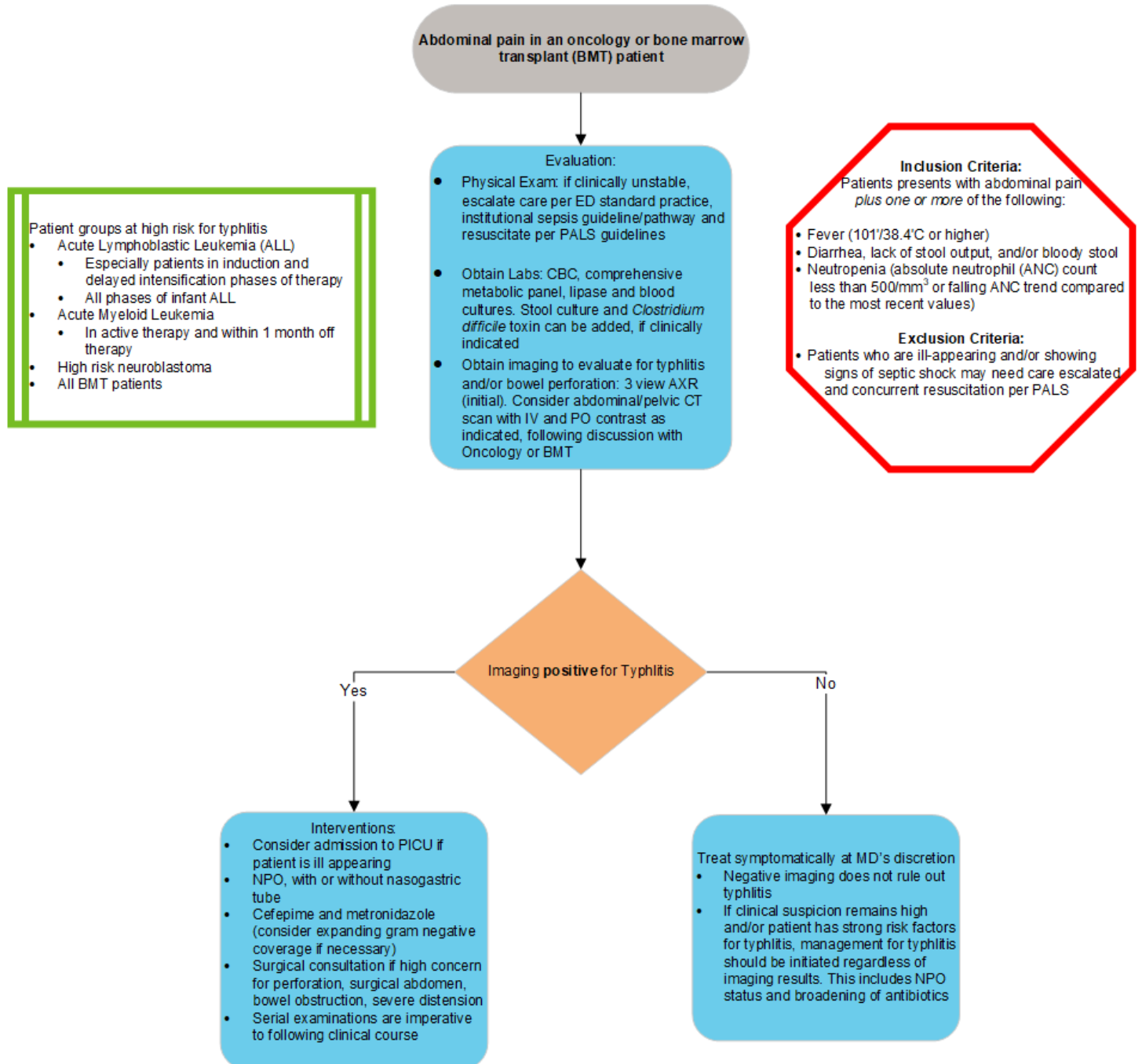


ABDOMINAL PAIN IN AN ONCOLOGY OR BONE MARROW TRANSPLANT (BMT) PATIENT (AKA TYPHLITIS)

ALGORITHM. Abdominal Pain in an Oncology or BMT Patient



Quick Links: [Sepsis Pathway](#)

TABLE OF CONTENTS

[Algorithm](#)

[Target Population](#)

[Clinical Management](#)

[Laboratory Studies | Imaging](#)

[Treatment | Therapeutics](#)

[References](#)

[Clinical Improvement Team](#)

TARGET POPULATION

Inclusion Criteria

- All oncology and bone marrow transplant (BMT) patients with abdominal pain

Exclusion Criteria

- General medicine patients
- Hematology patients who are not immunocompromised

CLINICAL MANAGEMENT

Overview

Typhlitis, also referred to as neutropenic enterocolitis¹, is an acute life-threatening condition, seen most commonly in children with myelosuppression. Mortality and morbidity rates associated with typhlitis are very high and early diagnosis and treatment is imperative as the clinical course progresses very quickly¹.

