

# CHAPTER 20

## OMPHALITIS

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### Introduction

Omphalitis is defined as infection of the umbilicus—in particular, the umbilical stump in the newborn. It primarily affects neonates, in whom the combination of the umbilical stump and decreased immunity presents an opportunity for infection. It is rarely reported outside the neonatal period. Varieties of congenital conditions predispose to infection of the umbilical stump and are also among the differential diagnoses to consider for the presentation.

Omphalitis may extend into the portal vein and result in various acute complications requiring medical as well as surgical interventions. Although this condition is uncommon in developed countries, it remains a significant cause of morbidity and mortality in Africa and other parts of the world where health care is less readily available. Umbilical cord infection contributes significantly to newborn infection and neonatal mortality in Africa, especially for infants delivered at home without skilled birth attendants and under unhygienic conditions.<sup>1</sup>

### Demographics

Omphalitis is uncommon in developed countries, with an incidence of 0.2–0.7%.<sup>1</sup> The incidence in developing countries has been quoted to be between 2 and 7 in every 100 live births.<sup>2,3</sup> However, the incidence is even higher in communities that practise application of nonsterile home remedies to the cord. In one study of neonates admitted to an African general paediatric ward, omphalitis accounted for 28% of neonatal admissions.<sup>4</sup> Hospital-based studies estimate that 2–54 babies per 1000 births will develop omphalitis.<sup>5</sup> However, one report from Tanzania<sup>6</sup> found a rate of 1.7% among babies of 3,262 women.

Although there is a male preponderance, there does not appear to be a racial or ethnic predilection to developing omphalitis. The mean age of onset is usually 3–5 days for preterm infants and 5–9 days for term infants. For those with complications, the age at presentation is 5–75 days (median, 33 days), according to one report.<sup>7</sup>

Unhygienic cord practices have been implicated as the main factor responsible for the high incidence of omphalitis in Africa. Risk factors include inappropriate cord handling (e.g., cultural application of substances such as engine oil, cow dung, talc powder, or palm oil to the cord); septic delivery secondary to prolonged rupture of membranes or maternal infection; nonsterile delivery; prematurity; and low birth weight. One report<sup>1</sup> cited use of old instruments to cut the cord, mother not bathing (washing the perineum with water and soap) or shaving before delivery, and application of substances on the umbilical cord to be independently associated with the risk of developing omphalitis. Other risk factors include neonates with weakened or deficient immune systems or who are hospitalised and subjected to invasive procedures such as umbilical catheterisation. Genetic defects in contractile proteins have been implicated, and in some, immunological factors such as leukocyte adhesion deficiency (LAD) syndrome and neutrophil mobility may play a role.

### Aetiology/Pathophysiology

The umbilical cord presents a unique substrate for bacterial colonisation. It is relatively rich in substrate, without the normal barrier of skin

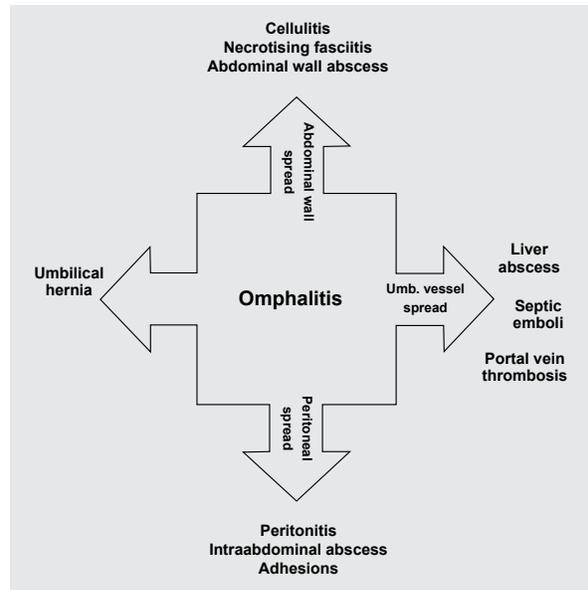


Figure 20.1: Pathophysiology of surgical complications of omphalitis.

defences, and it undergoes ischaemia and degradation as the umbilical stump dries and falls off. Normally, the cord area becomes colonised with potential bacterial pathogens intrapartum or immediately postnatal. Bacteria have the potential to invade the umbilical stump, leading to omphalitis. The pathophysiology of complications of omphalitis is closely related to the anatomy of the umbilicus. The infection can spread along the umbilical artery, umbilical veins, abdominal wall lymphatics and vessels, and by direct spread to contiguous areas (Figure 20.1).

