Fever in a Patient with Intestinal Failure and Central Venous Catheter (CVC)

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Connecticut Children's

What is a Clinical Pathway?

An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.

Objectives of Pathway

- Ensure effective and efficient treatment for febrile intestinal failure patients with indwelling catheters
- Standardize care practices upon presentation to the ED
- Decrease time to administration of antibiotics
- Identify potential areas of process improvement

Why is Pathway Necessary?

- Patients with Intestinal Failure (IF) often require central venous catheter (CVCs) for extended periods of time used for administration of parenteral nutrition (PN), which is required to maintain adequate growth and hydration.

- This puts them at a risk of recurrent central-line associated bloodstream infections (CLABSIs), with rates being higher than other pediatric patients with central lines.

Background

Bacterial translocation in patients with short bowel syndrome (SBS) is thought to contribute to the risk for recurrent CVC infection.

Septic complications, related to catheter-related bacteremia and liver failure, are the leading causes of morbidity and mortality in these PN-dependent patients.

- CLABSIs are a major cause of increased *morbidity & mortality.*
  - Sepsis
  - Intestinal Failure Associated Liver Disease
  - Access Issues
  - Transplant?

Background: Frequency

In 2018, Szydlowski *et. al* performed a five-year retrospective study[a] which showed **69% positivity**, with 60% being **enteral organisms**.

- *Other pediatric populations with CLIs mostly have gram+ organisms.*
- *More than double of Heme-Onc patients with BSIs (20-30%).*

Drews *et. al*'s two-year retrospective study[b] in 2009 showed **62% positivity**.

Central blood culture pathogens (N = 501)	N	%
*denotes Enteric organisms		
**Klebsiella* species	99	19.8
Coagulase-negative *Staphylococcus*	89	17.8
**Escherichia coli*	51	10.2
**Enterococcus faecalis*	46	9.2
Candida species	41	8.2
Methicillin-sensitive *Staphylococcus aureus*	37	7.4
**Enterobacter* species	35	7.0
Methicillin-resistant *Staphylococcus aureus*	12	2.4
*Vancomycin-resistant *Enterococci*	11	2.2
Alpha-hemolytic *Streptococcus*	10	2.0
**Bacillus* species non-anthracis	10	2.0
**Lactobacillus* species	9	1.8
**Citrobacter* species	9	1.8
**Serratia marcescens*	8	1.6
**Acinetobacter* species	8	1.6
**Proteus mirabilis*	6	1.2
Streptococcus pneumoniae	4	0.8
Streptococcus, Non-hemolytic	3	0.6
**Leuconostoc* species	3	0.6
**Pseudomonas*	2	0.6
Group B *Streptococcus*	2	0.6
**Aeromonas hydrophila*	1	0.2
*Diphtheroids	1	0.2
**Kluyvera ascorbata*	1	0.2
Neisseria species not Neisseria meningitides	1	0.2
**Pantoea (Enterobacter) agglomerans*	1	0.2
Stenotrophomonas (Xanthomonas) maltophilia	1	0.2

a Children's Hospital of Pittsburgh
b Children's Medical Center of Dallas

Background: National Recommendations

Blood Cultures

- Obtain culture from catheter tip
- Obtain both peripheral and central cultures

Treatment

- **Vancomycin** is recommended for institutions with high MRSA rate
- Empirical coverage for **gram-negative bacilli** based on local resistance pattern

Background

Management = Timely Intervention

- Gaieski *et al.* (2010):
  - Improved survival among patients who had time to antibiotic (TTA) <60minutes
- Kumar *et al.* (2006)
  - Each hour delay > associated with 7.6% increase in mortality.
- Hudgins *et al.* (2017)
  - QI Intervention
  - Mean TTA decreased from 112 min – 39 min
  - ED LOS decreased from 286 – 247 min

This is the Fever in a Patient with Intestinal Failure and Central Venous Catheter (CVC) Clinical Pathway.

We will be reviewing each component in the following slides.

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AND an indwelling Central Venous Catheter (CVC) such as Broviac, PICC or port who present with:

- temperature (obtained in any way) of ≥38°C or ≥100.4°F **or**
- signs and symptoms suggestive of Central Line Associated Blood Stream Infection (CLABSI) such as hypothermia, fatigue, changes in stool/ostomy output, vomiting, abdominal pain, feeding intolerance, general feeling of ill-being or parental concerns

Exclusion Criteria:
Hematology/oncology patients (see Oncology Patient with Fever Clinical Pathway), bone marrow transplant patients, patients on dialysis, hemodialysis catheters, concern for Multi-System Inflammatory Children in Children (MIS-C) (see MIS-C Clinical Pathway)

Initial ED Management:
ED Triage: Triage ESI level 2

ED RN:

- Make NPO and hold TPN; do not reconnect home TPN after accessing CVL
- Access central venous access device
- Place PIV and start IV fluids

