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Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in Children and Adolescents

A Systematic Review

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QU'EST CE QUE LA LITTÉRATURE NOUS DIT JUSQU'À PRÉSENT POUR LA POPULATION PÉDIATRIQUE?

Devis: Revue systématique de tous les articles publiés du 1er décembre 2019-3 mars 2020 (Chine, Singapour)

Inclusion criteria

- Population: children and adolescents (age ≤19 y) with confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection
- Study design: retrospective studies (cross-sectional studies, case-control studies, case series, and case reports), bulletins, and national reports
- Outcome: evaluation of clinical symptoms of patients with coronavirus disease 2019 (COVID-19); description of the sources and the possible mechanisms of infection; description of diagnostic tests and therapeutic strategies; patients' prognosis

Exclusion criteria

- Clinical guidelines, consensus documents, clinical trials, reviews, systematic reviews, and conference proceedings
- Studies about other serotypes of severe acute respiratory syndrome coronavirus and Middle East respiratory syndrome coronavirus infection

Résultats: 815 articles identifiés; 18 études incluses (1065 participants, pas O2 sauf*)

- Symptômes légers (T°C, toux sèche, fatigue) ou asx
- Épaississement péribronchique et opacités en verre dépoli (aussi décrit chez asx!)
- 1 seul cas sévère* (13 mois, choc avec acidose métabolique, insuffisance rénale, amine + ventilation assistée + dialyse à l'USI)
- 1 décès rapporté chez les 10-19 ans (pas de donnée); pas rapporté chez les 0-9 ans
- 1 article rapportant 8 patients avec un échantillon rectal + alors que l'échantillon nasopharyngé -

