

Consider COVID-19 When a Child Presents with Severe Croup in Summer

Niloufar Bineshfar¹, Alireza Mirahmadi¹, Fereshteh Karbasian², Abdollah Karimi³, Saeed Sadr⁴

1. Student Research Committee, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
2. Department of Pediatrics Emergency, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
3. Pediatric Infections Research Center, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
4. Department of Pediatrics Pulmonary Diseases, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.



ABSTRACT

Introduction: Coronavirus disease-2019 (COVID-19) has rapidly disseminated worldwide. In children, the most prevalent manifestations of COVID-19 are fever, cough, and fatigue. **Methods:** Here, we describe a case of croup secondary to COVID-19 with a preexisting laryngomalacia who presented with fever, dyspnea, and severe cough. The patient had respiratory stridor and diffuse wheezing on lung auscultation. **Conclusion:** Although a certain association between COVID-19 and croup has yet to be proven; but as it showed, SARS-CoV-2, like other viruses, can be a leading cause of croup. Therefore, we suggest in children with croup and upper airway symptoms, SARS-CoV-2 infection be ruled out.

Keywords: COVID-19, SARS-CoV-2, Croup, Pediatrics

Recived Date: 16 April 2022
Revised Date: 23 July 2022
Accept Date: 17 August 2022
Published Date: 01 March 2023
Editor: SAA. Safavi-Naini (Conflict of interest: None)
Reviewers: S. Afaghi (Conflict of interest: None), S. Nourian (Conflict of interest: None), A. Zeinaddini (Conflict of interest: None), SAA. Safavi-Naini (Conflict of interest: None), F. Shojaeian (Conflict of interest: None)

*Correspondence to: Fereshteh Karbasian, Assistant Professor of Pediatrics, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Email address: Karbasian.md@sbmu.ac.ir

Cite as : Alireza Mirahmadi, Niloufar Bineshfar, Fereshteh Karbasian, Abdollah Karimi, Saeed Sadr. Consider COVID-19 when a child presents with severe croup in summer. Canon Journal of Medicine.2023 March; 4(1), 11-13.



INTRODUCTION

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) was initially discovered in China, in December 2019, and has afterward disseminated rapidly worldwide, infecting millions of people (1). In children, typically presented symptoms of the illness induced by this novel coronavirus, so called Coronavirus disease-2019 (COVID-19), are fever, cough, and fatigue (2, 3).

Croup is inflammation of the larynx and the upper airway resulting in upper airway obstruction. Children usually present with abrupt onset barking cough, stridor, hoarseness, and respiratory distress (4). Influenza A and B viruses are typical causes of croup. Other viruses causing croup are respiratory syncytial virus, rhinovirus, coronavirus, human metapneumovirus, and adenovirus (5). Here we describe a COVID-19 patient with preexisting laryngomalacia who reached our emergency department with croup.

MATERIAL AND METHODS

A 2-year-old girl presented to our emergency department with a sudden fever and dyspnea. Fever started 24 hours earlier and was later accompanied by severe dry cough, dyspnea, and diarrhea. Her past medical history was significant for laryngomalacia.

On physical examination, the patient was alert and non-toxic. She had tachypnea, fever, and respiratory stridor. Oxygen saturation was 98%. The lung examination revealed diffuse wheezing. Other examinations yielded normal results. Laboratory testing was significant for elevated Creatinine (1.08 mg/dl, normal=0.3-0.7) and C-reactive protein (28 mg/l, normal<6), but complete blood count (CBC) result was within the normal range. A sample was obtained from the nasopharynx, which tested positive for SARS-CoV-2. A chest X-ray was obtained. No pathology such as a steeple sign was found in the X-ray. Due to the COVID-19 pandemic regulations, a chest CT scan was performed on patients with respiratory signs and symptoms (Figure1).

Based on the clinical sign and symptoms, the patient was treated for croup. Oxygen was administrated via plastic tubing held by the parent within a few centimeters of the child's nose and mouth (blow-by oxygen). Intravenous dexamethasone 0.6 mg/kg, nebulized ipratropium and epinephrine were used to restrict airway obstruction. Considering the possible bacterial super- or co-infection (due to CT scans results), the patient received empirical antibiotic therapy with ceftriaxone and azithromycin. The patient showed an excellent response to treatment, and respiratory signs resolved. After controlling fever and re-hydration, the creatinine level decreased into the normal range.

