

# CHAPTER 61

## NEONATAL INTESTINAL OBSTRUCTION

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### Introduction

Neonatal intestinal obstruction (NIO) is one of the most common emergency conditions a paediatric surgeon is called upon to assess during the neonatal period. Successful management of NIO depends on timely diagnosis and referral for therapy. The diagnosis is based on history (symptoms) and physical examination (signs) confirmed by some investigations such as radiographic and histopathological studies. Catastrophic events such as volvulus, ischaemic loop of bowel, pneumoperitoneum, and/or pneumonia from aspiration and malnutrition could be overcome through efficient and timely resuscitation and urgent transport to a specialised unit.

The desired goal of healthy survival of neonatal intestinal obstruction requires a coordinated interaction of medical, nursing, and rehabilitative specialties in an organised team. Early surgical intervention is paramount and may mean all the difference between intestinal salvage and crippling short gut syndrome. The typical case of neonatal bowel obstruction is generally straightforward, and the outcome is potentially excellent. Only very preterm babies and those of extremely low birth weight may succumb. However, in Africa, late presentations and poor resources lead to a mortality of up to 30%.<sup>1</sup> Few dedicated paediatric hospitals exist in developing countries.<sup>2</sup>

Intestinal obstruction can be complete (atresia, anorectal malformation (ARM)) or incomplete (stenosis, web). Obstruction may be intraluminal (meconium ileus or meconium plug syndrome) or functional (Hirschsprung's disease (HD)). Proximal obstruction presents with earlier vomiting and less abdominal distension, whereas distal bowel obstruction tends itself to late-onset and greater abdominal distension. This chapter provides an overview on neonatal bowel obstruction. Each specific condition is covered in chapters elsewhere in this book, specifically, Chapter 58 (inguinal and femoral hernias and hydrocoele), Chapter 62 (duodenal atresia and stenosis), Chapter 63 (intestinal atresia and stenosis), Chapter 65 (intestinal malrotation and midgut volvulus), Chapter 67 (meconium disease), Chapter 76 (Hirschsprung's disease), and Chapter 77 (anorectal anomalies).

### Demographics

The incidence of NIO is approximately 1 in 5,000 live births. The true incidence in Africa is unknown, but a recent report from Tanzania has shown that it is still the most common neonatal surgical emergency.<sup>1</sup> Many cases still die undiagnosed and untreated.

### Aetiology/Pathophysiology

Neonatal intestinal obstruction has varied aetiology, so the pathophysiology is diverse.

The gastrointestinal tract (GIT) arises from the yolk sac. At 3 to 4 weeks' gestation, it becomes a distinct entity. A connection, the vitelline (omphalomesenteric) duct, may persist as a Meckel's diverticulum. The alimentary tube is divided according to its blood supply into the foregut, midgut, and hindgut.

The foregut comprises the oesophagus, stomach, and duodenum. These are vascularised by multiple sources—the thyrocervical, intercostal, celiac axis, and superior mesenteric vessels.

The midgut comprises the jejunum and ileum as well as the ascending and proximal transverse colon. These are supplied by the superior mesenteric vessels.

The hindgut comprises the distal colon, which is supplied by the inferior mesenteric vessels, and the rectum, which is supplied by the internal iliac vessels.

Aberrations of foregut formation include duodenal stenosis, duodenal atresia, and annular pancreas. Maldevelopment of the midgut includes malrotation as well as jejunal and ileal atresia. Meconium ileus involves the distal ileum. Hirschsprung's disease (ganglionic megacolon), meconium plug syndrome, and imperforate anus involve the hindgut. Enteric duplications occur in all three locations.

**Jejunoleileal atresia** is a condition acquired during foetal development due to disruption of the mesenteric blood supply. In their classic work on foetal dogs in 1955, Lowy and Bernard from Cape Town, South Africa, clarified the pathophysiology of jejunoleileal atresia.<sup>3</sup> Other abdominal conditions occurring in utero, such as gastroschisis, volvulus, or intussusception, may be associated with intestinal atresia due to kinking, stretching, or otherwise disrupting the blood flow to the foetal bowel. Chromosomal anomalies are rare (<1%) in babies with jejunoleileal atresia.