Table. Results of Systematic Review

Source	Publication date	Study type	Country	No.		Age 10-19 y	Age	Sex	Symptoms (yes/no); type of symptoms	Radiologic		Therapy (yes/no); type of therapy
				Patients	Age <10 y					Tests	Findings	
Cai et al ¹¹	February 4, 2020	Case report	China	1	1	0	7 y	M	Yes; the child presented with fever, cough, runny nose, dyspnea, nausea, and loss of appetite.	Chest radiograph and CT	Bronchial thickening	Yes; supportive care
Shen and Yang ¹²	February 5, 2020	Case series	China	28	NA	NA	1 mo-17 y	NA	Yes; several patients gradually presented with fever, fatigue, and dry cough, accompanied by other upper respiratory symptoms including nasal congestion, runny nose, and seldom gastrointestinal symptoms such as nausea, vomiting, and diarrhea. Most pediatric patients had mild symptoms, without fever or pneumonia. They had good prognosis and recovered within 1 to 2 wk after disease onset. Only a few patients had lower respiratory tract infections.	Yes	Lung imaging examination revealed mild increase of lung markings or ground-glass opacity or pneumonia.	NA
Song et al ¹³	February 6, 2020	Retrospective study	China	1	0	1	16 y	NA	NA	Chest CT	NA	NA
Chang et al ¹⁴	February 7, 2020	Case series	China	2	1	1	2-15 y	NA	Yes; the youngest patient (age 2 y) had intermittent fever for 1 wk and persistent cough for 13 d before COVID-19 diagnosis. No symptoms were reported for the other child.	Yes	NA	NA
Schwartz and Graham ¹⁵	February 10, 2020	Case report with review of literature	China	1	1	0	30 h	NA	Yes; the infant developed shortness of breath and showed abnormalities of liver function.	Chest radiograph	Abnormal chest radiographs	NA
Zhang et al ¹⁶	February 11, 2020	Case report	China	1	1	0	3 mo	F	Yes; the patient developed fever.	Chest radiograph and CT	Bronchial thickening	Yes; the patient required antiviral therapy, antibiotics (azithromycin and ceftazidime), aerosol therapy, and supportive care.
Chen et al ¹⁷	February 11, 2020	Case report	China	1	1	0	13 mo	M	Yes; the patient developed vomiting and diarrhea 6 d before he showed fever, dyspnea, cyanosis, and hepatomegaly. The patient developed shock with metabolic acidosis that required intensive care and the administration of vasoactive drugs (dopamine), IV rehydration, and assisted ventilation. The patient also showed acute kidney failure that required the dialysis.	Chest radiograph and CT	Imaging showed different area of lung thickening, suggesting pneumonia.	Yes; shock required dopamine, IV rehydration, blood transfusion, and assisted ventilation. Also, the patient was treated with antibiotic therapy (meropenem and linezolid), oseltamivir, IVIG and steroids, nebulized interferon, and dialysis.
Wei et al ¹⁸	February 14, 2020	Retrospective study	China	9	9	0	1-11 mo	2 M/7 F	Yes, but not all patients; 4 patients reported fever, 2 had mild upper respiratory tract symptoms, and 1 had no symptoms. For 2 patients, there were no available data on symptoms. None of the 9 infants required intensive care or mechanical ventilation or had any severe complications.	NA	NA	NA
Chan et al ¹⁹	February 15, 2020	Retrospective study	China	2	2	0	7 and 10 y	10-y-old M	No; patients were asymptomatic.	Chest CT	The 10-y-old patient showed ground-glass lung opacities.	NA
Zhang et al ²⁰	February 15, 2020	Retrospective study	China	1	0	1	15 y	M	Yes; the patient developed fever and fatigue.	Chest radiograph	NA	NA
Feng et al ²¹	February 16, 2020	Retrospective study	China	15	NA	NA	4-14 y	5 M/10 F	Yes, not all patients; 5 children were febrile, and 10 were asymptomatic.	Chest CT	At chest CT images, 6 patients had no lesions, while 9 patients had pulmonary inflammation lesions. Seven cases of small nodular ground glass opacities and 2 cases of speckled ground glass opacities were found.	NA
Zeng et al ²²	February 17, 2020	Case report	China	1	1	0	17 d	M	Yes; the newborn had a history of rhinitis and vomiting.	Chest radiograph and CT	Imaging showed different area of lung thickening and enlargement of lung hila, suggesting pneumonia.	Yes; the newborn required IV rehydration and supportive care.
Pediatric Branch of Hubei Medical Association et al ²³	February 22, 2020	Case series	China	14	NA	NA	6 mo-14 y	6 M/8 F	Yes; fever, cough, fatigue, nausea, and vomiting were main symptoms.	NA	NA	NA
Wu and McGoogan ²⁴	February 24, 2020	Retrospective study	China	965	416	549	0-19 y	NA	NA	NA	NA	NA
Tian et al ²⁵	February 26, 2020	Retrospective study	China	11	NA	NA	0-12 y	NA	Yes; the most common symptoms of illness onset were fever, cough, fatigue, dyspnea, and headache. One severe case included dyspnea (patient age, <1 y).	NA	NA	NA
Kam et al ²⁷	February 28, 2020	Case report	Singapore	1	1	0	6 mo	M	Yes; the patient developed a transient temperature of 38.5 °C (1 episode).	NA	NA	No; no therapy
Cai et al ²⁶	February 28, 2020	Case series	China	10	10	0	3-131 mo	4 M/6 F	Yes; 8 patients (80%) had fever, 6 (60%) had cough, 4 (40%) had sore throat, 3 (30%) had stuffy nose, and 2 (20%) had sneezing and rhinorrhea. None of the patients had diarrhea or dyspnea during the course of illness. Fever resolved 24 h after fever onset with the peak of fever ranging from 37.7 °C to 39.2 °C.	Chest radiograph	Chest radiograph revealed unilateral patchy infiltrate in 4 of 10 patients (40%).	Yes; all patients received symptomatic treatment with no need of oxygen therapy, and a few patients with pneumonia received empirical antibiotic therapy.
Tong et al ¹⁰	March 3, 2020	Case reports	China	1	0	1	12 y	M	No; the patient was asymptomatic.	NA	NA	No; NA

Abbreviations: COVID-19, coronavirus disease 2019; CT, computed tomography; F, female; IV, intravenous; IVIG, intravenous immunoglobulin; M, male; NA, not available.

CE QU'IL FAUT RETENIR!

Les enfants présentent des symptômes plus légers.
L'âge & le sexe ne semblent pas influencer le pronostic, comme en adulte!

N.B. : il s'agit de données asiatiques exclusivement.

QU'EST CE QUE LA LITTÉRATURE NOUS DIT JUSQU'À PRÉSENT POUR LA POPULATION PÉDIATRIQUE?



Devis: Revue systématique de tous les articles publiés du 1er décembre 2019-7 avril 2020 (Chine, Italie, Iran, Singapore, Corée, Vietnam)

Inclusions: <18 ans, données originelles sur cas de COVID-19 confirmé par RT-PCR, données disponibles sur les manifestations cliniques et tests, incluant imageries



Résultats: 293 articles identifiés; 38 études incluses (1124 patients, dont 1117 avec une classification de leur sévérité et 7 cas nouveaux-nés)

- 14.2% asx; 36.3% légers; 46% modérés; 2.1% sévères & 1.2% critiques

Table 1. Severity of illness and characteristics of cases reported.

