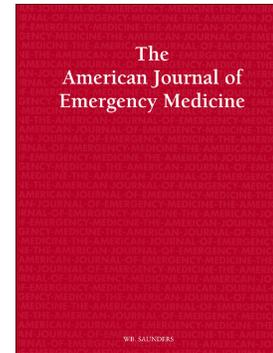


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Complications of Serious Acute Conditions in Children during the COVID-19 Pandemic

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Abbreviations:

CSAC	Complications of Serious Acute Conditions,
PED	Pediatric Emergency Departments,
COVID-19	Coronavirus Disease 2019,
ICU	Intensive Care Unit

A previous population-based study defined a broad set of complications of acute conditions encountered in Pediatric Emergency Departments (PEDs). These conditions represent a spectrum of diagnoses in which optimal PED care seems to reduce the risk of complications [1]. Recent studies on the impact of the severe coronavirus disease 2019 (COVID-19) pandemic found increased rates of appendiceal perforation, and severe diabetic ketoacidosis [2,3]. We investigated the rates of complications of serious acute conditions (CSAC) in PED patients during the COVID-19 pandemic.

A multicenter cross-sectional study was conducted in the PEDs of eleven public hospitals in Israel. Children with CSAC who attended the PED between 01/03/2020 and

31/05/2020 were compared with those who attended the PED between the same dates in 2019. Cases were identified using International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis codes used previously in code validation studies [1]. The following variables were abstracted: age, sex, COVID-19 test if performed, method of transport to the PED, triage acuity level (level 1-5), type of CSAC, hospital length-of-stay, and intensive care unit (ICU) admissions due to CSAC. Chart review was conducted in accordance with published methods for this type of study design [4]. Data were compared using descriptive statistics expressed as frequency, medians, and interquartile ranges (IQR). Fisher's exact test was used to compare proportions between groups. The Mann-Whitney U test was used to compare age and triage acuity. A two-sided p-value < 0.05 was considered statistically significant. All statistics were calculated using StatsDirect statistical software (V.2.6.6, StatsDirect Limited, Cheshire).

During the study periods in 2019 and 2020, 43,860 and 26,205 patients visited the PEDs, respectively, and 790 and 721 serious acute conditions were recorded, respectively. The most common condition was appendicitis, followed by mastoiditis, diabetic ketoacidosis, testicular torsion, ileocolic intussusception, septic arthritis, orbital cellulitis, meningitis, myocarditis, sepsis, ovarian torsion, encephalitis, stroke, empyema, and ectopic pregnancy. Eighty-one/790 (10.3%) and 85/721 (11.8%) patients had CSAC in 2019 and 2020, respectively; $p=0.365$. Demographic characteristics, method of transport, time-of-arrival, and triage acuity level of patients with CSAC are presented in Table 1. Only 12/85 (14%) patients underwent COVID-19 tests, all were negative. Testing for COVID-19 was performed using reverse transcriptase–polymerase chain reaction (RT-PCR) of an oropharyngeal or nasopharyngeal swab. Comparison of the rates of condition-specific complication is presented in Table 2. Median (IQR) hospital length-of-stay of patients with CSAC in 2019 and 2020 were 7 (5-11) days and 7

(5-11) days. Rates of intensive care units' admissions in patients with CSAC in 2019 and 2020 were 13/81 (16%) and 17/85 (20%), respectively; $p=0.550$.

The major finding of this study is that despite the significant (40.2%) reduction in PEDs visits during the pandemic period, there was no statistically significant difference in the overall CSAC rate, and in the complications rates of appendicitis, diabetic ketoacidosis, testicular torsion, ileocolic intussusception, septic arthritis, orbital cellulitis, and meningitis, between the pandemic and pre-pandemic periods. The two cohorts were similar with regard to age, sex, method of arrival to the PED, arrival time, and triage acuity level, and were also similar with regard to hospital length-of-stay and ICU admission. These findings suggest that the severity of serious acute conditions and their management were similar in both study periods. Higher rates of complications of mastoiditis were found in the pandemic period. Since many ambulatory practices in Israel delayed, canceled, or converted to telemedicine [5], we speculate that a higher rate of untreated purulent otitis media lead to the higher rate of complications of mastoiditis seen in the PED. There were also more complications of sepsis in 2020 than in 2019 (6/7 vs 3/11), but the small group size limits interpretation of this finding.