Labs: *obtain cultures prior to antibiotics*

- Obtain aerobic and anaerobic blood cultures from all lumens of CVL **and** aerobic and anaerobic peripheral blood cx
  - If peripheral blood cx delays antibiotics, defer
- CBC w diff, CRP, chem 10, LFTs, Coags, UA/Ucx

Medications:

- Do NOT give NSAIDs
- Hold on giving acetaminophen

ED Provider:

- STAT: Order labs, anaerobic and aerobic blood cultures, and antibiotics[1] (see dosing below) prior to assessing patient
- Obtain H&P
  - Onset of fever, recent antibiotic treatment, hx of infection/bacteremia/sepsis; cause of intestinal failure, hx of organ transplantation, medication hx (immunosuppressive agents), prior PICU admissions due to CLABSI
- Consider further work up as indicated:
  - Type and screen (if patient appears anemic or low H/H documented from clinic)
  - Cortisol (if long term corticosteroids or shock; if abnormal, discuss with Endocrinology)
  - CXR, COVID-19/flu/RSV PCR (if respiratory symptoms). If viral testing negative, consider sending respiratory BioFire if results will alter management.
  - AXR (if vomiting, abdominal distention, etc.)
  - GI BioFire (if abnormal stooling patterns, etc.)
- Contact GI On-Call to prep for inpatient admission

Signs of sepsis: Notify attending/fellow immediately and proceed to Septic Shock Pathway

[1]GIVE ANTIBIOTICS WITHIN 1 HOUR OF PRESENTATION!
Do not wait until labs have returned to start antibiotics.

- **Start empiric antibiotics and give through CVL if patent; rotate infusions through each lumen:**
  - Ceftazidime IV 150 mg/kg/day div q8hr (max 2 g/dose) - *give first* **AND**
  - Vancomycin IV – *start after ceftazidime*
    - ≤44 weeks PMA[†]/about ≤1 month old: 15 mg/kg x1
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[†]PMA (Post-Menstrual Age) = gestational age + postnatal age

[1]**Definition of Acute Kidney Injury (AKI)**
(It should be noted that this definition does not apply to children <1 year of age)

AKI is defined by having either:

- At least a 50% increase in Scr above baseline* and new Scr ≥0.5 mg/dL OR
- An increase by 0.3 mg/dL from baseline*, and new Scr ≥0.5 mg/dL

*If a baseline creatinine is unknown, estimate baseline Cr using the Schwartz Calculation ($baseline\ creatinine = (0.413 \times height\ cm)/120\ GFR$). For patients with Chronic Kidney Disease (CKD), use the CKID U25 Calculator.

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- Transfer to Med/Surg vs PICU depending on clinical stability

Inpatient Care

- Continue empiric antibiotics for 36 hours and discontinue if blood culture negative.
  - If blood culture is positive, use blood culture and BCID results to narrow and tailor antibiotics. Duration of antibiotics will depend on organism and whether CVL is retained or removed – consider ID consultation.
- Consult ID if: history of multi-drug resistant organism, blood culture is positive, or team wishes to continue vancomycin beyond 36 hours (or use another restricted antimicrobial)
- Repeat daily blood cultures from all lumens until 1 set of blood cultures is negative for 48 hours
- Discussion on salvage of line per primary team (GI)
- Hold enteral feeds for 24 hours due to increased risk of bacterial translocation

Discharge Criteria/Instructions:
Clinically stable, negative blood cultures with antibiotic plan in place, follow up plan in place

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LAST UPDATED: 04.08.26

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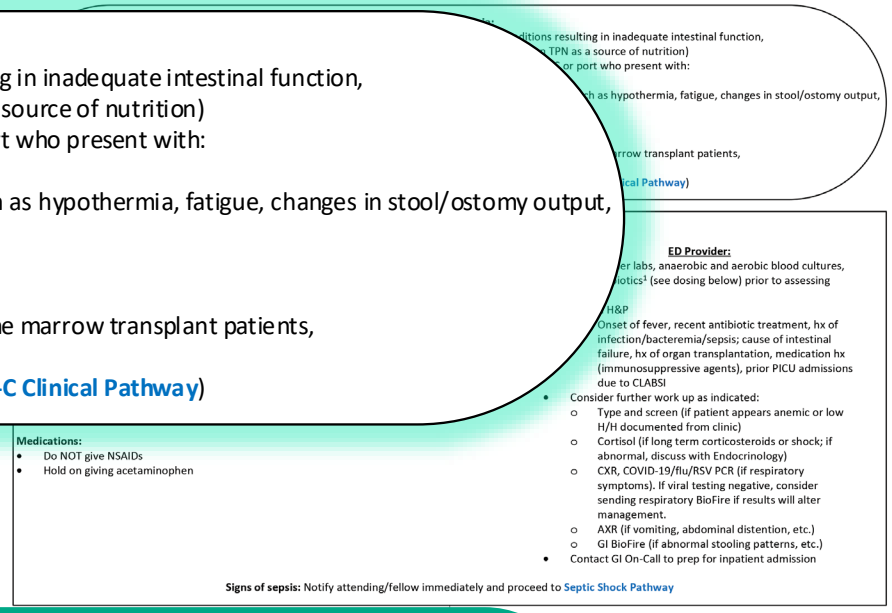