The bacteriological spectrum of omphalitis is undergoing change, in light of the changes in cord care, antibiotic use, bacterial resistance profiles, and local practices. A single organism is causative in most cases. More often, aerobic organisms are causative. Common organisms include:

- *Staphylococcus aureus* (most common)
- Group A streptococcus
- *Escherichia coli*
- *Klebsiella*
- *Proteus*

Up to one-third of cases of omphalitis are associated with anaerobic infection caused by:

- *Bacteroides fragilis*
- *Peptostreptococcus*
- *Clostridium perfringens*

### Clinical Presentation

Local signs of omphalitis include purulent or foul-smelling discharge from the umbilicus/umbilical stump, periumbilical erythema, oedema, and tenderness. Systemic signs include fever (temperature >38°C) or hypothermia (temperature <36°C), unstable temperature, or jaundice. Other systemic manifestations may include tachycardia (heart rate >180/min), hypotension and delayed capillary refill, tachypnoea (respiratory rate >60/min), signs of respiratory distress or apnoea, or abdominal distention with absent bowel sounds. Central nervous system involvement may manifest as irritability, lethargy, poor suckling, hypotonia, or hypertonia. A history of delayed cord separation may be present in LAD syndrome.

In advanced cases, the infant may present with septic shock or necrotising fasciitis (NF). NF is a severe complication of omphalitis that should be considered if the local signs have progressed to include a peau d'orange appearance, discolouration or bruising of the skin, skin necrosis, and crepitation.

### Differential Diagnoses

The differential diagnoses of omphalitis (and specific features of each) include:

- umbilical granuloma (visible granuloma at the umbilicus);
- patent vitello-intestinal duct remnants (cystic swelling or fistulous opening with feculent matter discharging);
- patent urachus (fistulous opening with urine discharging) or urachal cyst;
- necrotising enterocolitis (abdominal distention, bilious vomiting, bloody stools);
- general sepsis; and
- rarely, appendiculo-omphalic anomalies.

### Investigations

A microbiological swab of the umbilicus should be sent for aerobic and anaerobic cultures. A blood culture should be included when appropriate. A blood count with differential for white cell counts may show a neutrophilia (or occasionally a neutropaenia).

Other investigations are necessary either to rule out other differential diagnoses or to diagnose complications. Diagnostics may include the following:

- A plain abdominal radiograph is useful if necrotising enterocolitis is suspected. In addition, it may reveal intraperitoneal gas in those with peritonitis (caused by gas-producing bacteria). Multiple fluid levels may suggest adhesion obstruction but may also be present in simple ileus. Gas may be present within the subcutaneous tissue of the abdominal wall when clostridial infection is involved.
- Abdominal ultrasonography is useful in imaging the abdominal wall if a cyst is suspected. It is helpful in the diagnosis of intraperitoneal, retroperitoneal, and hepatic abscesses.
- Doppler ultrasonography is helpful if portal vein thrombosis is suspected.
- A fistulogram is indicated if a fistulous connection to the umbilicus is discovered. This will help define the anatomy of a vitello-intestinal or urachal remnant.
- Rarely, magnetic resonance imaging (MRI) or a computed tomography (CT) scan may be useful in assessing or ruling out congenital tracts or fistulas. Also rarely, a CT scan may be necessary to adequately localise intraabdominal abscesses in difficult diagnostic cases.

### Medical Treatment

Treatment of uncomplicated cases requires prompt antibiotic therapy. Antibiotics are the mainstay of medical treatment of omphalitis. Antibiotics specifically active against *Staphylococcus aureus* and an aminoglycoside to cover for both gram-positive and gram-negative organisms are used. The local antibiotic susceptibility patterns need to be considered in the initial therapy. Examples include ampiclox, cloxacillin, flucloxacillin, and methicillin in combination with gentamycin. Metronidazole may be added when anaerobes are suspected. Duration of treatment is typically for 10–14 days with initial parenteral therapy for complicated cases. A short antibiotic therapy of 7 days is adequate for simple uncomplicated omphalitis.

Complications such as respiratory failure, hypotension, and disseminated intravascular coagulation (DIC) arising from infection may require supportive care in the form of intravenous fluids, fresh whole blood, fresh frozen plasma, platelets, or cryoprecipitate.

### Treatment of Surgical Complications

The surgical complications of omphalitis could be acute/early or long term/late and tend to be associated with significant morbidity and mortality. In addition to medical treatment for ongoing/active omphalitis, the surgical treatment is handled according to the surgical complication.

