been captured.

Literature Search Results
The searches of the Ovid Medline, Embase, CDSR and TRIP databases retrieved 217 records. Our searches of other resources identified no additional studies that appeared to meet the inclusion criteria.

Once duplicates had been removed, we had a total of 154 records. We excluded 121 records based on titles and abstracts. We obtained the full text of the remaining 33 records. Six were excluded at the full text level.

We included a total of 45 studies: 27 were full text articles used to screen for RCTs for the meta-analyses and 18 were single RCTs meeting inclusion criteria that were obtained from the bibliographies of the 27 full text articles. The flow diagram summarizes the study selection process.



Flow diagram adapted from Moher D et al. BMJ 2009;339:bmj.b2535

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