

Pediatric hospitalization due to COVID-19: experience in a regional hospital

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Abstract

Background: SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) infection is usually mild in children, although it can become severe in some cases. Initially, doubts arose due to vertical perinatal transmission in infected mothers. Therefore, the first recommendations were very restrictive, suggesting mother-newborn separation. This study aimed to describe the clinical behavior of newborns born to mothers with SARS-CoV-2 infection and of children admitted to hospital due to COVID-19 (coronavirus-2 disease). **Methods:** We conducted a retrospective descriptive study of pediatric patients hospitalized between May 1, 2020, and April 30, 2021. **Results:** We included 19 patients: 47.4% were neonates born to mothers infected with SARS-CoV-2 (1.63% of deliveries), and 52.6% were pediatric patients aged 2 months to 12 years with confirmed COVID-19 infection (3.43% of all pediatric admissions). All patients presented mild symptomatology and remained isolated with a family member in the room. Vertical transmission was not found, although a positivity rate of 88.89% was detected in fathers. **Conclusions:** Pediatric admissions for COVID-19 did not represent an overload of care. No patient developed complications or required specific treatment. The incidence of COVID-19 deliveries was low, and vertical perinatal transmission was not observed. Admission with a companion facilitated pediatric care, which was favorable for the patient and the healthcare staff.

Keywords: COVID-19. Coronavirus. Emerging epidemic diseases. SARS-CoV-2. Pediatrics. Hospitalization.

Ingresos por COVID-19 en pediatría: experiencia en un hospital comarcal

Resumen

Introducción: La infección por SARS-CoV-2 (coronavirus tipo 2 del síndrome respiratorio agudo grave) es habitualmente leve en niños, aunque llega a evolucionar de forma grave en algunos casos. Inicialmente surgieron dudas por la transmisión perinatal vertical en madres infectadas, por lo que las primeras recomendaciones fueron muy restrictivas, ya que sugerían la separación madre-hijo. El objetivo de este estudio fue describir el comportamiento clínico de los recién nacidos de madres con infección por SARS-CoV-2 y de los niños ingresados al hospital por COVID-19 (enfermedad por coronavirus 2). **Métodos:** Se llevó a cabo un estudio descriptivo retrospectivo de pacientes pediátricos hospitalizados entre el 1 de mayo de 2020 y el 30 de abril de 2021. **Resultados:** Se incluyeron 19 pacientes: el 47.4% eran neonatos hijos de madres infectadas con SARS-CoV-2 (1.63% de los partos) y el 52.6%, pacientes pediátricos de entre 2 meses y 12 años de edad con COVID-19 (3.43% de los ingresos pediátricos). Todos los pacientes presentaron sintomatología leve y permanecieron aislados en la habitación con un familiar. No se constató la transmisión vertical, aunque se detectó una tasa de positividad en el

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padre del 88.89%. **Conclusiones:** Los ingresos pediátricos por COVID-19 no supusieron sobrecarga asistencial. Ningún paciente desarrolló complicaciones ni precisó tratamiento específico. La incidencia de partos COVID-19 fue baja y no se constató la transmisión vertical. El ingreso con un acompañante facilitó los cuidados pediátricos, lo que resultó favorable para el paciente y para el personal del servicio.

Palabras clave: COVID-19. Coronavirus. Enfermedades epidémicas emergentes. SARS-CoV-2. Pediatría. Hospitalización.

Introduction

Coronaviruses (CoVs) were not considered highly pathogenic agents for humans before the 2003 outbreak of severe acute respiratory syndrome. Subsequently, this epidemic highlighted the virulence of this group of viruses and included them among the causative agents of emerging epidemic diseases¹.

Later, in 2012, a new CoV responsible for Middle East respiratory syndrome was identified. Both infections were considered a threat to global health security. We are currently experiencing the third epidemic caused by a new CoV, called SARS-CoV-2 (severe acute respiratory syndrome coronavirus type 2), which emerged in Wuhan (China) and has triggered an unprecedented pandemic.

There are already countless publications and studies related to the clinical features, diagnosis, treatment, prognosis, and evolution of SARS-CoV-2 infection (COVID-19). However, most of them focus on adult patients, whereas the literature on disease in the pediatric population is scarce and heterogeneous.

Progressive advances in the knowledge of COVID-19 have resulted in constant changes in all types of recommendations over the last year, which has made it difficult to unify and standardize clinical practice.

Pediatric patients have been a population group with markedly different behavior towards COVID-19²; within the pediatric population, neonates have constituted a particularly protected subgroup³.

