Neonate Receiving Mechanical Ventilation with Continuous Bubbling Coming Through the Orogastric Tube

Kumar Ankur, MD, DNB,* Aparna Prasad, DNB,* Prashant Jain, MS, MCH,† Ankit Parakh, MD, DNB,‡ Ashish Prasad, DNB,† Sanjeev Chetry, MD, DNB*

*Departments of *Neonatology, †Pediatric Surgery, and ‡Pediatric Pulmonology, BLK Superspeciality Hospital, New Delhi, India*

[AQ1]

A male infant with a birthweight of 2,510 g (3% to 10%) is born at 38 weeks' gestation to a 29-year-old gravida 3, para 1 asymptomatic coronavirus disease 2019 (COVID-19)–positive woman without any sepsis risk factors. At 2 days of age, the neonate has cyanotic episodes during breastfeeding, which improve with spontaneous crying. The neonatology team evaluates the infant and is unable to pass a feeding tube through either naris but is able to easily pass an orogastric tube. The infant's physical examination findings are otherwise normal. Over the next 24 hours, he develops severe respiratory distress that does not improve with noninvasive ventilation and leads to abdominal distention. The infant then requires invasive ventilation; the postintubation chest radiograph is shown in the Fig.

Question 1. What is the most likely cause of this neonate's respiratory distress?

A. Perinatal COVID pneumonia
B. Bilateral choanal atresia
C. Early-onset sepsis with congenital pneumonia
D. Tracheoesophageal fistula
E. Gastroesophageal reflux disease

Question 2. Based on the infant's clinical and radiographic findings as well as the data gathered from Video 1, the infant most likely has: F1

A. Esophageal atresia with distal tracheoesophageal fistula
B. Esophageal atresia with proximal tracheoesophageal fistula
C. Esophageal perforation
D. H-type tracheoesophageal fistula
E. Tracheal perforation

DISCUSSION

After reviewing this infant's clinical course, the chest radiography findings of unilateral (right-sided) homogenous diffuse atelectasis, and the video showing the neonate receiving mechanical ventilation with bubbling from the orogastric tube, various potential diagnoses are discussed below.

Perinatal COVID Pneumonia

Given that the neonate's mother is positive for COVID-19, the onset of respiratory symptoms in the neonate soon after birth could potentially be the result of vertical transmission of COVID-19. However, the possibility of vertical transmission of COVID-19 has been reported rarely, and in these case reports, affected neonates did not present with pneumonia. (1)(2) Not surprisingly, a nasopharyngeal reverse

AUTHOR DISCLOSURE Drs Ankur, Prasad, Jain, Parakh, Prasad, and Chetry 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.

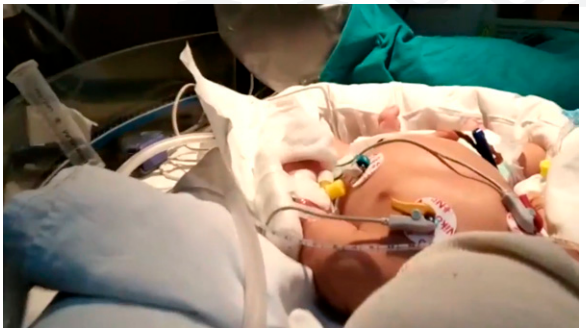


Figure. Chest radiograph showing unilateral (right-sided) homogenous diffuse atelectasis with loss of lung volume.

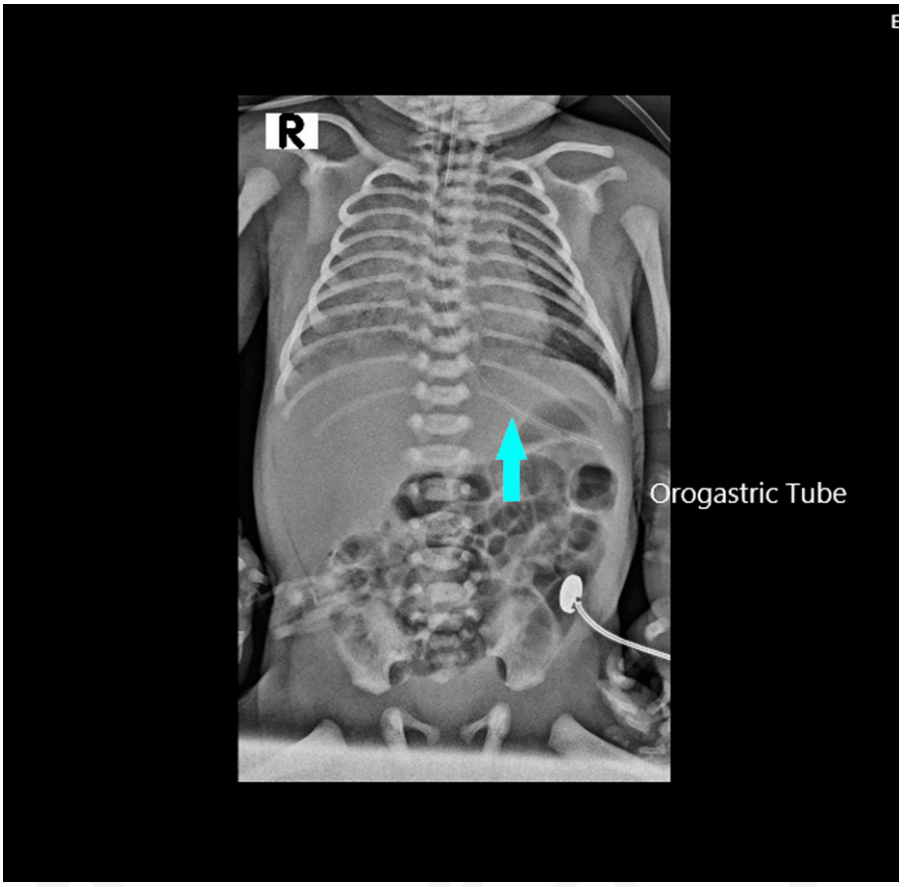
transcriptase polymerase chain reaction COVID-19 test performed at 36 hours of age showed negative results.

