

The effect of the COVID-19 pandemic on pediatric emergency admissions and tendency towards prescribing antibiotics

Feyza Husrevoglu Esen¹, Yakup Cag², Elif Sobu³, Elif Rusen Vayvada², Mehmet Tolga Kole², Aydin Esen⁴, Yasemin Akin²

Department of Pediatric Emergency¹, Pediatrics², Pediatric Endocrinology³, University of Health Sciences Kartal Dr. Lütfi Kırdar City Hospital, Türkiye

⁴Department of Pediatrics, University of Health Sciences, Umraniye Education and Research Hospital, İstanbul, Türkiye

ABSTRACT

Aim: To determine the changes in the diagnoses of patients admitted to pediatric emergency department due to infection and the change in the tendency towards prescribing antibiotics during the COVID-19 pandemic.

Methods: Age, gender and the diagnoses of and the antibiotics prescribed for patients under the age of 18 who admitted to the pediatric emergency department on two separate days before and during the pandemic period were compared retrospectively.

Results: It was found that the admissions to the pediatric emergency department decreased by 83% during the pandemic period compared to the pre-pandemic period. Upper respiratory tract infection (URTI) was diagnosed in 61.6% of the patients during the pre-pandemic period compared to 32.6% of the patients during the pandemic periods, indicating a statistically significant difference between the groups ($p < 0.001$). The percentage of patients diagnosed with paranasal infection in the pandemic period was also significantly lower than in the pre-pandemic period. On the other hand, the percentages of patients diagnosed with urinary infection and diagnoses other than infection in the pandemic period were significantly higher than in the pre-pandemic period. Additionally, the percentage of patients who were prescribed amoxicillin-clavulanic acid (CAM) was significantly higher, whereas the percentage of patients who were prescribed Clarithromycin was significantly lower in the pandemic period than in the pre-pandemic period. Furthermore, it was determined that Oseltamivir was not prescribed during the pandemic period.

Conclusions: Quarantines imposed due to the COVID-19 pandemic and the use of masks have reduced the incidence of upper and lower respiratory tract infections. In parallel, it was determined that the percentage of patients presented to the pediatric emergency department with the diagnosis of non-infectious diagnoses has increased. This result has been attributed to the use of masks and the attention paid to the hygiene, which caused a decrease in the incidence of infectious diseases, influenza in particular.

Key words: COVID-19, pediatric emergency, treatment, antibiotics, prescription.

✉ Dr. Feyza Husrevoglu Esen,

Department of Pediatric Emergency, University of Health Sciences Kartal Dr. Lütfi Kırdar City Hospital, Türkiye

E-mail: feyzahusrevoglu@hotmail.com

Received: 2022-05-15 / Revisions: 2022-06-19

Accepted: 2022-07-21 / Published: 2022-09-15

Introduction

A new type of coronavirus was detected in a series of pneumonia cases in the city of Wuhan, China, at the end of 2019. This virus has spread rapidly all over the world, infecting many people, causing the World Health Organization (WHO)

to declare it as the coronavirus 2019 (COVID-19) pandemic on March 11th, 2020 [1].

The COVID-19 has completely changed our lives in the last 2 years. Pediatric cases account for 1-5% of the COVID-19 cases detected so far. In pediatric cases, COVID-19 has a better prognosis and causes milder symptoms compared to adults. In parallel, COVID-19-related mortality rates are also lower among pediatric cases infected with COVID-19. Treatment protocols for COVID-19 in pediatric cases are mostly adapted from the treatment protocols used for adult patients. Since the majority of pediatric patients have a mild course, the main approach in the treatment of COVID-19 in pediatric cases is symptomatic supportive treatment [2].

Studies demonstrated that antibiotics are the most commonly prescribed and used group of medications [3,4]. Unnecessary antibiotic use is higher in patients with COVID-19.

Although COVID-19 is a viral infection, three-quarters of adult COVID-19 patients received antibiotics because of the risk of bacterial co-infection. The rate of pediatric COVID-19 who received antibiotics because of the risk of bacterial co-infection was lower than adults [5,6]. Admissions to the pediatric emergency departments have generally decreased during the pandemic period. There was a significant decrease in the percentage of patients who presented to the pediatric emergency departments with the complaint of respiratory tract infections, contrary to the percentages of patients who presented with complaints such as poisoning and psychiatric conditions, where there was no significant change [7]. The decrease in respiratory tract infections in pediatric patients has also led to a decrease in the amount of antibiotics prescribed [6,8,9].