DISCUSSION

“Croup” is a generic name for illnesses involving the upper airway, including larynx, trachea, and bronchi, such as laryngotracheitis, laryngotracheobronchitis, laryngotracheobronchopneumonitis, and spasmodic croup (recurrent croup). Croup ensued from viruses, is the most prevalent type of airway obstruction in the pediatric population aging from six months to six years old (6). Its symptoms usually start with a low-grade fever and coryza (like an upper respiratory tract infection) followed by a barking (croupy) cough, hoarseness, inspiratory stridor, wheezing, dyspnea, and varied degrees of respiratory distress such as nasal flaring and respiratory retractions (7, 8). Symptoms typically peak in one or two days and resolve within one week although it can become worse at

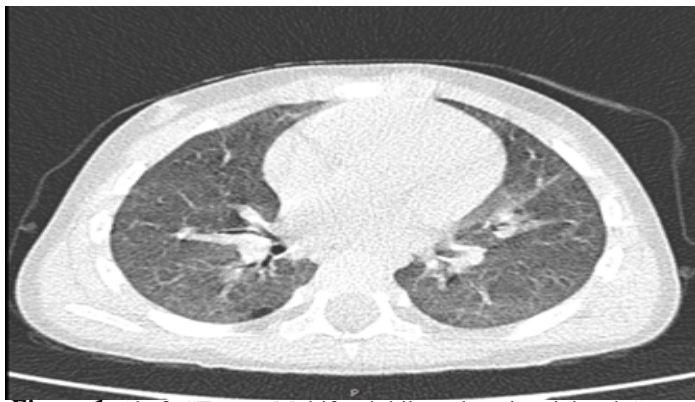


Figure 1. Chest CT scan. Multifocal, bilateral, and peripheral Ground glass (GGO), mainly in the lower lobes and less frequently in the middle lobe. Traction bronchiectasis is seen in the areas of ground glass. (Septal thickening, pleural thickening, subpleural involvement, pleural effusion, pericardial effusion, lymphadenopathy, cavitation, CT halo sign, and pneumothorax were not observed in our patient).

night or when a child is agitated (like crying) (4, 9).

Croup is most caused by viruses like parainfluenza virus (most common), influenza virus, respiratory syncytial virus, adenovirus, and rhinovirus, which can be detected in up to 80 percent of patients (8, 10, 11). Other causes are bacterial infections including diphtheria and *Mycoplasma pneumoniae* as well as allergic reactions and gastroesophageal refluxes in recurrent croup (12-14). Also, some studies have shown human coronavirus NL63 can cause croup in children (15, 16).

To date, there have been some reports on croup secondary to SARS-CoV-2; however, compared to previous studies, our patient had milder respiratory symptoms and didn't require endotracheal intubation (17-19). In one of these recent reports, the patient had developed multisystem inflammatory syndrome in children (MIS-C) after croup, and it was suggested that the emergence of croup secondary to SARS-CoV-2 could be interpreted as an indicator of MIS-C. (17).

We diagnosed croup in our patient based on clinical signs and radiological imaging. In the search for etiology, we found a positive COVID-19 polymerase chain reaction (PCR) test. Currently, there is evidence suggesting that SARS-CoV-2 penetrates cells in the lungs and respiratory tract through binding to the angiotensin convertase enzyme 2 (ACE2) receptors, and a study has also shown

that ACE2 is expressed a lot in these parts (20-22). COVID-19 associated croup might ensue from the direct cytopathic effect of local virus reproduction. Nevertheless, a definite association between COVID-19 and croup has not been shown yet; hence further research is required to assess any possible relation.

CONCLUSION

Although a certain association between COVID-19 and croup has yet to be proven; but as it was shown in ours and prior studies, SARS-CoV-2, like other viruses, can be a leading cause of croup. Therefore, we suggest that in children with croup and upper airway symptoms SARS-CoV-2 infection be ruled out. Management of covid patients with croup could be similar to other croup patients with more emphasis on anti-inflammatory drug administration.

ETHICAL CONSIDERATION

A written informed consent was obtained from the patient's guardians for participating in this study. All the personal information remained anonymous.

CONFLICT OF INTERESTS

Authors have no conflicts of interest to disclose.

ABBREVIATIONS

COVID-19; Coronavirus disease-2019, SARS-CoV-2; Severe acute respiratory syndrome coronavirus-2, CBC; complete blood count, MIS-C; multisystem inflammatory syndrome in children, ACE2; angiotensin convertase enzyme 2.