**Meconium ileus** is the earliest manifestation of cystic fibrosis (CF), an autosomal recessive condition characterised by abnormalities in cellular membrane physiology and chloride ion transport that contribute to progressive respiratory failure, derangements in cellular secretory patterns, and diminished mucosal motility. In developed countries, 10–20% of newborns with CF present with meconium ileus, an association first described by Landsteiner in 1903.<sup>4</sup> A cystic fibrosis gene that is different from that in the Caucasian population has been identified in the Black African population,<sup>5</sup> however, the incidence in Africa is much reduced, and in many sub-Saharan countries, the disease is not reported.<sup>6</sup>

Abnormalities in the cystic fibrosis transmembrane regulator (CFTR) disrupt transmembrane flux of the chloride ion, which subsequently affects sodium transport as well. The meconium of affected babies is thick and sticky; this, coupled with the poor motility of an immature intestine, leads to intraluminal obstruction of the terminal ileum. A contrast enema might reveal the characteristic finding of a microcolon. It is essential to push the contrast up to the level of obstruction, namely, the distal ileum to be therapeutic by flushing out the meconium plugs (Figures 61.1 to 61.4).

**Meconium plug syndrome** refers to inspissated meconium obstructing the colon; it may denote HD but not CF. Conditions that predispose to dysmotility of the neonatal bowel (e.g., maternal pre-eclampsia, diabetes mellitus, administration of magnesium sulfate, prematurity, sepsis, and hypothyroidism) may be responsible for the formation of the meconium plug. A water-soluble contrast enema can be both diagnostic and therapeutic for this condition.

**Hirschsprung's disease** is a disorder of the neuroenteric pathways in the distal colon that results in a bowel that is tonically contracted. Bowel peristalsis is controlled by neuroenteric ganglion cells, which

# Chapter 61 Neonatal Intestinal Obstruction

**Orvar Swenson, John G. Raffensperger**



## **Chapter 61 Neonatal Intestinal Obstruction:**

Pediatric Surgery Emmanuel A. Ameh, Stephen W. Bickler, Kokila Lakhoo, Benedict C. Nwomeh, Dan Poenaru, 2020-11-23

The second fully updated edition of this book applies and contextualizes up to date information on pediatric surgery for low and middle income countries LMICs The book is organized in general anatomic and thematic sections within pediatric surgery such as urology oncology orthopedics and gastroenterology and includes chapters addressing the unique challenges and approaches for pediatric surgery in low resource settings Each chapter has dual authorship LMIC author providing context specific insights and authors from high income countries HICs contributing experience from well resourced settings Written in a reader friendly format this book has a uniform structure in each chapter with introduction demographics etiology pathophysiology clinical presentations investigations management outcome prevention ethics evidence based surgery and references This comprehensive volume fills the gap between up to date pediatric surgical scholarship and knowledge developed and applied in HICs and the practical needs of practitioners in low resource settings This is an indispensable guide for postgraduate surgical trainees in Africa and other LMICs as well as general surgeons practicing in Africa and other LMICs who need to care surgically for children

### **IAPS Textbook of Pediatric Surgery** Rajeev

Redkar, Prakash Agarwal, V Raveenthiran, Shirin Joshi Gosavi, Anant Bangar, 2020-03-31 SECTION 1 GENERAL TOPICS IN PEDIATRIC SURGERY SECTION 2 TRAUMA AND ALLIED SECTION 3 HEAD FACE AND NECK SECTION 4 CHEST AND THORAX SECTION 5 ABDOMEN SECTION 6 ONCOLOGY SECTION 7 UROLOGY SECTION 8 TRANSPLANTATION SECTION 9 MISCELLANEOUS

### **Fetal and Neonatal Surgery and Medicine** Timothy M. Crombleholme, Foong-Yen Lim, Jose L. Peiro, Lynn Simpson, Natalie E. Rintoul, 2024-03-22

From prenatal diagnosis through neonatal surgery and beyond a multidisciplinary resource for an evolving specialty Fetal and Neonatal Surgery and Medicine is a comprehensive resource for all clinicians who care for fetal and neonatal patients Focusing on the continuum of care from prenatal diagnosis through the neonatal period and beyond the text guides specialists who deliver care to patients before and after delivery and offers invaluable insights to equip those counseling parents faced with a fetal anomaly Part I focuses on prenatal diagnosis and diagnostic techniques Part II spotlights fetal intervention and surgical techniques Part III concentrates special considerations in the fetus and neonate and Part IV covers the full range of fetal and neonatal anomalies Chapters are heavily illustrated to help the reader visualize what the chapter discusses Features Ideal for general pediatric surgeons neonatologists radiologists geneticists advanced practice nurses and residents and fellows Structured for quick access with at a glance chapter highlights Divided into prenatal diagnosis and diagnostic techniques and fetal intervention and fetal surgical techniques and fetal care and neonatal care Hundreds of ultrasound images MRI images fetal echocardiograms and surgical photographs