In this context, the objective of this study is to determine how the measures taken due to the

COVID-19 pandemic changed the pediatric emergency admissions by comparing the diagnoses made and the antibiotics used by the patients who applied to the pediatric emergency department where this study was conducted during the pre-pandemic and pandemic periods.

Materials and methods

This study was designed as a retrospective descriptive study. The study protocol was approved by the Kartal Dr. Lütfi Kırdar City Hospital Ethics Committee (2021/514/210/20). The study was conducted in accordance with the ethical principles set forth in the Declaration of Helsinki.

The study was conducted in a 1000-bed level-3 city hospital where COVID-19 patients were admitted and followed intensively. Patients suspected for COVID-19 or suspected to have been in contact with someone infected with COVID-19 were cared for in a separate outpatient clinic reserved for COVID-19 patients within the pediatric emergency department. There were nine such patients during the days covered by the study and these patients were not included in the study. The days chosen for the study were the third Monday of January in both 2020 and 2021 (20.01.2020 and 18.01.2021), that is, the busiest days of pediatric emergency department, where this study was conducted. The population of the study was consisted of the patients aged 0-18 years, who were admitted to the pediatric emergency department on an outpatient basis during the said two days. Patients included in the study were compared in terms of demographic characteristics such as gender and age as well as clinical characteristics such as diagnosis and medications prescribed. Patients' data were obtained from the hospital database with the exception of the medications prescribed, which were obtained from the MEDULA electronic prescription system. The

collected data were recorded in a Microsoft Excel table. Diagnoses of children admitted due to infection were divided into five groups: 'upper respiratory tract infection', 'lower respiratory tract infection', 'paranasal infection (sinusitis-otitis)', 'urinary system infection', and 'gastroenteritis'. All pediatric patients who were admitted to the pediatric emergency department for non-infectious reasons (seizures, poisoning, suicide, abdominal pain, and allergy) were gathered under the group of 'diagnoses other than infection'. Trauma patients were not included in the study because they were cared for in the adult emergency department. The most commonly prescribed antibiotics were divided into the following groups: 'Amoxicillin Clavulanic Acid (CAM)', Clarithromycin, third generation cephalosporin, pyeloseptil, and oseltamivir, if antiviral.

Statistical analysis

The research data were analyzed using the SPSS 26.0 (Statistical Package for Social Sciences for Windows, Version 26.0, IBM Corp., Armonk, New York, U.S., 2019) software package. Descriptive statistics were expressed as number (n), percentage (%), median (M), minimum (min), maximum (max) and interquartile range (IQR) values. The Shapiro-Wilk test was used to determine whether the age data of the patients conform to the normal distribution. Since it was determined that the age data did not conform to the normal distribution, the age data of the patients before and after pandemic period were compared using the Mann-Whitney U test. Pearson's chi-squared test was used to compare gender, diagnosis and prescribed medication data of patients before and after pandemic period. Subgroup analyzes were performed for the comparisons, which were found to be significant as a result of the Pearson's chi-squared test, using the two-sample z-test with Bonferroni correction.

Probability (p) values of <0.05 were deemed to indicate statistical significance.

Results

A total of 971 patients were included in the study, 830 (85.5%) were admitted to the pediatric emergency department on January 20th, 2020 and 141 (14.5%) on January 18th, 2021 (Table-1). The ages of the patients were in the range of 0-17 years. The median age of the patients admitted to the pediatric emergency department on both January 20th, 2020 and January 18th, 2021 was 4 years. There was no significant difference between the patients admitted to the pediatric emergency department on January 20th, 2020 and January 18th, 2021 in terms of age. 50.1% of the patients admitted to the pediatric emergency department on January 20th, 2020 were male compared to 57.4% of the patients who were admitted to the pediatric emergency department on January 18th, 2021. There was no significant difference between the patients admitted to the pediatric emergency department on January 20th, 2020 and January 18th, 2021 in terms of gender. It was found that the admissions to the pediatric emergency department decreased by 83% during the pandemic period compared to the pre-pandemic period, indicating a statistically significant difference ($p<0.05$). There was a significant difference between the patients admitted to the pediatric emergency department on January 20th, 2020 and January 18th, 2021 in terms of diagnoses ($p<0.001$). Accordingly, upper respiratory tract infection (URTI) was diagnosed in 61.6% of the patients during the pre-pandemic period compared to 32.6% of the patients during the pandemic period, indicating a statistically significant difference between the groups ($p<0.001$). Additionally, lower respiratory tract infection (LRTI) was diagnosed in 64 (%8.2) patients during the pre-pandemic period, whereas there was no patient who was

Table 1. Comparison of the pediatric patient groups admitted to the emergency department in 2020 and 2021.