Bilateral Choanal Atresia

As described before, the feeding tube (size 6F catheter) could not be passed through either of the infant's nares and the infant had cyanosis during feeding, which improved with crying, suggesting the possibility of bilateral choanal atresia. (3) However, neonates with bilateral choanal atresia also typically have upper airway obstruction and noisy breathing. To rule out bichoanal atresia, computed tomography of the head and nose was performed, which revealed no bony narrowing of the posterior nostril area. However, there was mucosal edema of both nostrils, probably because of repeated attempts to pass the feeding tube.

Early-onset Sepsis with Congenital Pneumonia

Early-onset sepsis with pneumonia is generally defined as onset within 48 hours up to the first week of age, occurring either because of aspiration of infected amniotic fluid or transplacental transmission of pathogens. However, this case had no sepsis risk factors (ie, prolonged rupture of the membranes, features of clinical chorioamnionitis, preterm delivery, intrapartum fever). (4) Generally, patients with congenital pneumonia have radiographic findings such as bilateral infiltrative findings, which were not found in this neonate.



Video 1. Patient on ventilator showing continuous bubbling through orogastric tube.

Tracheoesophageal Fistula

Tracheoesophageal fistula (TEF) is an anomaly of the airway, with a prevalence of 1 in 4,500 births. The clinical presentation of TEF depends on the presence or absence of esophageal atresia (EA). Infants with an EA are symptomatic immediately after birth, with excessive secretions that cause drooling, choking, respiratory distress, and the inability to feed. The most common type of TEF consists of an EA with a distal fistula, which is associated with air in the bowel; in contrast, an EA with a proximal fistula is associated with lack of gas in the intestinal tract. An H-type TEF is a rare variant that accounts for approximately 4% of all cases of congenital esophageal anomaly. Patients with a large H-type TEF may present early with coughing, choking, and/or cyanosis associated with feeding as milk is aspirated through the fistula. However, smaller defects of this type of TEF may not be symptomatic in the newborn period and diagnosis can be delayed from a few days to years. (5) Patients with an H-type TEF can present with recurrent pneumonias.

In the case described here, unilateral homogenous diffuse atelectasis was noted, which could be consistent with aspiration pneumonia (Fig). However, we suspected an H-type TEF only after intubation, because of the continuous large leak shown on the ventilator-measured parameters (leak=79%, range 79%–90%) despite an adequately sized endotracheal tube. In addition, the finding of continuous bubbling coming through the orogastric tube was consistent with an H-type TEF (Video 1). Because the orogastric tube was passed through to the stomach, this patient could not have an EA with either a distal or proximal TEF. The clinical findings were also not consistent with a perforation of either the esophagus or trachea because chest radiography revealed the tip of the feeding tube in the infant's stomach and there was no evidence of air leak in the chest or abdomen.

To confirm the diagnosis of an H-type TEF, flexible bronchoscopy was undertaken through the 3.5F endotracheal tube using a 2.8-mm videobronchoscope. The bronchoscope was placed in the lower end of the trachea and slowly the endotracheal tube was withdrawn with the bronchoscope. The posterior wall of the trachea (6 rings from the carina) in the middle third shows a large opening (Video 2) F2 through which the bronchoscope could be negotiated into the esophagus and the feeding tube was seen.

