DOI: 10.38103/jcmhch.86.3

Case report

# SEVERE CROUP IN CHILDREN INFECTED WITH SARS-COV-2

Ho Dang Quan[1], Dang Thi Thu Hang[2], Nguyen Huu Tho[1]
[1]Pediatric Center, Hue Central Hospital
[2]Pediatric Department, Hue University of Medicine and Pharmacy

**Received:**
27/11/2022
**Revised:**
18/3/2023
**Accepted:**
25/3/2023
**Corresponding author:**
Ho Dang Quan
Email: dangquan.1993@gmail.com
Phone: 0988782376

**ABSTRACT**

*Croup (laryngotracheitis) is frequently encountered in the emergency department among young children presenting with stridor. We described two previous healthy children who were admitted to our emergency department (ED) as the first documented cases of severe croup as a manifestation of SARS-CoV-2 infection in our hospital. Both cases (9 months and 8 months) presented with non - specific upper respiratory tract symptoms that developed into a barky cough with associated stridor at rest and respiratory distress. All were diagnosed with SARS-CoV-2 by antigen Rapid test from nasopharyngeal samples. Each received multiple doses of nebulized racemic epinephrine with minimal to no improvement shortly after medication. Both were admitted and received several doses of dexamethasone, which is an atypical treatment in our hospital due to the prolonged duration of symptoms in each patient. Antibiotics were used for both cases. All patients were eventually discharged. Pathogen testing is usually not indicated in croup, but with "COVID-19 croup," SARS-CoV-2 testing should be considered due to the prognostic significance and prolonged quarantine implications. Our limited experience with this newly described COVID-19 croup condition suggests that cases can present with significant pathology and might not improve as rapidly as those with typical croup.*

***Keywords:*** *COVID-19, Severe acute respiratory syndrome coronavirus 2, Croup, Pediatric, Emergency department, Stridor.*

## I. INTRODUCTION

Croup (laryngotracheitis) is a common childhood syndrome involving subglottic inflammation, which is associated with fever, a "barky cough," and stridor [1]. This viral illness usually occurs between 7 and 36 months of age [2], and is most often caused by human parainfluenza viruses, but it can also be associated with respiratory syncytial virus, rhinovirus, enterovirus, and other viruses [3]. It occurs predominantly in the late fall and early winter seasons, and patients usually have symptoms related to viral infections such as mild fever, runny nose, and diarrhea...

Meanwhile, the novel 2019 coronavirus (SARS-CoV-2) first appeared in Wuhan, China, and has since spread worldwide since the end of 2019. Most pediatric patients with confirmed cases are asymptomatic or present with mild upper respiratory symptoms [4], but a small percentage can progress to acute respiratory distress syndrome or multiorgan system dysfunction [5]. There is currently no evidence that SARS-CoV-2 causes croup in children although several clinical case reports have appeared scattered around the world [6 - 8].

The diagnosis of croup is based on clinical manifestations in most cases. On physical examination, patients have inspiratory stridor, which may occur at rest or only while crying, associated with a barky cough. Blood tests and imaging may be needed to differentiate it from other causes of stridor, such as acute epiglottitis, posterior pharyngeal abscess, or foreign object blocking the airway.

Neck AP X-ray shows narrowing of the subglottis or the steeple sign [9]. The severity of croup relates to the child's degree of respiratory status and work of breathing. Croup is a self - limiting illness that typically resolves in several days [10].

At the Pediatric Center, Hue Central Hospital, recently, we have received many cases of pediatric croup with evidence of SARS-CoV-2 infection. Most of them are mild and moderate. We report two cases of children with severe croup who were subsequently found to have SARS-CoV-2 infection.

**II. CASE REPORT**

**Case 1**

A 9 - month - old female childwas admitted to our center with a mild fever of 38 - 38.4$^{o}$C, cough, and runny nose. In the afternoon of the same day, she experienced more different breathing and appeared tired. The child had no previous history of stridor or other medical conditions.Upon arrival at the emergency department, she was irritable, had a mild fever, tachycardia of 170 bpm, a respiratory rate of 42 bpm, SpO2 92% measured by pulse oximeter on room air. Examination revealed that she had inspiratory stridor at rest with moderate retractions, barky cough, decreased aeration, no wheeze or crackles. She was diagnosed with severe acute croup, treated with racemic epinephrine and Pulmicort (Budesonide) nebulized via oxygen, ceftriaxone (a third - generation cephalosporin antibiotic), parenteral nutrition, antipyretic. A rapid antigen test for SARS-CoV-2 with a nasopharyngeal sample was positive. Her blood test results showed leukocytosis with WBC 16,96 K/µL (NEU 67,3%; LYM 14,8%); RBC 4,39 M/µL; Hgb 11,9 g/dL; PLT 216 K/µL; C-reactive protein was 7,52 mg/L (within normal range). A second nebulized racemic epinephrine (NRE) was given two hours after the first one due to persistent stridor and retractions. Subsequently, the third dose of NRE and intravenous dexamethasone (0.6 mg/kg) was administered after three hours. The patient gradually improved clinically without labored breathing, but still had mild stridor at rest. We stopped providing oxygen at the 10th hour and transferred the patient to the pediatric respiratory department. She received a second intravenous dose of dexamethasone 24 hours later. Pulmicort nebulizer was continued every 12 hours, and NRE was discontinued. She was discharged after 72 hours of hospitalization. At the discharge time, she had stridor with exertion only and had no exertion in breathing. Her general conditions were almost normal. In the follow-up, the patient was completely recovered without any complications.