Clinical Presentation

A high index of suspicion for typhlitis should be given to oncology or BMT patients presenting with abdominal pain² plus one or more of the following:

- Fever¹⁻³ (101°F/38.4°C or higher)
- Diarrhea^{2,3}, lack of stool output, and/or bloody stool
- Neutropenia¹⁻³ (absolute neutrophil count (ANC) less than 500/mm³ or falling ANC trend compared to most recent values)
- Diagnoses, including but not limited to:
 - Acute lymphoblastic leukemia (ALL), especially patients in Induction therapy or delayed intensification phases of therapy,¹ and infant ALL in all phases of therapy
 - Acute myeloblastic leukemia (AML), in active therapy or within 1 month off therapy
 - High-risk neuroblastoma¹
 - Bone marrow transplant patients (BMT)

Differential Diagnoses

Signs and symptoms of typhlitis often mimic other common gastrointestinal disorders including appendicitis, colonic pseudo-obstruction, diverticulitis, inflammatory bowel disease, infectious colitis, pancreatitis, and pseudomembranous colitis³.

LABORATORY | RADIOLOGIC STUDIES

Currently there is no gold standard for diagnosing typhlitis

Laboratory studies should include:

- Complete blood cell count (CBC)⁴
- Comprehensive metabolic panel⁴
- Serum lipase
- Blood cultures⁴
- Stool cultures and *Clostridium difficile* toxin⁵ should be considered if clinically indicated

Imaging:

- Controversy exists regarding the ideal modality for diagnostic imaging in patients with potential typhlitis. Abdominal x-rays with consideration of clinical signs are usually the first step of investigation and are usually sensitive enough for the diagnosis of typhlitis. CT abdomen/pelvis with IV and PO contrast is the next step imaging modality if questions and uncertainty remain amongst ED, PICU and Oncology/BMT teams.
- Radiographic findings suggestive of typhlitis include:
 - “Thumb-printing”
 - Fluid-filled mass like density in the right lower quadrant of the abdomen
 - Pneumatosis
 - Distention of adjacent bowel loops
- CT scans can also be used for diagnosis in cases where other pathology is a concern. Abdominal x-ray is often sufficient for the diagnosis of typhlitis.

TREATMENT | THERAPEUTICS

Treatment must be individualized to each patient⁴.

Conservative treatment consists of:

- Bowel rest³ with or without nasogastric suction
 - Parenteral nutrition may be considered
- Hemodynamic support
 - Intravenous fluids, and/or blood products as needed
- Antimicrobial Coverage³
 - Cefepime: 50 mg/kg/dose intravenously every 8 hrs. Maximum: 6 grams/day plus metronIDAZOLE: 7.5 mg/kg/dose intravenously every 6 hrs or 10 mg/kg/dose intravenously every 8 hrs. Recommended maximum: 2 grams/day
 - Consider additional Gram-negative coverage in patients who are clinically unstable, when resistant infection is suspected^{6,7}
 - The agent to select for double coverage is controversial, as aminoglycosides are of variable benefit and increased nephrotoxicity, and fluoroquinolones increase risk of *C. difficile* disease⁸

- Discontinue double Gram-negative coverage in patients who are clinically responding after 48 to 72 hours, if there is no specific microbiologic clinical indication to continue⁶
- Consider adding Enterococcal coverage per patient risk factors and clinical severity, per National Fever and Neutropenia guidelines⁶
- Consider expanding/adding anti-fungal coverage per patient risk factors and clinical severity, per National Fever and Neutropenia guidelines⁶
- For patients with cephalosporin allergy, choices include meropenem 20 mg/kg/dose intravenously every 8 hrs (single agent) Maximum: 3 grams/day, or ciprofloxacin 10 mg/kg/dose intravenously every 12 hours (Recommended maximum: 800 mg/day) + metroNIDAZOLE 10 mg/kg/dose orally or intravenously every 8 hrs (Recommended maximum: 500mg q8h)
 - If meropenem used, there is no clear benefit to double gram-negative coverage, though exceptions can be made for patients already on meropenem (for example for BMT prophylaxis)⁸
 - Double anaerobic coverage should be avoided, as it is unnecessary and may increase risk of *C. difficile infection*. Agents with significant anaerobic coverage used in this population include meropenem, piperacillin/tazobactam, metronidazole, and clindamycin (note: clindamycin is less effective against *B. fragilis*)⁹
- Duration of antimicrobials is dependent on clinical improvement of typhlitis symptoms and/or resolving neutropenia, whichever comes later
- Pain management pharmacotherapy
 - Note that NSAIDs may be contraindicated in setting of typhlitis due to impact on GI endothelium
 - Opiates should be used judiciously due to possible worsening of ileus
- Do *NOT* administer anticholinergics or antidiarrheals, as they may aggravate the condition or complicate the clinical presentation.
- Consider surgical consultation
- Immediate surgical intervention may be indicated for patients with free intra-abdominal perforation, electrolyte disturbances indicating necrotic tissue including hyperkalemia and acidosis, clinical deterioration during conservative medical treatment, unrelenting intra-abdominal sepsis or abscess formation, or continued hemorrhage¹⁰. A multidisciplinary discussion should be made between surgical, PICU, ED and oncology/BMT teams if a surgical intervention is indicated.