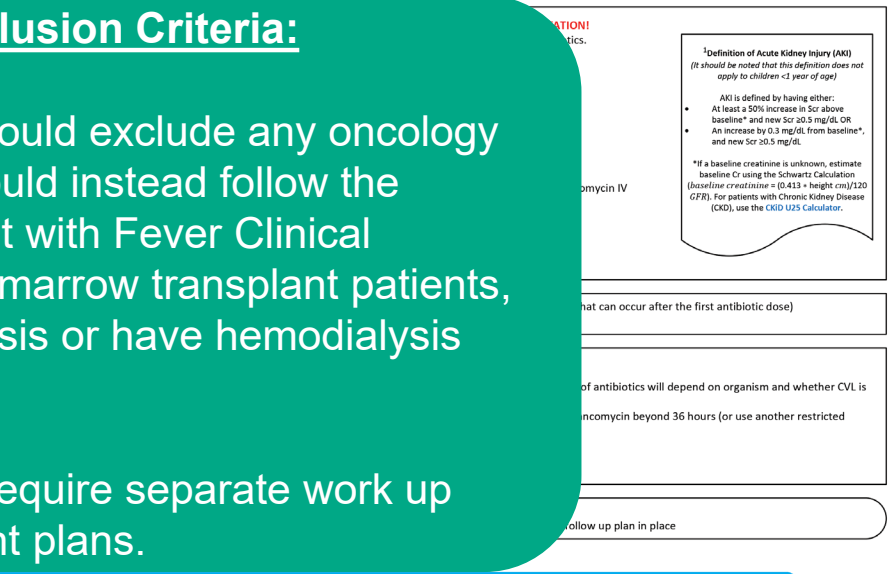

Inclusion Criteria:

This pathway is specifically for patients with intestinal failure who also have an indwelling CVC (broviac, PICC, or port) and present with:

- fever, **or**
- signs suggestive of a CLABSI (Central Line Associated Blood Stream Infection)

Exclusion Criteria:

This pathway should exclude any oncology patient (who should instead follow the Oncology Patient with Fever Clinical Pathway), bone marrow transplant patients, patients on dialysis or have hemodialysis catheters.

These patients require separate work up and management plans.

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If the patient meets the inclusion criteria:

- They will first be triaged and cared by the nursing team
- The MD/provider will initiate the pathway's order set, which will include orders for labs and antibiotics
- There will then be simultaneous assessments done by the provider, and lab collection/antibiotics preparation and administration by the RN
- The patient will then be treated and monitored

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ED RN:

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Medications:

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ED Provider:

- STAT: Order labs, anaerobic and aerobic blood cultures, and antibiotics[1] (see dosing below) prior to assessing patient
- Obtain H&P
  - Onset of fever, recent antibiotic treatment, hx of infection/bacteremia/sepsis; cause of intestinal failure, hx of organ transplantation, medication hx (immunosuppressive agents), prior PICU admissions due to CLABSI
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Inpatient Care

- Continue empiric antibiotics for 36 hours and discontinue if blood culture negative.
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- Consult ID if: history of multi-drug resistant organism, blood culture is positive, or team wishes to continue vancomycin beyond 36 hours (or use another restricted antimicrobial)
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Triage and Nursing

- Triage the patient and place in an exam room *as soon as possible*
- Obtain vitals
- Notify the ED provider immediately if the patient:
  - Has abnormal vitals (e.g., fever, tachycardia, widened pulse pressure, hypotension)
  - Appears ill
  - Has altered mental status or is lethargic
  - Or, if the patient's parent has significant concerns
- Make NPO and hold TPN; *DO NOT* reconnect the home TPN after accessing the CVL

Labs:

- Before giving antibiotics, obtain cultures (both aerobic and anaerobic cultures) and labs. Label the specimens accordingly.
- LFTs: gram negative sepsis is a risk factor for cholestasis

Medications:

- HOLD on giving acetaminophen until labs obtained and *DO NOT* give NSAIDS

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Provider Role:

- Place orders for cultures and labs even before assessment by practitioner
- Review clinical status
- Follow the septic shock clinical pathway for a patient in septic shock
- Take the relevant history:
  - General: onset of fever, recent antibiotics, hx of infections
  - Catheter-specific: cause of intestinal failure, hx organ transplant, medications, prior PICU admissions due to CLABSI
  - EHR review for prior CLABSI organisms
- 4. Contact the on-call GI provider and prepare for inpatient admission