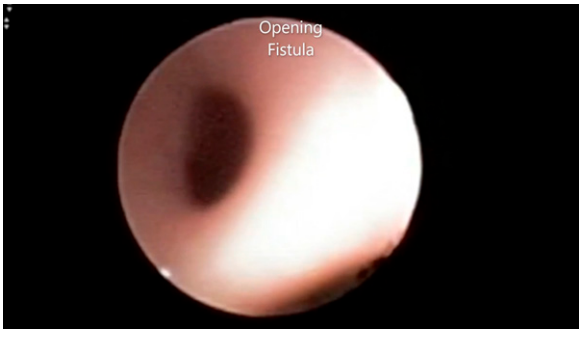
Laryngeal Cleft

Laryngeal clefts occur in approximately 1 in 10,000 to 20,000 live births. (6) During organogenesis, the trachea and esophagus develop from a single embryonic structure and are later separated completely by a tracheoesophageal septum. Partial separation of the septum might eventuate in congenital conditions such as laryngeal cleft and a TEF with EA. The smallest clefts may involve only the interarytenoid region, whereas more extensively arrested development of the tracheoesophageal septum can result in a large laryngotracheoesophageal cleft that extends to the carina.

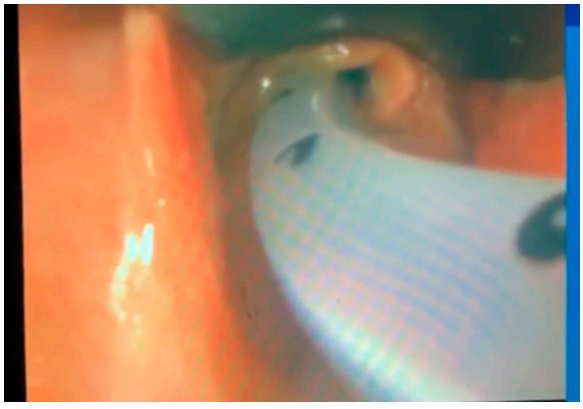
In this case, because of the continuous bubbling coming through the orogastric tube, direct video laryngoscopy was also performed, which did not demonstrate a laryngeal cleft (Video 3). Because of the restricted visibility of the posterior F3 glottic space on flexible laryngoscopy, microlaryngoscopy (not available in our unit) is the gold standard for diagnosing largyngeal cleft.

Gastroesophageal Reflux Disease

Symptoms associated with gastroesophageal reflux disease (GERD) in a neonate consist of irritability, nonspecific discomfort such as posturing or grimacing, frequent vomiting, and failure to thrive. (7) This neonate's chest radiograph (Fig), which was obtained after intubation, showed right-



Video 2. Bronchoscopy. The posterior wall of the trachea (6 rings from the carina) in the middle third shows a large opening (fistula) through which the bronchoscope could be negotiated into the esophagus and the feeding tube visible.



Video 3. Video laryngoscopy showing intact arytenoid cartilage without any cleft.

sided diffuse atelectasis with loss of lung volume that might be consistent with aspiration pneumonia associated with GERD. However, he did not have any episodes of emesis. In addition, GERD causing severe pneumonia during the first week of age is very unlikely. (8)

Correct Answer

Question 1: D—Tracheoesophageal fistula
Question 2: D—H-type tracheoesophageal fistula

American Board of Pediatrics Neonatal-Perinatal Content Specifications

- Recognize the clinical, laboratory, and imaging features of air leaks.
- Plan appropriate diagnostic evaluation and management for an infant with airway obstruction.

References

1 .Zaigham M, Andersson O. Maternal, and perinatal outcomes with COVID-19: A systematic review of 108 pregnancies. *Acta Obstet Gynecol Scand*. 2020;99(7):823–829

1. Kalamdani P, Kalathingal T, Manerkar S, Mondkar J. Clinical profile of SARS-CoV-2 infected neonates from a tertiary government hospital in Mumbai, India [published online ahead of print October 12, 2020]. *Indian Pediatr*. 2020;S097475591600250

3. Myer CM 3rd, Cotton RT. Nasal obstruction in the pediatric patient. *Pediatrics*. 1983;72(6):766–777

4. Spaans WA, Knox AJ, Koya HB, Mantell CD. Risk factors for neonatal infection. *Aust N Z J Obstet Gynaecol*. 1990;30(4):327–330.

5. Cassina M, Ruol M, Pertile R, et al. Prevalence, characteristics, and survival of children with esophageal atresia: a 32-year population-based study including 1,417,724 consecutive newborns. *Birth Defects Res A Clin Mol Teratol*. 2016;106(7):542–548

6. Johnston DR, Watters K, Ferrari LR, Rahbar R. Laryngeal cleft: evaluation and management. *Int J Pediatr Otorhinolaryngol*. 2014;78(6):905–911

7. Eichenwald EC; Committee on Fetus and Newborn, American Academy of Pediatrics. Diagnosis and management of gastroesophageal reflux in preterm infants. *Pediatrics*. 2018;142(1):e20181061

8. Leung AK, Hon KL. Gastroesophageal reflux in children: an updated review. *Drugs Context*. 2019;8:212591

QUERIES -NEO112020VidCorn00189q

[AQ1]: Please confirm all author names, degrees, affiliations, and disclosures are accurate for the time of authorship.