At the beginning of the pandemic, many doubts arose about the risk of perinatal transmission from mother to newborn among mothers infected with SARS-CoV-2. The first recommendations on the management of pregnant women and newborns issued by the Ministry of Health were very restrictive, recommending separation of the newborn from the mother at the time of birth due to the potential risk of transmission. After the initial uncertainty, most scientific societies recommended that breastfeeding continue and be maintained along with respiratory isolation measures^{4,5}. Based on these recommendations, the protocol of our hospital contemplates these aspects to preserve the humanization of the birth process and breastfeeding^{6,7}.

Published data suggest that the clinical course of infection is usually mild in pediatric patients. However, a small percentage may progress to a severe disease requiring admission to Intensive Care Units (ICU)⁸.

The objectives of the present study were to describe the clinical behavior of newborns born to mothers with SARS-CoV-2 infection and infants admitted to the hospital for COVID-19.

Methods

We conducted a retrospective descriptive study of patients with a confirmed diagnosis of active SARS-CoV-2 infection by PCR (polymerase chain reaction positive for SARS-CoV-2 on admission) hospitalized in the pediatric ward of the Hospital de Barbastro from May 1, 2020, to April 30, 2021. Patients admitted to the pediatric ward were those aged 0-13 years. Criteria for hospitalization were as follows: age < 3 months, children with risk factors (immunocompromised, with heart disease, or chronic respiratory pathology), hypoxemia (SaO₂ < 92%), or moderate/severe respiratory distress (score > 4 on the Wood-Downes scale), poor general condition, refusal of food, apneas, suspected PMIS-TS (pediatric multisystem inflammatory syndrome linked to SARS-CoV-2). The social motive was also included: family admission in the same room was agreed upon for three infected patients whose parents also required hospitalization due to symptoms.

Various data were collected, such as the reason for and duration of admission (in days), associated symptomatology, severity, treatment administered, need for mechanical ventilation or transfer to the pediatric ICU, and the age and sex of the patients. All patients remained in the room with one of their parents, maintaining strict isolation during the entire admission. A contact study was performed in all cases, and the family member accompanying the patient was also positive.

In the case of newborns, the inclusion criteria were mothers with positive PCR for SARS-CoV-2 at the time of delivery at the Hospital de Barbastro from May 1, 2020, to April 30, 2021. At our center, PCR for SARS-CoV-2 is performed on all women admitted to the hospital to give

birth, regardless of whether or not they have symptoms suspicious for COVID-19. We also perform a PCR test for the father in case of a positive maternal PCR result.

Data were collected on maternal and neonatal relatedness, symptoms, gestational age, type of delivery, birth weight, performance, and results of two PCRs for SARS-CoV-2 in the newborn in the first 48-72 hours of life, and feeding at discharge. All newborns born to mothers with SARS-CoV-2 infection underwent a PCR at birth and another before discharge, with a minimum interval of 48 hours from the first test in our hospital. Families were also oriented on caring for the newborn to minimize the risk of infection. They were advised to wash their hands frequently, especially before touching the newborn, and wear a mask, especially when less than 2 m away from the newborn.

A contact study was initiated in all admitted patients, and at least one of their parents was allowed to accompany them.

The Hospital de Barbastro is an IHAN (Initiative for the Humanization of Birth and Breastfeeding Assistance) or BFH (Baby-Friendly Hospital) hospital, a maternal and infant health reference.

Results

Between May 1, 2020, and April 30, 2021, a total of 19 pediatric patients who met the inclusion criteria were admitted to the pediatric ward of the Hospital de Barbastro. Of these, 47.4% were newborns born to mothers with SARS-CoV-2 infection; the remaining 52.6% were pediatric patients aged 2 months to 12 years with positive PCR for SARS-CoV-2.

Newborns born to mothers with SARS-CoV-2 infection

During the study period, there were a total of 549 deliveries, of which nine were to mothers with SARS-CoV-2 infection (1.63% of deliveries). Although 66% (6/9) were asymptomatic, they were positive by PCR on admission, and the remaining 33% (3/9) had symptomatology of COVID-19 infection. One of the mothers had a mild fever, and two had a high fever and respiratory symptoms. Regarding the type of birth, 77.77% were vaginal deliveries, and 22.22% were cesarean sections, which corresponded to the two mothers with severe symptoms due to their clinical situation.

There was no difference in the distribution by sex: 55.55% of the newborns were male, and 44.44% were female.

All newborns were hospitalized together and kept isolated in the family room with the mother and father during the entire hospitalization. The PCR positivity rate of the fathers who remained in the room with the mother and newborn was 88.89%.

Before hospital discharge, all newborns underwent two PCRs for SARS-CoV-2: one at birth and one at 48-72 hours of life. All PCRs performed on the newborns were negative. None of the newborns presented complications, and all were discharged at 48-72 hours of life. Of the newborns, 88.89% were exclusively breastfed at discharge, and one newborn was artificially breastfed (born by cesarean section at 36 weeks of gestation to a mother with symptoms) (Table 1).