Parameters	Year		Test Statistics	
	2020 n=830	2021 n=141	Test Value	p value
Age, (year) M (IQR) min-max	4,0 (5,0) 0,0-15,0	4,0 (10,0) 0,0-17,0	z=1,537	0,124
Gender, n (%) Female Male	414 (49,9) 416 (50,1)	60 (42,6) 81 (57,4)	$\chi^2=2,589$	0,108
Diagnosis, n (%) URTI LRTI Paranasal infection Urinary infection Gastroenteritis Other Diagnoses	478 (61,6) ^a 64 (8,2) ^a 70 (9,0) ^a 12 (1,5) ^a 35 (4,5) ^a 117 (15,1) ^a	46 (32,6) ^b 0 (0,0) ^b 1 (0,7) ^b 7 (5,0) ^b 5 (3,5) ^a 82 (58,2) ^b	$\chi^2=148,822$	<0,001
Prescribed Medications, n (%) None CAM Clarithromycin Cephalosporins Oseltamivir Pyeloseptil	n=645 177 (27,4) ^a 273 (42,3) ^a 72 (11,2) ^a 36 (5,6) ^a 83 (12,9) ^a 4 (0,6) ^a	n=119 33 (27,7) ^a 77 (64,7) ^b 1 (0,8) ^b 7 (5,9) ^a 0 (0,0) ^b 1 (0,8) ^a	$\chi^2=50,060$	<0,001*

M: Median, IQR: Interquartile range, min: minimum, max: maximum, z: Mann-Whitney U test, χ^2 : Pearson chi-squared test, URTI: upper respiratory tract infection, LRTI: lower respiratory tract infection, CAM: clavulanic acid-amoxicillin *Monte Carlo method, a, and b superscripts indicate differences between groups in each rows. There is no statistical difference between groups with the same superscripts.

diagnosed with LRTI during the pandemic period. The percentage of patients diagnosed with paranasal infection in the pandemic period (0.7%) was also significantly lower than in the pre-pandemic period. On the other hand, the percentages of patients diagnosed with urinary infection (5%) and diagnoses other than infection (58%) in the pandemic period were significantly higher than in the pre-pandemic period. There was no significant difference between the patients who were admitted to pediatric emergency department during the pandemic and

pre-pandemic periods in terms of percentage of patients diagnosed with gastroenteritis.

As for the medications prescribed; there was no significant difference between the patients who were admitted to pediatric emergency department during the pandemic and pre-pandemic periods in terms of percentages of patients who were prescribed any medication (Table-1). On the other hand, the percentage of patients who were prescribed amoxicillin-clavulanic acid (CAM) was significantly higher in the pandemic period (64.7%) than in the pre-

pandemic period. In contrast, the percentage of patients who were prescribed Clarithromycin was significantly lower in the pandemic period (0,8%) than in the pre-pandemic period. There was no significant difference between the patients who were admitted to pediatric emergency department during the pandemic and pre-pandemic periods in terms of percentages of patients who were prescribed a cephalosporin-group medication and pyeloseptil. Lastly, it was determined that oseltamivir was prescribed to 83 patients during the pre-pandemic period, but it was not prescribed to any patients during the pandemic period.

Discussion

Total number of admissions to the pediatric emergency department decreased by 83% during the pandemic period. Pediatric emergency department visits fell more sharply than adult ED visits during the COVID-19 pandemic. This finding is in line with the results of other relevant studies available in the literature [10,11,12]. The decrease in the number of pediatric emergency admissions for non-COVID-19 diseases was attributed to the fear of contracting COVID-19 from the hospital, that is, parents preferred not to bring their children to the hospital unless the condition of their children has aggravated [12,13,14]. On the other hand this reduction was the result of a decreasing in infectious disease. The using of face-masks, attention to hand hygiene, closing of schools, prevented not only SARS-CoV-2, also other communicable infectious disease.