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  - Vancomycin IV – *start after ceftazidime*
    - ≤44 weeks PMA‡/about ≤1 month old: 15 mg/kg x1
    - >44 weeks PMA‡/about >1 month old: 20 mg/kg x1 (initial max dose 2 g/dose)
    - Subsequent dosing per hospital pharmacy vancomycin protocol to avoid AKI
- *If allergic to ceftazidime:*
  - If no renal dysfunction[1]: piperacillin/tazobactam IV 300 mg/kg/day div q6hr (max 4.5 g/dose) **AND** vancomycin IV
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[1]Definition of Acute Kidney Injury (AKI)
(It should be noted that this definition does not apply to children <1 year of age)

AKI is defined by having either:
- At least a 50% increase in Scr above baseline* and new Scr ≥0.5 mg/dL OR
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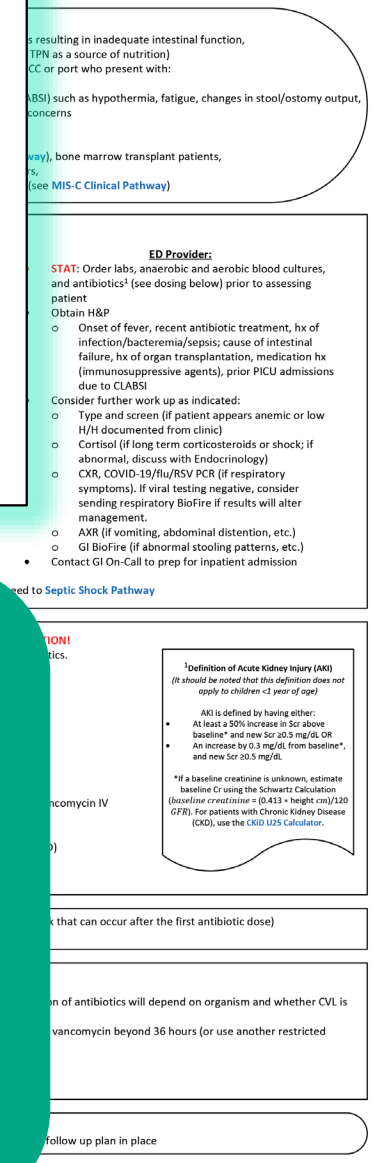
*If a baseline creatinine is unknown, estimate baseline Cr using the Schwartz Calculation ($baseline\ creatinine = (0.413 * \text{height}\ cm)/120\ GFR$). For patients with Chronic Kidney Disease (CKD), use the CKiD U25 Calculator.

Antibiotics:

- The goal is to give antibiotics *within 1 hour* of initial presentation
- Give antibiotics through CVL if patent, rotating through each lumen
- Empiric antibiotics include:
  - Ceftazidime (give first), AND
  - Vancomycin (give second)
- If there is an allergy to ceftazidime:
  - No AKI: piperacllin/tazobactam AND vancomycin
  - AKI: ciprofloxacin AND vancomycin
- If there are additional/other drug allergies, consult GI and Infectious Diseases for further management