Risk of Recurrence

Patients with a history of typhlitis are at risk for developing it again during subsequent treatment. Chemotherapy is almost always withheld until the patient has recovered and has sufficiently healed clinically. A discussion should take place between the oncology/BMT teams and the PICU or ED teams.

References

1. Mullassery D, Bader A, Battersby AJ, et al. Diagnosis, incidence, and outcomes of suspected typhlitis in oncology patients--experience in a tertiary pediatric surgical center in the United Kingdom. *J Pediatr Surg* 2009;44:381-5.
2. Shafey A, Ethier MC, Traubici J, Naqvi A, Sung L. Incidence, risk factors, and outcomes of enteritis, typhlitis, and colitis in children with acute leukemia. *J Pediatr Hematol Oncol* 2013;35:514-7.
3. Cloutier RL. Neutropenic enterocolitis. *Emerg Med Clin North Am* 2009;27:415-22.
4. Moran H, Yaniv I, Ashkenazi S, Schwartz M, Fisher S, Levy I. Risk factors for typhlitis in pediatric patients with cancer. *J Pediatr Hematol Oncol* 2009;31:630-4.
5. El-Matary W, Soleimani M, Spady D, Belletrutti M. Typhlitis in children with malignancy: a single center experience. *J Pediatr Hematol Oncol* 2011;33:e98-100.
6. Lehrnbecher T, Phillips R, Alexander S, et al. Guideline for the management of fever and neutropenia in children with cancer and/or undergoing hematopoietic stem-cell transplantation. *J Clin Oncol* 2012;30:4427-38.
7. Freifeld AG, Bow EJ, Sepkowitz KA, et al. Clinical practice guideline for the use of antimicrobial agents in neutropenic patients with cancer: 2010 update by the infectious diseases society of america. *Clin Infect Dis* 2011;52:e56-93.
8. Sick AC, Tschudin-Sutter S, Turnbull AE, Weissman SJ, Tamma PD. Empiric Combination Therapy for Gram-Negative Bacteremia. *Pediatrics* 2014.
9. Snyderman DR, Jacobus NV, McDermott LA, et al. Lessons learned from the anaerobe survey: historical perspective and review of the most recent data (2005-2007). *Clin Infect Dis* 2010;50 Suppl 1:S26-33.
10. Chui CH. Surgical management of complications of multimodal therapy. *Pediatr Blood Cancer* 2012;59:405-9.
11. Portugal R, Nucci M. Typhlitis (neutropenic enterocolitis) in patients with acute leukemia: a review. *Expert Rev Hematol*. 2017 Feb;10(2):169-174



CLINICAL IMPROVEMENT TEAM MEMBERS

- Lia Gore, MD | Hematology/Oncology
- Alexandria Wiersma, MD | Emergency Department
- Nicole Kaiser, PharmD | Clinical Pharmacist
- Amy Keating, MD | Bone Marrow Transplant
- Michele Loi, MD | Critical Care and Hematology/Oncology
- Christopher Ruzas, MD | Critical Care
- Leanne Adamson, CNS | Hematology / Oncology
- Debra Southworth, CPS | Center for Cancer and Blood Disorders
- Jeylinne Enriquez, MSW, MHSA, PAHM | Clinical Effectiveness

APPROVED BY

Clinical Pathways and Measures Review Committee – March 28, 2022

Pharmacy & Therapeutics Committee – February 3, 2022

MANUAL/DEPARTMENT	Clinical Pathways/Quality
ORIGINATION DATE	March 1, 2011
LAST DATE OF REVIEW OR REVISION	July 31, 2024
COLORADO SPRINGS REVIEW BY	 Michael DiStefano, MD Chief Medical Officer, Colorado Springs
APPROVED BY	 Lalit Bajaj, MD, MPH Chief Quality Outcomes Officer

REVIEW | REVISION SCHEDULE

Scheduled for full review on March 28, 2026

Clinical pathways are intended for informational purposes only. They are current at the date of publication and are reviewed on a regular basis to align with the best available evidence. Some information and links may not be available to external viewers. External viewers are encouraged to consult other available sources if needed to confirm and supplement the content presented in the clinical pathways. Clinical pathways are not intended to take the place of a physician's or other health care provider's advice, and is not intended to diagnose, treat, cure or prevent any disease or other medical condition. The information should not be used in place of a visit, call, consultation or advice of a physician or other health care provider. Furthermore, the information is provided for use solely at your own risk. CHCO accepts no liability for the content, or for the consequences of any actions taken on the basis of the information provided. The information provided to you and the actions taken thereof are provided on an "as is" basis without any warranty of any kind, express or implied, from CHCO. CHCO declares no affiliation, sponsorship, nor any partnerships with any listed organization, or its respective directors, officers, employees, agents, contractors, affiliates, and representatives.