Studies	N	Age	Gender		Severity of illness					
			Males	Females	Asymptomatic	Mild	Moderate	Severe	Critical	NA
Dong et al.	731	10 y*	420	311	94 (12.9%)	315 (43.1%)	300 (41.0%)	15 (2.5%)	3 (0.4%)	1 (0.1%)
Lu et al.	171	6 y (1 d to 15 y)*	104	67	27 (15.7%)	33 (19.3%)	107 (62.6%)	1 (0.6%)	3 (1.7%)	
Qiu et al.	36	8 y (1 y to 16 y)**	23	13	10 (27.7%)	7 (19.4%)	19 (52.8%)			
Wang et al.	31	7 (6 mo to 17)**	15	16	4 (12.9%)	13 (41.9%)	14 (45.1%)			
Zheng et al.	25	3 y (3 mo to 14 y)**	14	11		8 (32.0%)	15 (60.0%)		2 (8.0%)	
Xia et al.	20	2 y (1 day to 14 y)*	13	7			19 (95.0%)	1 (5.0%)		
Feng et al.	15	7 (4 y to 14 y)**	5	10		3 (20.0%)	12 (80.0%)			
Cai et al.	10	74 mo (3 mo to 131 mo)*	4	6		6	4			
Wei et al.	9	6 mo (1 mo to 11 mo)*	2	7	1	6				2
Su et al.	9	4.5 y (11 mo to 9y)*	3	6	6	3				
Zhou et al.	9	1 y (7 mo to 3 y)**	4	5	5		4			
Sun et al.	8	6.8 y (2 mo to 15 y)*	6	2				5	3	
Liu et al.	6	3 y (1y to 7y)**	2	4			4	1		1
Hu et al.	5	8 y (5 y to 15 y)*	3	2	4	1				
Liu et al.	5	5.9 y (7 mo to 13 y)*	4	1	3	2				
Liu et al.	4	3 y (2 mo to 9 y)*	2	2		1	3			
Lou et al.	3	6 mo/6 y/8 y	1	2			3			
Zeng et al.	3	neonates	3				2		1	
Zhang et al.	3	6 y/8 y/9 y	3				3			
Li et al.	2	4 y/4 y	1	1	1		1			
Ji et al.	2	15 y/9 y	2			2				
Aghdam et al.	1	15 d	NR	NR				1		
Canarruto et al.	1	32 d	1			1				
Le et al.	1	3 mo		1		1				
Lin et al.	1	7 y		1		1				
Pan et al.	1	3 y	1		1					
Wang et al.	1	19 days	1			1				
Zhang et al.	1	1 y 2 m		1		1				
Yu et al.	1	neonate	NR	NR	1					
Park et al.	1	10 y		1			1			
Cui et al.	1	55 d		1				1		
Tang et al.	1	10 y	1		1					
Zhang et al.	1	3 mo					1			
Cai et al.	1	7 y	1				1			
Zeng et al.	1	17 d	1				1			
Chen et al.	1	1 y	1						1	
Kam et al.	1	6 mo	1			1				
Chan et al.	1	10 y	1		1					
Total	1117		643	478	159 (14.2%)	406 (36.3%)	514 (46.0%)	25 (2.1%)	13 (1.2%)	4 (0.4%)

* value expressed as mean (range)

** value expressed as median (range)

- 36.9% avec pneumonie
- 10.9% avec IVRS
- 1 décès (10 mois, avec intussusception)
- 12.9% avec lymphocytes bas

N.B.:

- Légers: IVRS
- Modérés: Pneumonie
- Sévères: Désaturation < 92%
- Critiques: ARDS/insuffisance respiratoire, choc, insuffisance cardiaque, MOF, etc.

Limites:

Des données sur les mêmes patients pourraient avoir été représentés plusieurs fois; données provenant d'ailleurs majoritairement de Chine.

CE QU'IL FAUT RETENIR!

La fièvre et les symptômes respiratoires ne sont pas les seules manifestations cliniques du COVID-19 chez les enfants. Prenez note des caractéristiques les plus fréquentes!

Table 2. Distributions of clinical manifestations of children with COVID-19 described in the selected studies.

Clinical manifestations	Frequency of occurrence*
Fever	187 (47.5%)
Cough	163 (41.5%)
Pneumonia	145 (36.9%)
Pharyngeal erythema	81 (20.6%)
Tachycardia on admission	73 (18.6%)
Tachypnea on admission	53 (13.4%)
Nasal symptoms	44 (11.2%)
Upper airway infections	43 (10.9%)
Diarrhea	32 (8.1%)
Nausea/Vomiting	28 (7.1%)
Fatigue	20 (5.0%)
Respiratory distress	14 (3.5%)
Sore throat	10 (2.5%)
Respiratory failure	7 (1.8%)
Creptations	6 (1.5%)
Sputum	6 (1.5%)
Hypoxemia	5 (1.3%)
Abdominal pain	2 (0.5%)
Sneezing	2 (0.5%)
Cyanosis	2 (0.5%)
Lymphadenopathy	1(0.2%)

* expressed in absolute number and percentage in relation to the total of cases in which clinical manifestations were described (n = 393).