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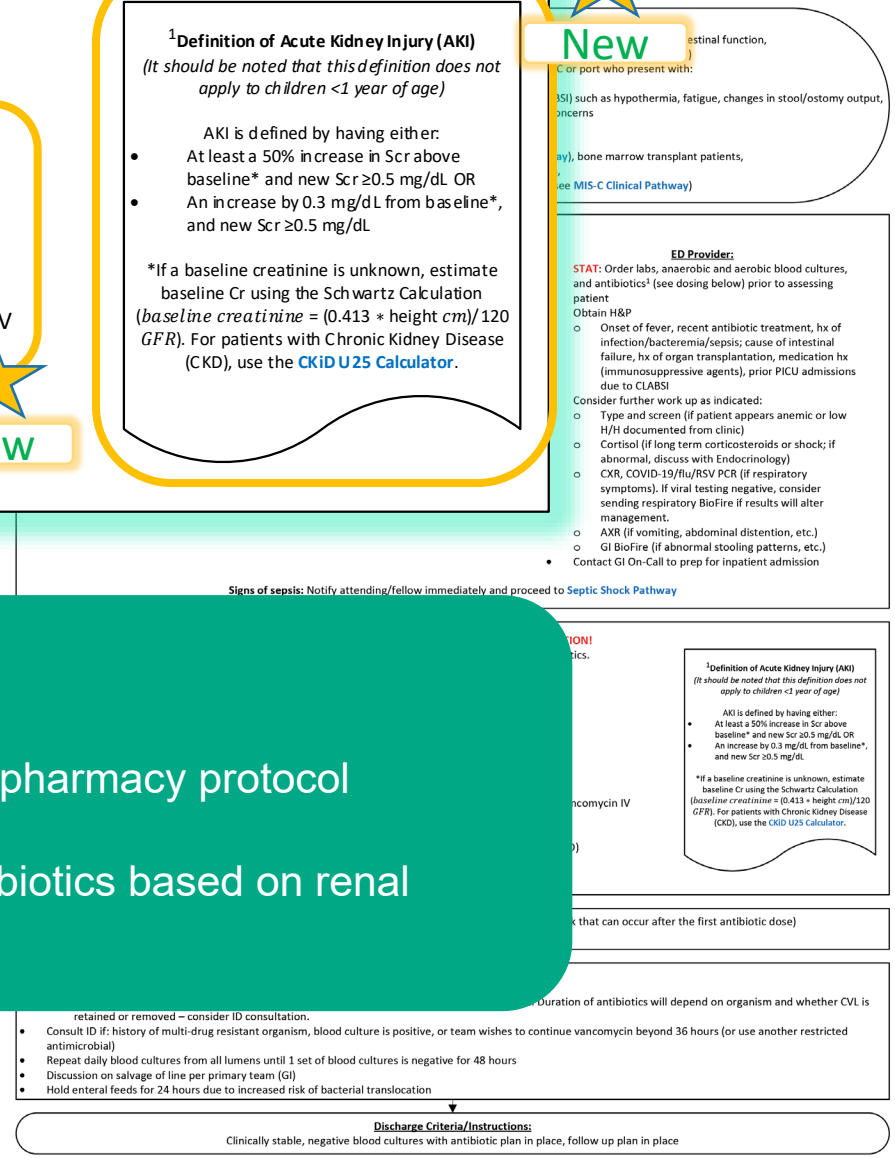

Antibiotics – updates for 2026

- Note that the vancomycin dosing has been updated to a new pharmacy protocol
- The definition of AKI has been updated
- If there is an allergy to ceftazidime, recommendations for antibiotics based on renal function are listed here.

CONTACTS: LOGAN JERGER, MD | KARAN EMERICK, MD | JONATHAN SALAZAR, MD

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Additional Interventions:

- Acetaminophen:
  - If there is evidence of liver dysfunction, consult with the on-call GI provider prior to administering
  - Acetaminophen can be given for temperatures above 38°C (101°F) or pain if:
    - the patient has no evidence of liver dysfunction (or cleared by GI to give)
    - has not yet received acetaminophen, or
    - it has been 6 hours since the last dose
  - Dose: give 15 mg/kg PO. Do **not** administer it PR.

CLINICAL PATHWAY:
Fever in a Patient with Intestinal Failure and Central Venous Catheter (CVC)

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Inclusion Criteria:
Patients with intestinal failure (surgically resected bowels or with medical conditions resulting in inadequate intestinal function, such as intestinal pseudo-obstruction; often primarily dependent on TPN as a source of nutrition)
AND an indwelling Central Venous Catheter (CVC) such as Broviac, PICC or port who present with:

- temperature (obtained in any way) of ≥38°C or ≥100.4°F **or**
- signs and symptoms suggestive of Central Line Associated Blood Stream Infection (CLABSI) such as hypothermia, fatigue, changes in stool/ostomy output, vomiting, abdominal pain, feeding intolerance, general feeling of ill-being or parental concerns

Exclusion Criteria:
Hematology/oncology patients (see Oncology Patient with Fever Clinical Pathway), bone marrow transplant patients, patients on dialysis, hemodialysis catheters, concern for Multi-System Inflammatory Children in Children (MIS-C) (see MIS-C Clinical Pathway)

Initial ED Management:
ED Triage: Triage ESI level 2

ED RN:

- Make NPO and hold TPN; do not reconnect home TPN after accessing CVL
- Access central venous access device
- Place PIV and start IV fluids

Labs: *obtain cultures prior to antibiotics*

- Obtain aerobic and anaerobic blood cultures from all lumens of CVL **and** aerobic and anaerobic peripheral blood cx
  - If peripheral blood cx delays antibiotics, defer
- CBC w diff, CRP, chem 10, LFTs, Coags, UA/Ucx

Medications:

- Do NOT give NSAIDs
- Hold on giving acetaminophen

ED Provider:

- STAT: Order labs, anaerobic and aerobic blood cultures, and antibiotics[1] (see dosing below) prior to assessing patient
- Obtain H&P
  - Onset of fever, recent antibiotic treatment, hx of infection/bacteremia/sepsis; cause of intestinal failure, hx of organ transplantation, medication hx (immunosuppressive agents), prior PICU admissions due to CLABSI
- Consider further work up as indicated:
  - Type and screen (if patient appears anemic or low H/H documented from clinic)
  - Cortisol (if long term corticosteroids or shock; if abnormal, discuss with Endocrinology)
  - CXR, COVID-19/flu/RSV PCR (if respiratory symptoms). If viral testing negative, consider sending respiratory BioFire if results will alter management.
  - AXR (if vomiting, abdominal distention, etc.)
  - GI BioFire (if abnormal stooling patterns, etc.)
- Contact GI On-Call to prep for inpatient admission

Signs of sepsis: Notify attending/fellow immediately and proceed to Septic Shock Pathway

[1]GIVE ANTIBIOTICS WITHIN 1 HOUR OF PRESENTATION!
Do not wait until labs have returned to start antibiotics.