Children admitted for COVID-19

Regarding pediatric patients admitted with positive PCR for SARS-CoV-2 (excluding the neonatal period), no differences in sex distribution were observed; ages ranged from 2 months to 12 years, with a mean age of 4.05 years. It should be noted that the first pediatric patient with this diagnosis was admitted in July 2020. In the Pediatrics service, there were a total of 262 admissions during the study period, so patients with COVID-19 accounted for 3.43% of pediatric admissions. During this period, a total of 802 patients with a diagnosis of COVID-19 were admitted to the Hospital de Barbastro. Pediatric patients represented 1.12% of the total number of admissions for COVID-19.

The duration of pediatric admissions for COVID-19 ranged from 1 to 5 days, with a mean stay of 2.88 days.

The accompaniment of these patients did not imply an overload of work for the nursing staff or an increase in the risk of contagion, but rather the opposite, since family members collaborated in the care of the patient, minimizing the need for the staff to enter the room (i.e., they took the patient's temperature and transmitted it by telephone, cleaning, and hygiene, among other activities).

All patients had mild symptoms associated with SARS-CoV-2 infection, and none required referral to another center. None of the patients received specific treatment for SARS-CoV-2. Patients receiving therapy during admission were treated for symptoms (antipyretics, analgesics, antiemetics, and intravenous glucose perfusion) or related to the intercurrent process (intravenous antibiotics in infants with febrile urinary tract infection). All patients evolved favorably without developing complications of SARS-CoV-2 disease and did not require respiratory support or transfer to the PICU.

Table 1. Characteristics of newborns and their mothers

	Sex	Gestational age (w+d)	Weight at birth	PCR at birth	PCR > 48 hours	NB clinical picture	Mother clinical picture	Type of delivery	Type of feeding
NB 1	F	38+3	2740 g	Negative	Negative	Asymptomatic	Asymptomatic	Normal delivery	Breastfeeding
NB 2	M	36+1	2580 g	Negative	Negative	Asymptomatic	COVID-19 pneumonia	Cesarean section	Breastfeeding
NB 3	M	38+3	3695 g	Negative	Negative	Asymptomatic	Asymptomatic	Normal delivery	Breastfeeding
NB 4	F	37+2	2600 g	Negative	Negative	Asymptomatic	Asymptomatic	Normal delivery	Breastfeeding
NB 5	F	39+4	3050 g	Negative	Negative	Asymptomatic	Asymptomatic	Instrumented delivery	Breastfeeding
NB 6	F	39+6	3570 g	Negative	Negative	Asymptomatic	Asymptomatic	Instrumented delivery	Breastfeeding
NB 7	M	39+4	3300 g	Negative	Negative	Asymptomatic	Mild symptoms	Normal delivery	Breastfeeding
NB 8	F	39+2	4300 g	Negative	Negative	Asymptomatic	COVID-19 pneumonia	Cesarean section	Breastfeeding
NB 9	M	37+1	2935 g	Negative	Negative	Asymptomatic	Asymptomatic	Normal delivery	Breastfeeding

COVID-19, coronavirus disease 2019; F, female; M, male; NB, newborn; PCR, polymerase chain reaction test for SARS-CoV-2.

Furthermore, none of the patients required a chest X-ray since they showed no complications. Pneumonia was not suspected in any patient, as they remained with adequate baseline oxygen saturation (SaO₂) and no signs of respiratory distress. Blood tests were not performed in all patients but only in those whose age or clinical situation required it.

The most frequent reason for admission was for observation of clinical or analytical evolution (5/10, 50%), followed by social reasons (3/10, 30%) and intolerance to oral feeding (2/10, 20%).

Three asymptomatic patients were admitted for social reasons; i.e., as their parents were also admitted, they requested joint isolation, and this measure was allowed. One 2-month-old infant was admitted for high fever but remained stable with no other complications. This patient's blood test results showed slightly elevated C-reactive protein, with normal PCT (procalcitonin) (6.58 mg/L and 0.12 µg/L, respectively). The complete blood count (CBC) showed lymphocytosis and monocytosis (lymphocytes, 6050/mm³; monocytes, 1680/mm³).

A 3-month-old infant was admitted for mild respiratory symptoms that progressively improved. A 4-year-old patient with hereditary spherocytosis was admitted for a hemolytic crisis secondary to SARS-CoV-2