**Case 2**

An 8 - month - old boy had a fever for two days (maximum temperature was 40°C) with a cough, and runny nose. The rapid antigen test for SARS-CoV-2 was positive. The next day, the child's fever decreased, but he developed noisy breathing, increased difficulty breathing, and reduced oral intake. At the emergency department, the child showed agitation, had 89% oxygen saturation on room air, was afebrile (37.5°C), had tachycardia of 150 bpm, respiratory rate of 44 bpm with deep subcostal andintercostal recessions, and audible biphasic stridor, decreased aeration, no rales, a normal cardiac exam. According to the mother, the child has no previous history of stridor or any underlying disease.

He was diagnosed with severe acute croup due to SARS-CoV-2. He received oxygen therapy, intravenous dexamethasone (0.6 mg/kg), nebulized racemic epinephrine (NRE), and ceftriaxone (a third - generation cephalosporin antibiotic) were administered. Neck X-rays revealed subglottic narrowing with no radiopaque foreign body or evidence of epiglottitis. Chest X-ray showed relatively normal findings.

Full blood counts showed hemoglobin was 11.4 g/dL, and there was no leukocytosis with the total white blood cell count was 9,72 K/mL (51,6% NEU and 36,8% LYM). Inflammatory markers were normal with C reactive protein (CRP) of 7,0 mg/L. The child did not have electrolyte and blood sugar disorders. The secondrapid antigen test for SARS-CoV-2 with a nasopharyngeal sample was positive.

The child did not respond to the first dose of NRE, so the second dose was provided 2 hours later, along with nebulized Pulmicort (Budesonide).

After the second dose of NRE, the child showed improvement, with reduced dyspnea, mild exertion, mild stridor at rest, and SpO2 of 98%. He had stridor at rest for 13 hours after the first dexamethasone,

oxygen therapy was stopped. The child continued to be treated at the Pediatric Respiratory Department with intravenous dexamethasone, and nebulized Pulmicort. Antibiotic was discontinued after laboratory and clinical results had shown no signs of infection. He was discharged at the 72nd hour after admission. On follow - up care, his mother reported improved symptoms gradually, and he was "fully recovered" from all symptoms one week after discharge.

**III. DISCUSSION**

Croup is a common disease in young children and is most commonly due to viral etiology [8, 11]. The diagnosis of croup is mostly clinical, and determining the etiology is rarely helpful [7]. A thorough physical examination and imaging can help rule out other potential causes, such as epiglottitis or retropharyngeal abscess.In most cases, viral croup is self - limiting and resolves within 3 to 7 days [7]. However, in rare cases, croup can cause significant airway obstruction, respiratory distress, and even death [12].

Our case report describes two children with croup who experienced severe respiratory distress and required ICU care. Both cases were found to be secondary to SARS-CoV-2 infection, as confirmed by positive rapid antigen tests. Regrettably, screening tests for other common childhood croup pathogens have not been performed in these cases. However, in this pandemic, identifying if the croup is associated with SARS-CoV2 infection assumes novel importance for counseling inpatient and outpatient families on quarantine and home isolation precautions. These cases suggest that COVID-19 croup may have more severe pathophysiology than previously described croup. Both patients in our report had stridor at rest which was relatively unresponsive to multiple NRE treatments. In addition, NRE reduces croup symptom scores by decreasing upper airway edema, a finding that might be commonly seen with COVID-19 pathophysiology [13, 14].