- **Start empiric antibiotics and give through CVL if patent; rotate infusions through each lumen:**
  - Ceftazidime IV 150 mg/kg/day div q8hr (max 2 g/dose) - *give first* **AND**
  - Vancomycin IV – *start after ceftazidime*
    - ≤44 weeks PMA[‡]/about ≤1 month old: 15 mg/kg x1
    - >44 weeks PMA[‡]/about >1 month old: 20 mg/kg x1 (initial max dose 2 g/dose)
    - Subsequent dosing per hospital pharmacy vancomycin protocol to avoid AKI
- *If allergic to ceftazidime:*
  - If no renal dysfunction[1]: piperacillin/tazobactam IV 300 mg/kg/day div q6hr (max 4.5 g/dose) **AND** vancomycin IV
  - If renal dysfunction[1]: ciprofloxacin IV 30 mg/kg/day div q8hr (max 400 mg/dose) **AND** Vancomycin IV
- *If other drug allergy exists or history of multi-drug resistant organism:* consult GI and Infectious Diseases (ID)

[‡]PMA (Post-Menstrual Age) = gestational age + postnatal age

[1]Definition of Acute Kidney Injury (AKI)
(It should be noted that this definition does not apply to children <1 year of age)

AKI is defined by having either:

- At least a 50% increase in Scr above baseline* and new Scr ≥0.5 mg/dL OR
- An increase by 0.3 mg/dL from baseline*, and new Scr ≥0.5 mg/dL

*If a baseline creatinine is unknown, estimate baseline Cr using the Schwartz Calculation ($baseline\ creatinine = (0.413 \times height\ cm)/120\ GFR$). For patients with Chronic Kidney Disease (CKD), use the CKID U25 Calculator.

- Observe the patient in the ED for 1 hour after first antibiotic dose finishes (there is a risk of endotoxic shock that can occur after the first antibiotic dose)
- Transfer to Med/Surg vs PICU depending on clinical stability

Inpatient Care

- Continue empiric antibiotics for 36 hours and discontinue if blood culture negative.
  - If blood culture is positive, use blood culture and BCID results to narrow and tailor antibiotics. Duration of antibiotics will depend on organism and whether CVL is retained or removed – consider ID consultation.
- Consult ID if: history of multi-drug resistant organism, blood culture is positive, or team wishes to continue vancomycin beyond 36 hours (or use another restricted antimicrobial)
- Repeat daily blood cultures from all lumens until 1 set of blood cultures is negative for 48 hours
- Discussion on salvage of line per primary team (GI)
- Hold enteral feeds for 24 hours due to increased risk of bacterial translocation

Discharge Criteria/Instructions:
Clinically stable, negative blood cultures with antibiotic plan in place, follow up plan in place