infection. Blood tests showed C-reactive protein of 32.48 mg/L, PCT of 0.86 µg/L, and lymphopenia of 590/mm³. Furthermore, due to the underlying disease, the patient showed significant hemolysis triggered by SARS-CoV-2 infection, with a total bilirubin of 5.93 mg/dL from indirect bilirubin, lactate dehydrogenase (LDH) of 1835 IU/L, and hemoglobin (Hb) of 9.2 g/dL, with a subsequent decrease to 7.4 g/dL, after which there was a progressive improvement. A 7-month-old infant was admitted for hypoglycemia secondary to feeding refusal caused by COVID-19. Blood tests showed blood glucose values of 47 mg/dL; CBC, C-reactive protein and PCT were within normal range. A 6-year-old female patient admitted for vomiting showed C-reactive protein, PCT, and CBC within normal values. A 6-month-old infant was admitted for intravenous antibiotic therapy for a urinary tract infection. During admission, PCR detected SARS-CoV-2 infection. Blood tests showed C-reactive protein values of 250.55 mg/L and PCT of 2.84 µg/L, an increase attributed to the urinary tract infection and not to COVID-19. The CBC showed leukocytosis (22,400/mm³), 8890/mm³ neutrophils, 9700/mm³ lymphocytes, and 3670/mm³ monocytes, most likely secondary to the urinary tract infection. Finally, a 6-year-old patient was

Table 2. Characteristics of pediatric patients admitted for SARS-CoV-2 (severe acute respiratory syndrome coronavirus type 2) infection

	Sex	Age at admission	Length of stay (days)	Reason for admission	Severity	Need for oxygen	Need for intensive care
Patient 1	F	3 months	1	Surveillance for RF	Mild	No	No
Patient 2	M	6 months	3	Surveillance for RF	Mild	No	No
Patient 3	F	6 years	1	Food intolerance via the oral route	Mild	No	No
Patient 4	F	2 months	1	Surveillance for RF	Mild	No	No
Patient 5	M	12 years	5	Social	Mild	No	No
Patient 6	M	5 years	5	Social	Mild	No	No
Patient 7	M	7 months	1	Food intolerance via the oral route	Moderate	No	No
Patient 8	F	4 years	5	Surveillance for RF	Moderate	No	No
Patient 9	F	6 years	4	Social	Mild	No	No
Patient 10	M	6 years	2	Surveillance for RF	Moderate	No	No

F, female; M, male; RF, risk factor.

admitted for fever, altered general condition, vomiting, and abdominal pain related to SARS-CoV-2. The patient also showed alterations in blood tests: pro-B-type natriuretic peptide (proBNP) values of 273 ng/L, D-dimer of 1144 ng/mL, C-reactive protein 100.52 mg/L, and PCT 0.88 ng/L. The CBC showed lymphocytosis and monocytosis (lymphocytes 6050/mm³, monocytes 1680/mm³), and no other findings. The patient evolved favorably and progressively with symptomatic antipyretic treatment and normalization of laboratory tests before discharge (Table 2).

Discussion

In contrast to adults, COVID-19-related admissions in pediatric patients did not represent a work overload in our unit since they only represented a small percentage of the number of admissions to the pediatric ward (1.12%). These data are similar to those published in other studies^{2,8,9}, in which children admitted presented mild SARS-CoV-2 infections more frequently. In these studies, the most frequent reason for admission in most cases was monitoring⁸, similar to that observed in our study.

As for blood test findings, these were diverse in our patients. We did not always find elevation of acute phase parameters or alterations in the CBC. However, the small sample size was one of the main limitations of the study. The studies available to date conclude that

there are no specific blood alterations in children affected by COVID-19, although lymphopenia is frequent, especially in severe forms of the disease¹⁰. This finding was observed in only one of our patients.

Co-admission and accompanied admissions have facilitated the care of pediatric patients, which has been favorable for both the patient and the healthcare staff.

In our sector, the incidence of deliveries of patients with SARS-CoV-2 infection has been low, and most of the mothers were asymptomatic, detected by PCR testing on admission. Two pregnant women were previously diagnosed with mild respiratory symptoms but no complications. However, those with moderate-severe symptoms (COVID-19 pneumonia) required cesarean section due to their clinical situation. All symptomatic and asymptomatic mothers were admitted with the father and the newborn in our study. All newborns remained asymptomatic, and no vertical transmission was observed in any case. These data are similar to those published in other series, in which most of the newborns had negative PCR and remained asymptomatic². With the available data, we can conclude that—considering the appropriate measures—mother-to-child transmission is low^{11,12}.

Co-hospitalization, together with the support offered by our healthcare staff, has facilitated the successful establishment of breastfeeding with very satisfactory results, both for the healthcare personnel and for the families.

Admissions with COVID-19 during this period, contrary to what occurred in adults, did not imply an overload of work in our unit since they represented a small percentage of the total number of admissions to the pediatric ward. Furthermore, none of the patients presented complications derived from SARS-CoV2 infection or required specific treatment or transfer to the ICU.

Vertical transmission was excluded in all newborns born to mothers with SARS-CoV2 infection, regardless of maternal symptoms or type of delivery. Co-admission with a companion facilitated maternal and infant care and allowed breastfeeding to be established in almost all cases.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author has this document.

Conflicts of interest

The authors declare no conflict of interest.

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