Discrimination is Against the Law. Children's Hospital Colorado complies with applicable Federal civil rights laws and does not discriminate on the basis of race, color, national origin, age, disability, or sex. Children's Hospital Colorado does not exclude people or treat them differently because of race, color, national origin, age, disability, or sex.

Children's Hospital Colorado provides free aids and services to people with disabilities to communicate effectively with us, such as: Qualified sign language interpreters, written information in other formats (large print, audio, accessible electronic formats, other formats). Children's Hospital Colorado provides free language services to people whose primary language is not English, such as: Qualified interpreters, information written in other languages.

If you need these services, contact the Medical Interpreters Department at 720.777.9800.

If you believe that Children's Hospital Colorado has failed to provide these services or discriminated in another way on the basis of race, color, national origin, age, disability, or sex, you can file a grievance with: Corporate Compliance Officer, 13123 E 16th Avenue, B450, Aurora, Colorado 80045, Phone: 720.777.1234, Fax: 720.777.7257, corporate.compliance@childrenscolorado.org. You can file a grievance in person or by mail, fax, or email. If you need help filing a grievance, the Corporate Compliance Officer is available to help you.

You can also file a civil rights complaint with the U.S. Department of Health and Human Services, Office for Civil Rights, electronically through the Office for Civil Rights Complaint Portal, available at ocrportal.hhs.gov/ocr/portal/lobby.jsf, or by mail or phone at: U.S. Department of Health and Human Services 200 Independence Avenue, SW Room 509F, HHH Building Washington, D.C. 20201 1-800-368-1019, 800-537-7697 (TDD) Complaint forms are available at www.hhs.gov/ocr/office/file/index.html.

Children's Hospital Colorado complies with applicable Federal civil rights laws and does not discriminate on the basis of race, color, national origin, age, disability, or sex.

ATENCIÓN: si habla español, tiene a su disposición servicios gratuitos de asistencia lingüística. Llame al 1-720-777-9800.

CHÚ Ý: Nếu bạn nói Tiếng Việt, có các dịch vụ hỗ trợ ngôn ngữ miễn phí dành cho bạn. Gọi số 1-720-777-9800.

주의: 한국어를 사용하시는 경우, 언어 지원 서비스를 무료로 이용하실 수 있습니다. 1-720-777-9800 번으로 전화해 주십시오.

注意: 如果您使用繁體中文, 您可以免費獲得語言援助服務。請致電1-720-777-9800。

ВНИМАНИЕ: Если вы говорите на русском языке, то вам доступны бесплатные услуги перевода. Звоните 1-720-777-9800.

ማስታወሻ: የሚናገሩት ቋንቋ አማርኛ ከሆነ የትርጉም አርዳታ ድርጅቶቹ፣ በነጻ ሊያገዝዎት ተዘጋጅተዋል። ወደ ሚከተለው ቁጥር ይደውሉ 1-720-777-9800 (መስማት ስተሳናቸው)።

ملحوظة: إذا كنت تتحدث انكر اللغة، فإن خدمات المساعدة اللغوية تتوفر لك بالمجان. اتصل برقم 1-720-777-9800 (رقم)

ACHTUNG: Wenn Sie Deutsch sprechen, stehen Ihnen kostenlos sprachliche Hilfsdienstleistungen zur Verfügung. Rufnummer: 1-720-777-9800.

ATTENTION : Si vous parlez français, des services d'aide linguistique vous sont proposés gratuitement. Appelez le 1-720-777-9800.

ध्यान बनु होस्तयाइले नेपाल बोलनहनछ भन तयाइको निम्त भाषा सहायता सवाहू नःशलक रूपमा उपलब्ध छ । फोन गनु होसर 1-720-777-9800 ।

PAUNAWA: Kung nagsasalita ka ng Tagalog, maaari kang gumamit ng mga serbisyo ng tulong sa wika nang walang bayad. Tumawag sa 1-720-777-9800.

注意事項: 日本語を話される場合、無料の言語支援をご利用いただけます。1-720-777-9800 まで、お電話にてご連絡ください。

Nti: O buri na asu lbo, asusu aka oasu n'efu, defu, aka. Call 1-720-777-9800.