There was a significant difference between the patients admitted to the pediatric emergency department during the pre-pandemic and pandemic periods in terms of diagnoses. URTI was diagnosed in 61.6% of the patients during the pre-pandemic period compared to 32.6% of the patients during the pandemic period. This result

has been attributed to the use of masks and observing social distancing and quarantines. [11]. LRTI was diagnosed in 8.2% of the patients during the pre-pandemic period, whereas there was no patient who was diagnosed with LRTI during the pandemic period. This result suggested that the pediatric patients who would otherwise be diagnosed with LRTI were diagnosed with COVID-19 pneumonia during the pandemic period. The decrease in the incidence of URTI also reduced the development of LRTI.

The percentage of patients diagnosed with paranasal infection in the pandemic period was significantly lower than in the pre-pandemic period. The percentage of patients diagnosed with urinary infection in the pandemic period was significantly higher than in the pre-pandemic period. This result has been attributed to the decrease in the incidence of viral diseases and the relative increase in the incidence of bacterial diseases. The percentage of patients diagnosed with diagnoses other than infection in the pandemic period were also significantly higher than in the pre-pandemic period. It seems that the use of masks and observance of quarantines reduced the incidence of infections on one hand but increased the incidence of conditions such as seizures, poisoning cases, suicides, allergies, which may be attributed to extended stays at home, on the other hand. As a matter of fact, it has been reported in the literature that extended stays at home were associated with 'psychological disorders' and 'intake of substances by accident' [15].

The most commonly prescribed antibiotic both during the two periods was amoxicilline/clavulanic acid. Contrary to the findings reported in the literature, the percentage of patients who were prescribed amoxicillin-clavulanic acid (CAM) was significantly higher in the pandemic period. This result suggested that

because of using clinical findings suggestive of bacterial infection were more prominent [16,17]. Another thought of us may be the physicians do not want to leave the patient without antibiotics during the pandemic period [18]. Turkey is one of the countries where the inappropriate use of antibiotics is very common [19, 20].

The percentage of patients who were prescribed Clarithromycin was significantly lower in the pandemic period than in the pre-pandemic period. This finding has been attributed to the decrease in cases suggestive of atypical infection. Similar to other studies, while percentage of patients who were prescribed respiratory tract antibiotics decreased, percentage of patients who were prescribed other antibiotics (cephalosporin, pyeloseptil) did not change during the pandemic period compared to the pre-pandemic period [17]. There were no patients who were prescribed Oseltamivir during the pandemic period. This result has been attributed to a decrease in the incidence of influenza infection [21,22].

The study has some limitations. The main limitation of the study was that only one day was chosen to represent each of the pre-pandemic and pandemic periods. Secondly, the inpatient group and trauma patients were not included in the study. Studies that cover longer periods would provide better results.

Conclusion: COVID-19 pandemic has affected our country as well as the whole world. Although Turkey is one of the countries that emergency medicine services (EMS) are used intensively, this decrease in pandemic period has considered that unnecessary use of EMS in our country once again. The use of masks and quarantines have reduced the possibility of contracting respiratory tract infections, which resulted in a decrease in the number of patients admitted to pediatric emergency departments due to infection. As a result, there was also a marked decrease in the antibiotics prescribed for infections.

Funding: The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical Statement: The study protocol was approved by the Kartal Dr. Lütfi Kırdar City Hospital Ethics Committee (2021/514/210/20).

Open Access Statement

Experimental Biomedical Research is an open access journal and all content is freely available without charge to the user or his/her institution. This journal is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/). Users are allowed to read, download, copy, distribute, print, search, or link to the full texts of the articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author.

Copyright (c) 2021: Author (s).

References

- [1]Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506.
- [2]Cui X, Zhao Z, Zhang T, et al. A systematic review and meta-analysis of children with coronavirus disease 2019 (COVID-19). J Med Virol. 2021;93(2):1057-1069.
- [3]Gholamreza-Sepahri, Manzumeh-Shamsi M. The quality of prescribing in general practice in Kerman, Iran. Int J Health Care Qual Assur Inc Leadersh Health Serv. 2005;18(4-5):353-360.
- [4]Hampton T, Ogden J, Higgins HM. Understanding doctors' emergency department antibiotic prescribing decisions in children with respiratory symptoms in the UK: a qualitative study. BMJ Open. 2021;11(12).