#### Necrotising Fasciitis

Necrotising fasciitis is one of the most commonly reported serious complications of omphalitis,<sup>1,8-12</sup> occurring in 26% of patients with major complications, according to one report.<sup>6</sup> It has been noted to occur in 13.5% of neonates with omphalitis.<sup>8</sup> The condition starts initially as periumbilical cellulitis, which, without treatment, progresses rapidly to necrosis of the skin and subcutaneous tissue (Figures 20.2 and 20.3), and in some instances,



Figure 20.2: Periumbilical cellulitis with early necrosis of scrotal skin.



Figure 20.3: Early necrotising fasciitis beginning at the umbilicus.



Figure 20.4: Advanced necrotising fasciitis involving upper abdominal and lower chest wall.

myonecrosis. The scrotum is the most commonly affected by NF,<sup>7</sup> but the abdominal wall may also be involved (Figure 20.4). If treated early, peri-umbilical cellulitis can be controlled by use of parenteral broad-spectrum antibiotics. The antibiotic regime should always include an antianaerobe (e.g., metronidazole).

NF should be treated by prompt debridement, removing all dead and dying tissues, followed by daily dressing of the wound. If the baby is too ill for a general anaesthetic, the debridement can be performed by the bedside (using parenteral paracetamol or rectal paracetamol for analgesia). The resulting wound will later require secondary closure (or skin grafting if the defect is large). However, scrotal wounds may heal well without secondary closure or skin grafting.<sup>13</sup>

### Evisceration

Intestinal evisceration is another frequently reported serious complication (Figure 20.5).<sup>7</sup> The eviscerated intestine is usually loops of small intestine, but large intestine may be involved. Rarely, presentation may be late, and the eviscerated intestine may be gangrenous.<sup>7</sup>

The eviscerated intestine should be covered by clean moist gauze, and placed in an intestinal bag (a transparent plastic bag will do if there is no intestinal bag available). Care should be taken to ensure that the intestine is not twisted.

Under general anaesthetic, the eviscerated intestine is cleaned and returned to the peritoneal cavity and the umbilicus repaired. If the umbilical defect is narrow, it may require extension in the transverse plane. In the presence of features of peritonitis or intestinal gangrene, a formal laparotomy needs to be done to drain any abscesses and clean the peritoneal cavity. Gangrenous intestine needs to be resected and intestinal continuity restored.



Figure 20.5: Intestinal evisceration from omphalitis.

### Peritonitis

Peritonitis may occur with or without intraperitoneal abscess collection. In the absence of an abscess, the infection could resolve with use of broad-spectrum intravenous antibiotics alone, and surgery is usually not required.

If an intraperitoneal abscess is confirmed by ultrasound, or there is no facility for ultrasonography, then laparotomy is required. Any abscess is drained and the peritoneal cavity thoroughly cleaned.

### Abscesses

Abscesses may develop at various sites, but are frequently intraabdominal. Intraperitoneal abscess is drained at laparotomy. Retroperitoneal abscess<sup>14</sup> is best drained by an extraperitoneal approach, but if located anteriorly in the retroperitoneal, an intraperitoneal approach may be required. Hepatic abscess should be properly localised by ultrasonography or CT scan. The abscess is aspirated by a wide-bore needle under imaging guidance, and the abscess cavity is irrigated with normal saline. This can be repeated once more if it recollects. In difficult cases, or in recurrence after needle aspiration, open drainage may be required. If the abscess is multiple, parenteral antibiotics alone may suffice, and aspiration/drainage reserved for persistent cases. Abscesses may be located in the anterior abdominal wall or in other superficial locations. These would require drainage.

### Late Complications

Late complications occur several weeks, months, or years after omphalitis in the neonatal period.

### Portal Vein Thrombosis

Portal vein thrombosis (PVT) is a complication with serious consequences. Although an early complication, the major consequences produced are in the long term. In one report of 200 patients undergoing portosystemic shunt for portal hypertension due to PVT,<sup>15</sup> 15% of the PVT was suspected to be the result of neonatal omphalitis. The thrombosis may produce a cavernoma, which can cause biliary obstruction.<sup>16</sup>

A portosystemic shunt may be required if portal hypertension develops.<sup>15</sup> Biliary obstruction is treated on its merit.

### Umbilical Hernia

Umbilical hernia is a common problem in children in Africa, and several are the result of weakening of the umbilical cicatrix from neonatal omphalitis. The management of these hernias is discussed in Chapter 57.