Dexamethasone is administered in cases of croup as it has been shown to improve symptoms, decreases hospital length of stay, and reduces return visit rates [15]. In our hospital's practice, multiple doses of dexamethasone are infrequently given and are reserved for atypical cases that do not respond to initial treatments [16]. Both of the cases in this report required a second dose of dexamethasone 24 hours later. Typically, symptoms of Croup improve within 0.5 to 4 hours of initial dexamethasone administration, and the time from initial dexamethasone to resolution of stridor at rest ranges from 13 to 21 hours [15, 17, 18]. In both cases, symptoms improved, exertion was reduced, stridor at rest stopped, and the use of oxygen was discontinued at 10 and 13 hours after admission. Antibiotics were prescribed for the possible secondary lower respiratory tract infection in both cases, but were discontinued after 24 - 48 hours when clinical results showed no signs of infection.

This report has some limitations, such as the diagnosis ofSARS-CoV-2 infection based only on rapid antigen testing without performing PCR test and the lack of specific teststo exclude the causative agent of children's croup. In addition, the diagnosis of acute croup is based on clinical symptoms and response to treatment without objective evidence such as laryngoscopy.

**IV. CONCLUSION**

Many cases of SARS-CoV-2 infection in children with laryngeal dyspnea have been admitted to the hospital, but most of the cases are mild - moderate. Our limited experience with this newly described COVID-19 croup suggests that cases can present with severe pathology and might not improve as rapidly with treatments as in typical croup patients. Testing for SARS-CoV-2 in pediatric croup assumes novel importance for prognostic and quarantine implications during this pandemic. Overall, further research is needed to better understand COVID-19 croup and develop optimal treatment strategies.

**REFERENCES**

1. Engorn B, Flerlage J, The Harriet lane handbook E-book. 2014: Elsevier Health Sciences.
2. Zoorob R, Sidani MA, Murray J. Croup: an overview. American Family Physician. 2011;83(9):1067-1073.
3. Peltola V, Heikkinen T, Ruuskanen O. Clinical courses of croup caused by influenza and parainfluenza viruses. The Pediatric infectious disease journal. 2002;21(1):76-78.
4. Hoang A, Chorath K, Moreira A, Evans M, Burmeister-Morton F, Burmeister F, et al. COVID-19 in 7780 pediatric patients: a systematic review. EClinicalMedicine.

2020;24100433.

5. Lu X, Zhang L, Du H, Zhang J, Li YY, Qu J, et al. SARS-CoV-2 infection in children. New England Journal of Medicine. 2020;382(17):1663-1665.
6. Oliver CM, Campbell M, Dulan O, Hamilton N, Birchall M. Appearance and management of COVID-19 laryngo-tracheitis: two case reports. F1000Research. 2020;9.
7. Pitstick CE, Rodriguez KM, Smith AC, Herman HK, Hays JF, Nash CB. A curious case of croup: laryngotracheitis caused by COVID-19. Pediatrics. 2021;147(1).
8. Venn AMR, Schmidt JM, Mullan PC. Pediatric croup with COVID-19. The American Journal of Emergency Medicine. 2021;43287.e1-287.e3.
9. Mills JL, Spackman TJ, Borns P, Mandell GA, Schwartz MW. The usefulness of lateral neck roentgenograms in laryngotracheobronchitis. American Journal of Diseases of Children. 1979;133(11):1140-1142.
10. Thompson M, Vodicka TA, Blair PS, Buckley DI, Heneghan C, Hay AD. Duration of symptoms of respiratory tract infections in children: systematic review. Bmj. 2013;347f7027.
11. A; M , LR. K. Viral croup. Pediatr Rev. 2001;22:5-12.
12. Cherry JD. Croup. New England Journal of Medicine. 2008;358(4):384-391.
13. Bjornson C, Russell K, Vandermeer B, Klassen TP, Johnson DW. Nebulized epinephrine for croup in children. Cochrane Database of Systematic Reviews. 2013(10).
14. Martines RB, Ritter JM, Matkovic E, Gary J, Bollweg BC, Bullock H, et al. Pathology and pathogenesis of SARS-CoV-2 associated with fatal coronavirus disease, United States. Emerging infectious diseases. 2020;26(9):2005.
15. Gates A, Gates M, Vandermeer B, Johnson C, Hartling L, Johnson DW, et al. Glucocorticoids for croup in children. Cochrane Database of Systematic Reviews. 2018(8).
16. Roked F, Atkinson M, Hartshorn S. G95(P) Best practice: one or two doses of dexamethasone for the treatment of croup? Archives of Disease in Childhood. 2015;100 (Suppl 3): A40-A41.
17. Dobrovoljac M, Geelhoed GC. How fast does oral dexamethasone work in mild to moderately severe croup? A randomized double-blinded clinical trial. Emergency Medicine Australasia. 2012;24(1):79-85.
18. Westley CR, Cotton EK, Brooks JG. Nebulized Racemic Epinephrine by IPPB for the Treatment of Croup: A Double-Blind Study. American Journal of Diseases of Children.