REFERENCES

1. Adil MT, Rahman R, Whitelaw D, Jain V, Al-Taani O, Rashid F, et al. SARS-CoV-2 and the pandemic of COVID-19. *Postgraduate Medical Journal*. 2021;97(1144):110.
2. Castagnoli R, Votto M, Licari A, Brambilla I, Bruno R, Perlini S, et al. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in Children and Adolescents: A Systematic Review. *JAMA pediatrics*. 2020.
3. 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;24.
4. Bjornson CL, Johnson DW. Croup. *Lancet*. 2008;371(9609):329-39.
5. Bjornson CL, Johnson DW. Croup in children. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne*. 2013;185(15):1317-23.
6. Knutson D, Aring A. Viral croup. *American family physician*. 2004;69(3):535-40.
7. Sobol SE, Zapata S. Epiglottitis and croup. *Otolaryngologic clinics of North America*. 2008;41(3):551-66, ix.
8. Malhotra A, Krilov LR. Viral croup. *Pediatrics in review*. 2001;22(1):5-12.
9. Klassen TP. Croup. A current perspective. *Pediatric clinics of North America*. 1999;46(6):1167-78.
10. Cherry JD. Clinical practice. Croup. *The New England journal of medicine*. 2008;358(4):384-91.
11. Miller EK, Gebretsadik T, Carroll KN, Dupont WD, Mohamed YA, Morin LL, et al. Viral etiologies of infant bronchiolitis, croup and upper respiratory illness during 4 consecutive years. *Pediatr Infect Dis J*. 2013;32(9):950-5.
12. Ottolini MG, Porter DD, Blanco JC, Prince GA. A cotton rat model of human parainfluenza 3 laryngotracheitis: virus growth, pathology, and therapy. *The Journal of infectious diseases*. 2002;186(12):1713-7.
13. Worrall G. Croup. *Canadian family physician Medecin de famille canadien*. 2008;54(4):573-4.
14. Hoa M, Kingsley EL, Coticchia JM. Correlating the clinical course of recurrent croup with endoscopic findings: a retrospective observational study. *The Annals of otology, rhinology, and laryngology*. 2008;117(6):464-9.
15. Florek D, Burmistrz M, Potempa J, Pyrc K. Stability of infectious hu-

- man coronavirus NL63. *Journal of virological methods*. 2014;205:87-90.
16. Hofmann H, Pyrc K, van der Hoek L, Geier M, Berkhout B, Pöhlmann S. Human coronavirus NL63 employs the severe acute respiratory syndrome coronavirus receptor for cellular entry. *Proceedings of the National Academy of Sciences of the United States of America*. 2005;102(22):7988-93.
 17. Lim CC, Saniasiaya J, Kulasegarah J. Croup and COVID-19 in a child: a case report and literature review. *BMJ Case Rep*. 2021;14(9).
 18. Park S, You J, Lee J, Park E. Two Case Reports of Life-Threatening Croup Caused by the SARS-CoV-2 Omicron BA.2 Variant in Pediatric Patients. *J Korean Med Sci*. 2022;37(24):e192.
 19. Venn AMR, Schmidt JM, Mullan PC. Pediatric croup with COVID-19. *Am J Emerg Med*. 2021;43:287.e1-e3.
 20. Li Y, Zhou W, Yang L, You R. Physiological and pathological regulation of ACE2, the SARS-CoV-2 receptor. *Pharmacological research*. 2020;157:104833.
 21. Zhao Y, Zhao Z, Wang Y, Zhou Y, Ma Y, Zuo W. Single-Cell RNA Expression Profiling of ACE2, the Receptor of SARS-CoV-2. *American journal of respiratory and critical care medicine*. 2020;202(5):756-9.
 22. Jia HP, Look DC, Shi L, Hickey M, Pewe L, Netland J, et al. ACE2 receptor expression and severe acute respiratory syndrome coronavirus infection depend on differentiation of human airway epithelia. *Journal of virology*. 2005;79(23):14614-21.

Author Contribution: A. M.: acquisition of data and writing the manuscript, N. B.: writing the manuscript, F. K.: conception, design, and revising the manuscript, A. K.: revising the manuscript, S. S.: revising the manuscript.

Funding statement: This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

Acknowledgements: None.

© 2023 The Author(s). An open-access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided proper citing of the original work.