**2016 ICD-10-CM Hospital Professional Edition** Carol J. Buck, 2014-10-10 Select diagnosis codes accurately with

Carol J Buck s 2016 ICD 10 CM for Hospitals Professional Edition Designed by coders for coders this full color manual

includes all the ICD 10 codes needed for today's inpatient and Medicare coding. As coders need more extensive knowledge to code with ICD 10 CM and to choose from the thousands of possible codes, this edition provides an essential background in A. This manual includes an introduction to ICD 10 CM coding in Part I, an alphabetic index to diseases and injuries in Part II, and the Tabular List of diseases and injuries in Part III. UPDATED 2016 Official Code set reflects the latest ICD 10 codes needed for diagnosis coding.

**Swenson's Pediatric Surgery** Orvar Swenson, John G. Raffensperger, 1980. *2014 ICD-10-CM Draft Edition - E-Book* Carol J. Buck, 2013-08-29. Code more efficiently and effectively with Carol J. Buck's 2014 ICD 10 CM Draft Edition. Designed by coders for coders, this reference combines Netter's Anatomy illustrations and the Official Guidelines for Coding and Reporting. It simplifies ICD 10 diagnosis to ensure the most accurate billing and optimal reimbursement for outpatient medical services. Full color images and clear explanations of A/P pathology and medical terminology make it easy to develop the knowledge needed to assign the appropriate ICD 10 CM codes. At a glance. Guide to the Updates lists all new and revised codes providing quick access to the annual changes. Official Guidelines for Coding and Reporting. OGCRs are listed and also integrated within the code set providing fast, easy access to the official coding rules. Unique Full color Netter's anatomy art is cross referenced within the Tabular List to help you understand anatomy and how it will affect choosing codes. More than 150 full color illustrations provide visual orientation and help you understand difficult terminology, diseases, conditions, or coding in a specific category. Additional elements within specific codes define terms and supply additional coding instruction to aid in understanding difficult terminology, diseases, and conditions, or coding in a specific category. Symbols and highlights show which codes are an Unacceptable Principle Diagnosis and identify codes that call for the use of additional characters. NEW Updated 2014 Draft Code set. NEW American Hospital Association's Coding Clinic citations provide reference information regarding official ICD 10 CM coding advice that will enhance understanding of specific codes. NEW CC Complications, Comorbidities, and MCC Major Complications, Comorbidities, Exclusions call attention to CC and MCC exceptions.

*Emergency Medicine* Judith E. Tintinalli, Robert J. Rothstein, Ronald L. Krome, 1985.

*Pediatric Gastrointestinal Disease* W. Allan Walker, 2004. This new edition of *Pediatric Gastrointestinal Disease* is dedicated to the maintenance of a comprehensive approach to the practice of Pediatric Gastroenterology. Considered to be the definitive reference work, this fourth edition has been extensively reviewed. As a result, the size and content of various sections have been modified and new

**Oski's Pediatrics** Julia A. McMillan, Ralph D. Feigin, Catherine DeAngelis, M. Douglas Jones, 2006. A comprehensive guide to the current practice of pediatric care, this updated edition includes new chapters on complementary and alternative medicine, genetics in primary care, and updated chapters regarding infant and child behavior and development.

*Rudolph's Pediatrics, 24th Edition* Mark W. Kline, Jordan S. Orange, Angelo P. Giardino, Mahesh M. Rathore, Z Leah Harris, Antonio Cabrera, 2026-01-30. The landmark pediatrics reference updated with timely new content and more clinically relevant than ever, Rudolph's Pediatrics has virtually defined the pediatric field for

over a century becoming one of the most important and well respected pediatrics texts ever published. Renowned for its balance of clinical features and treatment of disease with underlying biological principles, this classic sourcebook has helped generations of pediatricians optimize their care of infants, children, and adolescents. This twenty-fourth edition of Rudolph's Pediatrics continues a long tradition of adapting its content to changes in our understanding of children's health and disease, providing an up-to-date, in-depth survey of pediatric medicine unmatched by any other text. With its algorithmic approach to pediatric systems, the book facilitates the diagnosis and treatment of both common and uncommon pediatric illnesses, and it reflects new technologies and advances in molecular medicine that continue to evolve with current thinking about normal childhood development and pediatric disease processes.