Our study has certain limitations including the inherent limitations of a retrospective study design. We investigated the first three months of the outbreak; therefore, only a few patients were tested for COVID-19, and the new disease known as multisystem inflammatory syndrome in children (MIS-C) was not included in the data. Since healthcare systems vary greatly across countries, our findings may not be generalizable to other populations.

In summary, study results suggest that the overall CSAC rate was not increased during the first months of the outbreak in Israel. CSAC rate analysis can be used by healthcare organizations to evaluate the impact of the outbreak on pediatric emergency medicine.

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Contributors' Statement Page

Dr Jacob designed the study, analyzed and interpreted the data, reviewed the literature, and critically revised the article; Dr Weiser designed the study, analyzed and interpreted the data, reviewed the literature, and critically revised the article. Dr Weiser has equal contribution as first author; Drs Padeh, Kaplan, Maimon, Takagi, Peled, Gamsu, Krupik, Kuchinski Cohen, Klein, Gur-Soferman, Sharkansky and Chistyakov analyzed and interpreted the data, carried out the initial analysis and critically revised the article; IS conceived the idea for the study, analyzed and interpreted the data, and drafted the manuscript. IS has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Table 1 Demographic characteristics, method of transport, time of arrival, and triage acuity level of patients who had complications of serious acute conditions during the pandemic (March 1-May 31, 2020) and pre-pandemic (March 1-May 31, 2019) periods.

	2019 (n=81)	2020 (n=85)	P value
Age, years, median (IQR)	9.1 (3.7, 13.4)	10.1 (3.8, 14.5)	0.637
Males/Females	42/38	39/46	0.359
Methods of transport to the ED			0.155
-With EMS	3	8	
-Without EMS	78	77	
Time of Arrival			
-Morning shift (07:00-15:00), n (%)	31	39	0.327
-Evening shift (15:00-23:00), n (%)	33	38	0.610
-Night shift (23:00-07:00), n (%)	17	8	0.040
Triage acuity level, median (IQR)	3 (3,3)	3 (3,4)	0.852

Notes

IQR=Interquartile Range, ED=Emergency Department, EMS=Emergency Medical Services.

Table 2 Comparison of complications of serious acute conditions during the pre-pandemic (March 1-May 31, 2019) and pandemic (March 1-May 31, 2020) periods.

Serious Acute Condition	2019			2020			P value
	n	Complication rate, n (%)	Type of complication	n	Complication rate n (%)	Type of complication	
<i>Appendicitis</i>	453	55 (12.1)	32 perforations 20 periappendicular abscesses 2 sepsis, 1 bowel resection	482	59 (12.2)	32 perforations 27 perpendicular abscesses	0.964

<i>Mastoiditis</i>	100	6 (6)	4 mastoidectomy 2 CSVT	40	9 (22.5)	6 mastoidectomy 3 CSVT	0.013
<i>DKA</i>	55	0		71	1 (1.4)	Brain edema	-
<i>Testicular torsion</i>	48	9 (18.7)	9 orchiectomies	34	5 (14.7)	5 orchiectomies	0.77
<i>Ileocolic intussusception</i>	41	0	-	25	1 (4)	1 perforation and surgical intervention	-
<i>Arthritis</i>	20	2 (10)	2 sepsis	8	1 (12.5)	1 sepsis	0.840
<i>Orbital cellulitis</i>	17	1 (5.9)	1 surgical intervention	15	0		-
<i>Meningitis</i>	17	3 (17.6)	1 seizure 1 surgical intervention 1 mechanical ventilation	7	1 (14.2)	1 death 1 surgical intervention	0.896
<i>Myocarditis</i>	11	0		8	0		-
<i>Sepsis</i>	11	3 (27.2)	2 ventilation 1 death	7	5 (86)	4 death 2 mechanical ventilation	0.049
<i>Ovarian torsion</i>	8	0		1	0		-
<i>Encephalitis</i>	5	1 (20)	1 seizure and requirement for rehabilitation	5	1 (20)	1 seizure and requirement for rehabilitation	-
<i>Stroke</i>	3	1 (33.3)	1 requirement for rehabilitation	1	0	-	-
<i>Empyema</i>	1	0	-	0	0	-	-
<i>Ectopic pregnancy</i>	0	0	-	2	1 (50)	1 surgical intervention	-
<i>Compartment syndrome</i>	0	0	-	0	0	-	-

Notes

CSVT=Cerebral Sinus Vein Thrombosis, DKA=Diabetic Ketoacidosis