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CLINICAL PATHWAY:
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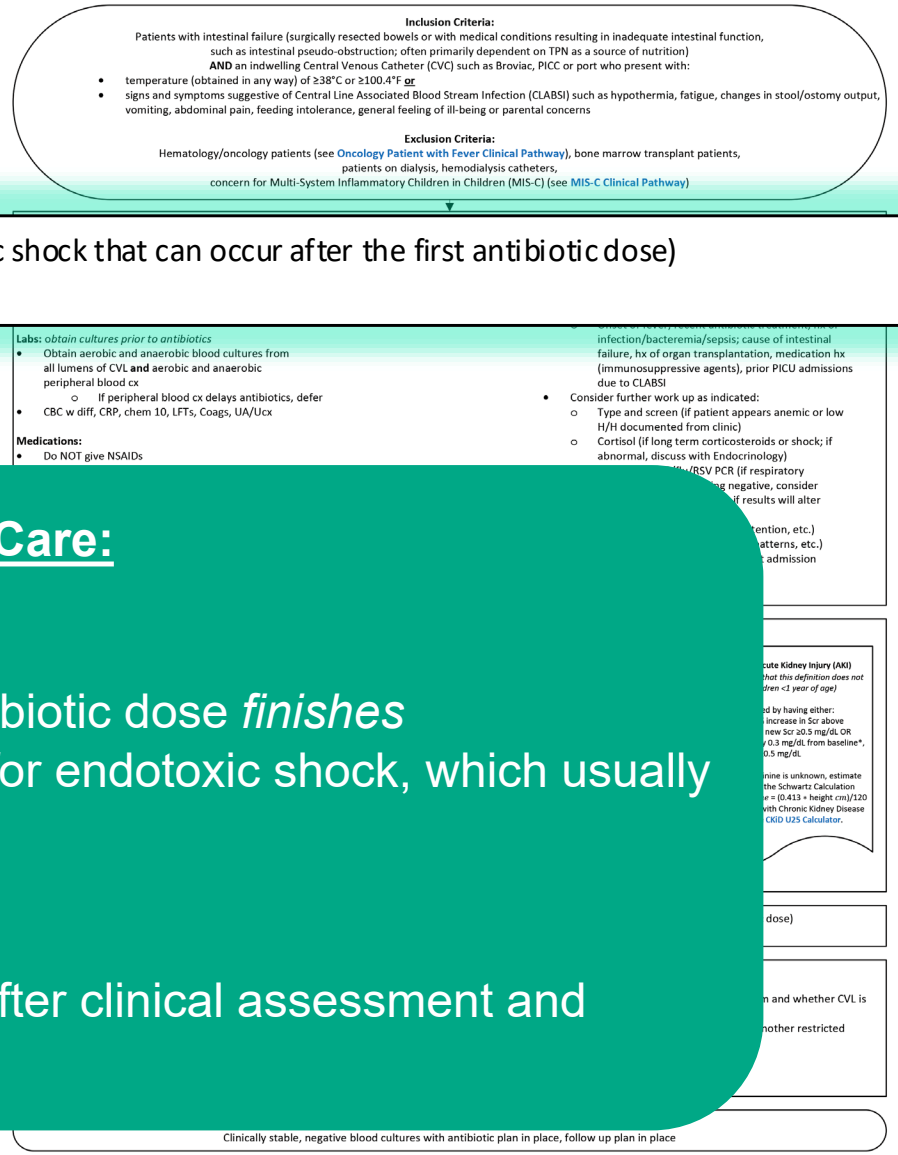

- Observe the patient in the ED for 1 hour after first antibiotic dose finishes (there is a risk of endotoxic shock that can occur after the first antibiotic dose)
- Transfer to Med/Surg vs PICU depending on clinical stability

Observation and Transfer of Care:

Observation:

- Monitor the patient in the ED for 1 hour after the first antibiotic dose *finishes*
  - Patients with intestinal failure and CVCs are at risk for endotoxic shock, which usually occurs *after* the first antibiotic dose

Transfer:

- Transfer the patient to the med/surg floors or the PICU after clinical assessment and consultations with GI and/or PICU teams

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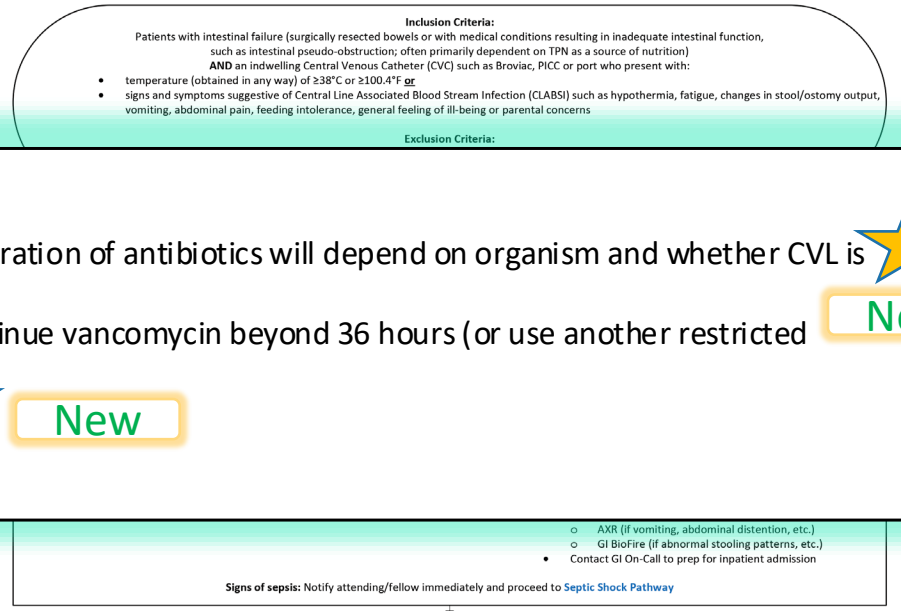

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Exclusion Criteria:

- AXR (if vomiting, abdominal distention, etc.)
- GI BioFire (if abnormal stooling patterns, etc.)
- Contact GI On-Call to prep for inpatient admission

Signs of sepsis: Notify attending/fellow immediately and proceed to Septic Shock Pathway