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**Primary Pediatric Radiology** Susan L. Williamson, 2002. This text encompasses the most essential information in the field of pediatric radiology in a concise, easy-to-use source. Highly focused, succinct chapters organized by symptom help readers to select the most appropriate imaging approaches and arrive at correct diagnoses based on patients presenting signs. Most significantly, the book separates coverage of neonates from material on older infants and children, since radiographic presentation differs so dramatically between these two groups. Includes valuable chapters on the neonate with respiratory distress, the neonate with birth trauma, the child and adolescent with abdominal pain, and recognizing cases of child abuse. Describes all relevant imaging modalities used in pediatric radiology, including conventional radiology, computed tomography, ultrasonography, magnetic resonance imaging, and nuclear medicine. Begins each section with images and descriptions of normal anatomy as a foundation for better understanding of abnormal radiologic images. Discusses specific technical considerations and common mistakes and provides memory hints and charts for quick reference. Features over 525 outstanding, never-before-published illustrations that cover the entire gamut of pediatric imaging findings.

**Rudolph's Pediatrics, 23rd Edition, Self-Assessment and Board Review** Michael deCastro Cabana, Angelo P. Giardino, 2022-11-18. Add the authority of Rudolph's Pediatrics 23rd Edition to your pediatric board examination review. Rudolph's Pediatrics Twenty-Third Edition Self-Assessment Board Review provides the focused practice you need to ace your certification exam. This companion to the landmark pediatrics text has been fully revised to match the current content outline of the American Board of Pediatrics for the pediatrics board certification and recertification exams. More than 1,500 test questions focus on topics including epidemiology, pathophysiology, presenting symptoms, clinical decision making, therapeutics, and prognosis of different pediatric disorders.

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**Neonatal Surgery** James Lister,Irene M. Irving,1990

**Surgery of the Alimentary Tract** Richard T. Shackelford,George D. Zuidema,1978

**Protocols in Neonatal Nursing** Carole Kenner,Stephanie Rockwern Amlung,Ann Applewhite Flandermeyer,1998 This handy resource places essential guidance on neonatal nursing at your fingertips Inside you ll find key information on pathophysiology signs and symptoms assessment diagnostic testing pertinent laboratory values patient outcomes early discharge and follow up and much more

**Anesthesia and Uncommon Pediatric Diseases** Jordan Katz,David J. Steward,1987

**Pediatric Surgery** James A. O'Neill,1998 The fifth edition of this classic reference has been completely revised to reflect the extensive changes in pediatric surgery since the publication of the fourth edition in 1986 Among the many areas to reflect significant advances are coverage of oncology transplantation extracorporeal membrane oxygenation ECMO gene therapy minimally invasive techniques and new approaches to anesthesia and pain control

**Current Pediatric Diagnosis & Treatment** William W. Hay,2007 Offers concise clinically oriented coverage of the ambulatory and hospital care of children from birth through infancy and adolescence Utilizing the popular Current Series format this handy guide answers all the questions that come up in daily practice and provides the details necessary to make a sound diagnosis and treatment plan

**Color Atlas of Pediatrics** Richard P. Usatine,Camille Sabella,2014-05-22 ACCURATELY DIAGNOSE PEDIATRIC CONDITIONS BY VISIBLE SIGNS AND INTERNAL IMAGING WITH THIS FULL COLOR ATLAS The Color Atlas of Pediatrics features more than 1 800 full color photographs to help you visually diagnose a wide variety of common and uncommon conditions and disorders spanning the entire pediatric spectrum This superb collection of clinical images is supported by concise evidence based treatment recommendations presented in easy to apply bulleted text Each chapter begins with a patient story that ties the photographs to real life patients Coverage for conditions includes Epidemiology Etiology and Pathophysiology Risk Factors Diagnosis Differential Diagnosis Management Prevention Patient Education Strength of recommendation ratings are cited throughout skillfully blending the art and science of medicine for optimal patient care

**Clinical Guidelines in Neonatology** Lucky Jain,2019-07-05 Publisher s Note Products purchased from Third Party sellers are not guaranteed by the publisher for quality authenticity or access to any online entitlements included with the product The first neonatal handbook to focus on clinical protocols and best management practicesClinical Guidelines in Neonatology provides a compilation of the most current and authoritative clinical care recommendations for the neonatal patient The goals of this innovative text are to

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