- [5] Armitage R, Nellums LB. Antibiotic prescribing in general practice during COVID-19. *Lancet Infect Dis.* 2021;21(6):e144.
- [6] Langford BJ, So M, Raybardhan S, et al. Antibiotic prescribing in patients with COVID-19: rapid review and meta-analysis. *Clin Microbiol Infect.* 2021;27(4):520-531.
- [7] DeLaroche AM, Rodean J, Aronson PL, et al. Pediatric emergency department visits at US children's hospitals during the COVID-19 pandemic. *Pediatrics.* 2021;147(4).
- [8] Dutcher L, Li Y, Lee G, et al. COVID-19 and Antibiotic Prescribing in Pediatric Primary Care. *Pediatrics.* 2022;149(2).
- [9] Gillies MB, Burgner DP, Ivancic L, et al. Changes in antibiotic prescribing following COVID-19 restrictions: Lessons for post-pandemic antibiotic stewardship. *Br J Clin Pharmacol.* 2022;88(3):1143-1151.
- [10] Šokota A, Prtorić L, Hojsak I, et al. Pediatric tertiary emergency care departments in Zagreb, Rijeka, and Split before and during the coronavirus disease 2019 pandemic: a Croatian national multicenter study. *Croat Med J.* 2021;62(6):580-589.
- [11] Pines JM, Zocchi MS, Black BS, et al. Characterizing pediatric emergency department visits during the COVID-19 pandemic. *Am J Emerg Med.* 2021;41:201-204.
- [12] Fidancı İ, Taşar MA, Akıntuğ B, et al. The impact of the COVID-19 pandemic on paediatric emergency service. *Int J Clin Pract.* 2021;75(9):e14398.
- [13] Tuygun N, Karacan CD, Göktuğ A, et al. Evaluation of changes in pediatric emergency department utilization during COVID-19 pandemic. *Arch Pédiatrie.* 2021;28(8):677-682.
- [14] Dann L, Fitzsimons J, Gorman KM, et al. Disappearing act: COVID-19 and paediatric emergency department attendances. *Arch Dis Child.* 2020;105(8):810-811.
- [15] Hill RM, Rufino K, Kurian S, et al. Suicide Ideation and Attempts in a Pediatric Emergency Department Before and During COVID-19. *Pediatrics.* 2021;147(3).
- [16] Dutcher L, Li Y, Lee G, Grundmeier R, et al. COVID-19 and Antibiotic Prescribing in Pediatric Primary Care. *Pediatrics.* 2022;149(2).
- [17] Gillies MB, Burgner DP, Ivancic L, et al. Changes in antibiotic prescribing following COVID-19 restrictions: Lessons for post-pandemic antibiotic stewardship. *Br J Clin Pharmacol.* 2022;88(3):1143-1151.
- [18] Giacomelli A, Ridolfo A, Oreni L, et al. Consumption of antibiotics at an Italian university hospital during the early months of the COVID-19 pandemic: Were all antibiotic prescriptions appropriate? *Pharmacol Res.* 2021; 164: 105403.
- [19] Erbay A, Bodur H, Akıncı E, et al. Evaluation of antibiotic use in intensive care units of a tertiary care hospital in Turkey. *Journal of Hospital Infection.* 2005; 59:53-61.
- [20] Sözen H, İbak G, Sözen A, et al. Application of ATC/DDD methodology of evaluate to antibiotic use in a general hospital in Turkey. *Annals of Clinical Microbiology.* 2013;12:1-6.
- [21] Yeoh DK, Foley DA, Minney-Smith CA, et al. Impact of Coronavirus Disease 2019 Public Health Measures on Detections of Influenza and Respiratory Syncytial Virus in Children during the 2020 Australian Winter. *Clin Infect Dis.* 2021;72(12):2199-2202.
- [22] Sullivan SG, Carlson S, Cheng AC, et al. Where has all the influenza gone? The impact of COVID-19 on the circulation of influenza and other respiratory viruses, Australia, March to September 2020. *Eurosurveillance.* 2020;25(47):1.