### Peritoneal Adhesions

Peritoneal adhesions are the result of previous subclinical or treated peritonitis from omphalitis. The adhesions may produce intestinal

obstruction, which usually is not amenable to nonoperative measures. Laparotomy and lysis/excision of the adhesions are usually required. Any ischaemic intestinal segment needs to be resected.

### Prognosis and Outcome

Promptly treated uncomplicated omphalitis usually resolves without serious morbidity. However, when presentation and treatment are delayed, mortality could be high, reaching 7–15%.<sup>1,7,13,17</sup>

Serious morbidity and mortality may occur from complications such as NF, peritonitis, and evisceration.<sup>6</sup> Portal vein thrombosis may be fatal.<sup>18</sup> Mortality may reach 38–87% following NF and myonecrosis.<sup>1,19,20</sup> Also, certain risk factors such as prematurity, small size for gestational age, male sex, and septic delivery are associated with poor prognosis.

### Prevention

The incidence of omphalitis is low in well-resourced countries and for those born in hospital. For these, there is probably little benefit of prophylactic measures to reduce the incidence. In developing countries, and especially after home birth, however, the incidence is high enough to consider prophylaxis to prevent the morbidity and mortality associated with late presentation of the disease. Access to proper maternity and delivery services helps reduce the incidence.

Teaching safe cord-care practice to mothers as well as using traditional birth attendants and primary-care workers are of utmost importance in the prevention of omphalitis in Africa. Vigilance is also important to identify major complications and refer patients early for prompt intervention. In most African hospital settings, methylated spirit and gentian violet are commonly used for cord care. In other parts of the world, betadine, bacitracin, silver sulfadiazine, or triple dye is recommended. Currently, not using any medicinal washes on the cord but just simply allowing the cord to dry and fall off is being advocated in developed parts of the world. There is little data to support any one cord care or lack thereof over the other.

In one report, a simple clean delivery kit produced by the United Nations Population Fund (UNFPA) was found to reduce cord infections.<sup>1</sup> Babies of mothers who did not use the kit were 13 times more likely to develop cord infection than babies of mothers who used the kit. The same report also noted that babies of mothers who did not bathe before delivery were 3.9 times more likely to develop cord infection than babies of mothers who bathed.

## Evidence-Based Research

Table 20.1 presents an overview of an evidence-based study on early antisepsis with chlorhexidine.

Table 20.1: Evidence-based research.

<b>Title</b>	Topical applications of chlorhexidine to the umbilical cord for prevention of omphalitis and neonatal mortality in southern Nepal: a community-based, cluster-randomised trial
<b>Authors</b>	Mullany LC, Darmstadt GL, Khatry SK, Katz J, LeClerq SC, Shrestha S, Adhikari R, Tielsch JM
<b>Institution</b>	Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA
<b>Reference</b> <sup>21</sup>	Lancet 2006; 367(9514):910–918
<b>Problem</b>	Omphalitis contributes to neonatal morbidity and mortality in developing countries. Umbilical cord cleansing with antiseptics might reduce infection and mortality risk, but has not been rigorously investigated.
<b>Intervention</b>	In this community-based, cluster-randomised trial, 413 communities in Sarlahi, Nepal, were randomly assigned to one of three cord-care regimens: 4,934 infants were assigned to 4.0% chlorhexidine, 5,107 to cleansing with soap and water, and 5,082 to dry cord care.
<b>Comparison/control (quality of evidence)</b>	Cluster-randomised control study
<b>Outcome/effect</b>	The frequency of omphalitis was reduced significantly in the chlorhexidine group. Severe omphalitis in chlorhexidine clusters was reduced by 75% (incidence rate ratio, 0.25, 95% CI 0.12-0.53; 13 infections/4839 neonatal periods) compared with dry cord-care clusters (52/4930). Neonatal mortality was 24% lower in the chlorhexidine group (relative risk, 0.76 [95% CI 0.55-1.04]) than in the dry cord-care group. Within the first 24 hours, mortality was significantly reduced by 34% in the chlorhexidine group (0.66 [0.46-0.95])
<b>Historical significance/comments</b>	Early antisepsis with chlorhexidine of the umbilical cord reduces local cord infections and overall neonatal mortality

### Key Summary Points

1. Omphalitis is a common problem in resource-limited settings and is related to unhygienic cord practices.
2. Although a simple infection, life-threatening complications may occur if presentation and treatment are delayed.
3. Prompt recognition of complications and treatment is necessary to avoid morbidity and mortality.
4. Omphalitis is easily preventable by clean and safe delivery and cord-care practices.

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