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Inpatient Care

- Continue empiric antibiotics for 36 hours and discontinue if blood culture negative.
  - If blood culture is positive, use blood culture and BCID results to narrow and tailor antibiotics. Duration of antibiotics will depend on organism and whether CVL is retained or removed – consider ID consultation.
- Consult ID if: history of multi-drug resistant organism, blood culture is positive, or team wishes to continue vancomycin beyond 36 hours (or use another restricted antimicrobial)
- Repeat daily blood cultures from all lumens until 1 set of blood cultures is negative for 48 hours
- Discussion on salvage of line per primary team (GI)
- Hold enteral feeds for 24 hours due to increased risk of bacterial translocation

New

New

Inpatient Care

- Note that enteral feeds should be HELD for 24 hours!
- Empiric antibiotics should continue until cultures from all lumens are negative for 36 hours
- If the blood culture is positive, utilize sensitivities and BCID results to tailor antibiotics, including determination of antibiotic duration (the latter will also depend on whether or not CVL was removed)
- Blood cultures should be repeated until cultures are negative for 48 hours
- Considerations for consulting ID are listed here
- Discussions on salvaging the line per the primary team (GI)c

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Discharge Criteria/Instructions:
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Medications:
Do NOT give NSAIDs
Hold on giving acetaminophen

and antibiotics[1] (see dosing below) prior to assessing patient
- Obtain H&P
  - Onset of fever, recent antibiotic treatment, hx of infection/bacteremia/sepsis; cause of intestinal failure, hx of organ transplantation, medication hx (immunosuppressive agents), prior PICU admissions due to CLABSI
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Discharge Criteria/Instructions:
Clinically stable, negative blood cultures with antibiotic plan in place, follow up plan in place

Discharge Criteria:

- Discharge criteria includes clinical stability, negative blood cultures with an antibiotic plan in place, and adequate follow up in place after discharge.

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Review of Key Points

- Timely antibiotics (within 1 hour) are essential for patients with intestinal failure and a CVC who present with fevers
  - Providers should place orders for cultures and labs before assessing the patient
- Obtain both aerobic and anaerobic cultures and labs before antibiotics
- Patients are at risk for endotoxic shock, which usually occurs after the first antibiotic dose. Make sure to monitor in the ED for 1 hour after the first antibiotic finishes.
- Antibiotics should continue until cultures are negative for 36 hours
- If cultures are positive, utilize sensitivities to tailor antibiotics

Quality Metrics

- Percentage of patients with pathway order set usage
- Average time from ED arrival to ED triage start time (minutes)
- Average time from ED arrival to antibiotic order
- Average time from antibiotic order to administration
- Average time from ED arrival to antibiotic administration
- ALOS (ED, minutes)
- ALOS (IP/OBS, days)

Pathway Contacts

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  - Connecticut Children's Department of Gastroenterology
- Logan Jerger, M.D.
  - Connecticut Children's Department of Gastroenterology
- Karan Emerick, M.D.
  - Connecticut Children's Department of Gastroenterology
- Multidisciplinary Intestinal Rehabilitation Team (MIRT)
  - Connecticut Children's Department of Digestive Diseases, Hepatology and Nutrition

References

Szydlowski EG, Rudolph JA, Vitale MA, Zuckerbraun NS. Bloodstream Infections in Patients With Intestinal Failure Presenting to a Pediatric Emergency Department With Fever and a Central Line. *Pediatr Emerg Care*. 2017;33(12):e140-e145.

Drews BB, Sanghavi R, Siegel JD, Metcalf P, Mittal NK. Characteristics of catheter-related bloodstream infections in children with intestinal failure: Implications for clinical management. *Gastroenterol Nurs*. 2009;32(6):385-90.

Mermel LA, Allon M, Bouza E, et *al*. Clinical Practice Guidelines for the Diagnosis and Management of Intravascular Catheter-Related Infection: 2009 Update by the Infectious Diseases Society of America. *Clin Infect Dis* 2009:49:1-45.

Gaieski DF, Mikkelsen ME, Band RA, *et al*. Impact of time to antibiotics on survival in patients with severe sepsis or septic shock in whom early goal-directed therapy was initiated in the emergency department. *Crit Care Med*. 2010;38(4):1045–1053

Kumar A, Roberts D, Wood KE, Light B, Parrillo JE, Sharma S, Suppes R, Feinstein D, Zanotti S, Taiberg L, Gurka D, Kumar A, Cheang M. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. Crit Care Med. 2006 Jun;34(6):1589-96. doi: 10.1097/01.CCM.0000217961.75225.E9. PMID: 16625125.

Hudgins JD, Goldberg V, Fell GL, Puder M, Eisenberg MA. Reducing Time to Antibiotics in Children With Intestinal Failure, Central Venous Line, and Fever. *Pediatrics*. 2017;140(5):e20171201.

Thank You!

About Connecticut Children's Pathways Program

Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children's, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgment.