

## Red and Swollen Umbilical Region

Akash Kumar, MD, PhD,\* Anna-Kaisa Niemi, MD, PhD,\* Chad M. Thorson, MD, MSPH,<sup>†</sup> Jonathan P. Palma, MD, MS\*

Departments of \*Pediatrics and <sup>†</sup>Surgery, Stanford University, Palo Alto, CA

### THE CASE

At 18 days of age, a male infant born at term presents with redness and swelling surrounding the umbilicus (Fig 1).



Figure 1. Abdomen at admission.

### PRENATAL AND BIRTH HISTORIES

- Born to a 22-year-old, gravida 2, para 2 woman in good health
- Benign prenatal maternal screens including rubella immune, rapid plasma reagin negative, human immunodeficiency virus negative, group B *Streptococcus* negative
- Benign prenatal course with normal fetal survey
- 8 days before delivery fetal ultrasonography revealed an amniotic fluid index of 1.5 with possible rupture of membranes
- Infant born via cesarean delivery because of nonreassuring fetal heart tones in the setting of persistent oligohydramnios; there were no signs of chorioamnionitis
- Estimated gestational age: 39 weeks and 2 days
- Birthweight: 3.04 kg (26th percentile)
- Apgar score: 9 at 1 minute of age, 9 at 5 minutes of age
- Infant was discharged from the hospital on the 4<sup>th</sup> postnatal day

**AUTHOR DISCLOSURE** Drs Kumar, Niemi, Thorson, and Palma have disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

## PRESENTATION

At 13 days of age, the infant had spontaneous separation of the umbilical stump following routine dry umbilical cord care. At 17 days of age, the infant's mother noted redness around the umbilicus, which progressed rapidly throughout the day. His mother also noted scant yellow drainage from the umbilicus. She brought him to the emergency department at 18 days of age. At that time, he was afebrile, breastfeeding well, and acting appropriately, with normal voiding and stooling patterns.

### Vital Signs

- Heart rate: 168 beats/min
- Respiratory rate: 30 breaths/min
- Temperature: 97.9°F (36.6°C)
- Oxygen saturation: 97% in room air

### Physical Examination

- Head: Normocephalic; normal, open, flat fontanelles; symmetric facies; patent nares
- Oral cavity: Pink mucosae; intact palate; scattered, white 2- to 3-mm papules on anterior surface of gingiva
- Abdomen: Approximately 7×7-cm tender area of erythema and swelling around the umbilicus with scant yellow drainage from the umbilicus; positive bowel sounds; mildly distended but soft abdomen
- Cardiovascular: Normoactive precordium; regular rate and rhythm; no murmur, rub, or gallop
- Genitourinary: Normal male genitalia, testes descended bilaterally
- Skeletal: Spine normal appearing
- Skin: No icterus or rash, slate gray patch above gluteal cleft; vernix smeared in skin creases of legs
- Neurologic: Normal strength, tone, suck reflex, and palmar/plantar grasp age appropriate

### Laboratory Studies

- White blood cell count: 15,100/ $\mu\text{L}$  ( $15.1 \times 10^9/\text{L}$ ) with 56% neutrophils, 30% lymphocytes
- Platelet count:  $553 \times 10^3/\mu\text{L}$  ( $553 \times 10^9/\text{L}$ )
- Chemistry
  - Sodium: 134 mEq/L (134 mmol/L)
  - Potassium: 5.8 mEq/L (5.8 mmol/L)
  - Chloride: 97 mEq/L (97 mmol/L)
  - Bicarbonate: 23 mEq/L (23 mmol/L)
  - Glucose: 116 mg/dL (6.4 mmol/L)
  - Blood urea nitrogen: 4 mg/dL (7.8 mmol/L)
  - Creatinine: 0.21 mg/dL (18.5  $\mu\text{mol/L}$ )
- Transaminases
  - Alanine aminotransferase: 6 U/L
  - Aspartate aminotransferase: 31 U/L
- Alkaline phosphatase: 289 U/L
- Total bilirubin: 1.25 mg/dL (21  $\mu\text{mol/L}$ )
- C-reactive protein: 7.7 mg/dL (reference range, < 0.9 mg/dL)

A neonatologist was consulted and further testing was performed.

## PROGRESSION

In the emergency department, the infant was noted to have tachycardia, prompting the team to administer a normal saline bolus. The team then consulted with the neonatologist. Although the infant appeared well, the neonatologist recommended further evaluation and management. Cultures were performed on peripheral blood samples and drainage from the umbilical cord. The infant was given intravenous vancomycin and gentamicin before being transferred to the NICU in stable condition. The infant then underwent complete abdominal ultrasonography (Fig 2).

## DIFFERENTIAL DIAGNOSIS

For this term infant with redness and swelling of umbilical cord, the differential diagnosis included:

- Allergic reaction
- Cellulitis
- Neutrophil function defects (if delayed umbilical cord separation)
- Omphalitis
- Omphalomesenteric duct remnant (patent omphalomesenteric duct, sinus tract)
- Umbilical granuloma
- Urachal remnant (patent urachus, urachal sinus, infected urachal cyst)

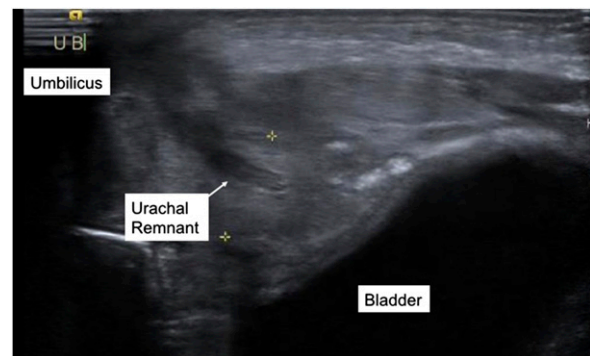


Figure 2. Ultrasonographic scan of abdomen reveals tract from bladder to umbilicus (ie, urachal remnant).

## ACTUAL DIAGNOSIS

Omphalitis with urachal remnant

## MANAGEMENT

Ultrasonography of this infant's abdomen showed soft tissue swelling consistent with omphalitis as well as a thickened communicating tract from the bladder to the umbilicus. Culture of the umbilical cord drainage grew methicillin-sensitive *Staphylococcus aureus* (blood cultures remained negative) and antibiotics were narrowed to intravenous cefazolin after broad antibiotic treatment for 3 days. The infant's C-reactive protein decreased with time. He continued to remain well appearing, afebrile, and tolerated oral feedings. By the 10<sup>th</sup> day of antibiotic treatment, the redness and swelling surrounding his umbilicus had resolved (Fig 3).

## WHAT THE EXPERTS SAY

Omphalitis is an infection and inflammation of the umbilical cord stump that is characterized by erythema, swelling, and tenderness of the periumbilical region, with severity ranging from isolated discharge from the umbilical cord to subcutaneous and peritoneal inflammation. (1)(2) Although improvements in cord care techniques have made this condition rare in hospitalized newborns in developed countries, the incidence is much greater worldwide, approaching 20% in some developing countries. (3) Risk factors for omphalitis include poor umbilical cord care, protracted labor, and prolonged rupture of membranes, as well as anatomic abnormalities involving umbilical remnants



Figure 3. Abdomen after antibiotic treatment for 10 days.

(eg, patent urachus). (1) Causative organisms include *S aureus* and *Streptococcus* species, as well as gram-negative rods including *Escherichia coli*. (4) Infections can spread locally to the skin and abdominal wall, or can track through the umbilical and portal vessels to the liver and bladder. Complications of such infections can be life threatening. Necrotizing fasciitis is a rare complication that results from pathogens tracking along fascial planes, which can rapidly lead to tissue necrosis and sepsis. Infection of the urachal remnant that connects the umbilicus to the bladder can create an abscess that requires drainage. An infection of portal vessels can result in thrombosis with subsequent liver failure. (4)

Evaluation of an infant with erythema and swelling of the umbilicus requires a thorough physical examination and immediate imaging studies. Rare inherited neutrophil function deficiencies such as leukocyte adhesion defects should be considered if cord separation is delayed with concomitant neutrophilia. (5) The umbilical cord of the infant described in this case separated at 13 days (slightly late but within the normal timeframe). After establishing omphalitis as a likely diagnosis, evaluation for potential complications involving the liver, bladder, and peritoneum is important. Early ultrasonography of the abdomen in this patient helped to rule out an intra-abdominal abscess and necrotizing fasciitis that would have required surgical drainage.

Abdominal ultrasonography also identified an abnormal connection between the umbilicus and bladder in this patient. Abnormalities can derive from the urachus, an embryologic structure between the umbilicus and bladder that is typically obliterated before birth and results in 1 of the following 4 anomalies: patent urachus, urachal cyst, urachal sinus, and urachal diverticulum. A patent urachus may present with urine draining from the umbilicus. Incomplete obliteration of the urachus would result in an isolated urachal cyst containing epithelial cells or urachal sinus that communicates with the umbilicus, which could serve as a nidus of infection. (6) Although a urachal remnant was identified in this patient, its type could not be determined, nor could it be confirmed whether it was responsible for the infection in this patient. A skin infection is likely, given the type of organism isolated and the signs of inadequate hygiene with persistent vernix noted in the infant's skin creases. The source of infection did not influence the immediate treatment, because broad-spectrum antibiotics would be indicated initially, regardless of the anatomic abnormality. This patient will require follow-up abdominal ultrasonography after treatment to clarify the diagnosis and ensure no anatomic abnormalities predisposing to infection remain. It is likely that the inflammatory process, healing, and subsequent scar formation will close off this tract, obviating the need for further intervention. (7)

Omphalitis is a potentially fatal infection of newborns; timely diagnosis, evaluation for complications, and administration of antimicrobial therapy can be lifesaving.

### Acknowledgments

We thank J.L. Aby and J. Santoro for helpful discussions.

## American Board of Pediatrics Neonatal-Perinatal Content Specifications

- Know the clinical and laboratory features, treatment, and complications of neonatal omphalitis.
- Know how to evaluate and manage disorders of the umbilical cord, including granulomas, persistent omphalomesenteric duct remnant, and patent urachus.

## References

1. Ameh E, Beckler S, Lakhoo K, et al. *Paediatric Surgery: A Comprehensive Text For Africa*. Seattle, WA: Global HELP; 2010
2. Aby J. *The Newborn Book: Significance of Physical Findings in the Neonate*. Colorado Springs, CO: Book Villages; 2014:443–446
3. Mir F, Tikmani SS, Shakoore S, et al. Incidence and etiology of omphalitis in Pakistan: a community-based cohort study. *J Infect Dev Ctries*. 2011;5(12):828–833
4. Fraser N, Davies BW, Cusack J. Neonatal omphalitis: a review of its serious complications. *Acta Paediatr*. 2006;95(5):519–522
5. van de Vijver E, van den Berg TK, Kuijpers TW. Leukocyte adhesion deficiencies. *Hematol Oncol Clin North Am*. 2013;27(1):101–116, viii [viii.]
6. Mesrobian HG, Zacharias A, Balcom AH, Cohen RD. Ten years of experience with isolated urachal anomalies in children. *J Urol*. 1997;158(3 pt 2):1316–1318
7. Lipskar AM, Glick RD, Rosen NG, et al. Nonoperative management of symptomatic urachal anomalies. *J Pediatr Surg*. 2010;45(5):1016–1019

### ANSWER KEY FOR MAY 2018 NEOREVIEWS

Corneal Opacities in the Neonate: 1. C; 2. A; 3. D; 4. E; 5. C.  
Mandibular Distraction for Micrognathia: 1. B; 2. D; 3. A; 4. C; 5. C.

## Red and Swollen Umbilical Region

Akash Kumar, Anna-Kaisa Niemi, Chad M. Thorson and Jonathan P. Palma

*NeoReviews* 2018;19:e308

DOI: 10.1542/neo.19-5-e308

<b>Updated Information &amp; Services</b>	including high resolution figures, can be found at: <a href="http://neoreviews.aappublications.org/content/19/5/e308">http://neoreviews.aappublications.org/content/19/5/e308</a>
<b>References</b>	This article cites 5 articles, 0 of which you can access for free at: <a href="http://neoreviews.aappublications.org/content/19/5/e308#BIBL">http://neoreviews.aappublications.org/content/19/5/e308#BIBL</a>
<b>Subspecialty Collections</b>	This article, along with others on similar topics, appears in the following collection(s): <b>Pediatric Drug Labeling Update</b> <a href="http://classic.neoreviews.aappublications.org/cgi/collection/pediatric_drug_labeling_update">http://classic.neoreviews.aappublications.org/cgi/collection/pediatric_drug_labeling_update</a>
<b>Permissions &amp; Licensing</b>	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: <a href="http://classic.neoreviews.aappublications.org/site/misc/Permissions.xhtml">http://classic.neoreviews.aappublications.org/site/misc/Permissions.xhtml</a>
<b>Reprints</b>	Information about ordering reprints can be found online: <a href="http://classic.neoreviews.aappublications.org/site/misc/reprints.xhtml">http://classic.neoreviews.aappublications.org/site/misc/reprints.xhtml</a>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



# NeoReviews™

AN OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF THE PEDIATRICS

## **Red and Swollen Umbilical Region**

Akash Kumar, Anna-Kaisa Niemi, Chad M. Thorson and Jonathan P. Palma

*NeoReviews* 2018;19:e308

DOI: 10.1542/neo.19-5-e308

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://neoreviews.aappublications.org/content/19/5/e308>

Neoreviews is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since . Neoreviews is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2018 by the American Academy of Pediatrics. All rights reserved. Online ISSN: 1526-9906.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

