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Clinical Profile and Outcome of Neonates and Children Diagnosed with COVID-19 in Tertiary Level Teaching hospital in Eastern Nepal

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ABSTRACT

Introduction: COVID-19 is an acute respiratory infection caused by SARS-CoV-2. The disease spread all over the world so rapidly that WHO has declared global health emergency and pandemic on 30 January 2020.Neonates and children are affected less frequently as compared to adults. Impact and outcome of COVID on neonates are unknown and a major public health concern. However, evidence on neonatal covid is still limited.

Objetives: To explore the clinical profile and to find outcome of neonates and children with COVID-19.

Methodology: This was an observational, descriptive study done in the pediatric department. Sixty-three neonates and children up to the age of 14-year, diagnosed as Covid-19 by RT-PCR and antibody were included.

Results: Sixty-three neonates and children were admitted in PICU, NICU and COVID ward in BMCTH. Thirty-five (56%) were male with predominant age group of 10-14 year (20,31.7%). Children mostly presented with fever (48,76.2%), cough (34,54%) and shortness of breath (24,38.1%). Nine (14.3%) newborns developed late onset neonatal Covid-19 with 6 (66.7%) were term and AGA while 3(33.3%) were preterm and LBW. They presented with fever (5,55%), respiratory distress (5,55%), cough (2,22.2%). Jaundice (22.2%) and cyanosis (11.1%). Respiratory (42,66.7%), gastrointestinal (28,44.5%) and neuromuscular (13, 20.6%) were commonly involved system. Mild, moderate and severe categories of disease were 11 (17%) , 34 (54%)and 18(29%) respectively . 60 (95.2%) children survived and three (4.8%) children died. Average LOS was 4.85 days(median;4days). Eight (12.7%)children developed MIS-C.

Conclusion: COVID-19 presentation in children ranged from mild to severe disease with low mortality. Fever, cough and difficulty in breathing were common features in children while fever, difficulty in breathing and sepsis in neonates.

INTRODUCTION

Corona virus disease 2019 (COVID-19) is an acute respiratory infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The disease is originated from Wuhan, China in January 2020 and spread all over the world so rapidly that the world health organization (WHO) has declared global health emergency and pandemic on 30 January 2020.[1,2] Peoples of almost all countries of the world are affected by COVID-19. Neonates and children are affected less frequently as compared to adults. They are mostly asymptomatic (40-71.9%) or experience clinically mild disease.[3,4,5] Although severe disease in children does occur, mortality is around 0.2-2.3%. [3, 5] All age groups of children are affected equally without gender difference. Children with COVID-19 present with symptoms of fever, persistent cough, shortness of breath, body ache, headache, sore throat, abdominal pain, vomiting, diarrhea, anorexia and loss or change to sense

smell, taste.[6,7,8] Similarly neonates present with fever, respiratory distress, poor feeding, lethargy, cough, cyanosis.[9] Transmission of disease occurs through respiratory droplets produced when an affected person sneezes or coughs.[10] Incubation period ranges from 1 to 14 days with median 5 days.[11, 12, 13]

Diagnosis of the disease is confirmed by viral testing. Real-Time polymerase chain reaction (RT-PCR) remains the only specific method of diagnosis even if radiologic findings are suggestive of COVID-19 on chest radiograph or computerized tomography (CT) scan of chest. There are some radiological and hematological findings such as serum antibodies that may help indicate COVID-19, even though they are not very specific. Pulse oximetry, arterial blood gas (ABG) analysis, complete blood count (CBC), coagulation profile, renal function test (RFT), liver function test (LFT), C-reactive protein (CRP) and serum ferritin are other investigations for the management of the disease.

Severity of illness is based on the presenting symptoms and categorized into asymptomatic or mild, moderate (pneumonia) and severe (severe pneumonia and critical disease (Shock, acute respiratory distress syndrome (ARDS), multisystem inflammatory syndrome in children (MIS-C).[14] In case of neonates, severe disease are those which meet at least two of the following: (1) any of hyperthermia (>37·5°C), apnea, cough, tachypnea, respiratory distress or recession, supplemental oxygen requirement, poor feeding or vomiting, or diarrhea; (2) any of low white blood cell count, low lymphocyte count or raised C-reactive protein and (3) abnormal chest x-ray according to Chris Gale et al.[15]

Age less than 2 years, obesity, chronic lung disease, prematurity, sickle cell disease, congenital heart disease (CHD), diabetes, genetic, metabolic conditions, immunosuppressant conditions are risk factors for serious illness. Suspected COVID -19 or lab confirmed (RT-PCR) patient, dyspnea (SPO2<94% at room air) and symptom suggestive of higher acuity such as chest pain, chest tightness, dizziness, confusion, altered mental status are criteria for hospital admission.[16]

During the pandemic, Specific Covid-19 hospital, Isolation wards were established for the management of the disease mostly for adult patients in Nepal. We started a pediatric intensive critical care, neonatal intensive care unit and covid ward for children in Birat Medical College Teaching Hospital, Morang in the eastern Nepal. As the disease emerges as pandemic, more evidences about the epidemiology, mode of transmission, clinical profile, outcome were needed. Objectives: To explore the clinical profile and to find outcomes of the neonates and children with COVID 19.

METHODOLOGY

This was observational, descriptive study done in the pediatric intensive care unit (PICU), NICU and COVID ward, Birat Medical College Teaching Hospital (BMCTH) from July2021 to June2022. All the children admitted in Pediatric ICU, NICU and covid ward with positive RT-PCR and antibody were included who gave written and verbal consent. Samples for RT-PCR were taken from the nasal and posterior wall of pharynx while COVID antibody was detected from blood samples. Pulse oximetry, arterial blood gas analysis (ABG), complete blood count (CBC), coagulation profile, renal function test (RFT), liver function test (LFT), C-reactive protein (CRP), serum ferritin, chest radiograph and other investigations were done for the management of the disease. Data were collected by using specifically designed performa after taking written and oral consent. Ethical clearance was done from the Institutional Review Committee, BMCTH. Data entry was done in Microsoft offices excel worksheet and analyzed by using IBM SPSS version 26. Frequency, median, mode, interquartile range were used for descriptive study.

RESULTS

Out of 63 children, most common affected age group was 10-14 year (20, 31.7%) followed by 1-5 year (14, 22.2%). Male (35, 56%) were affected more than female (28, 44%). Fever (48, 76.2%), cough (34, 54%) and shortness of breath (24, 38.1%) were common symptoms. The other features were noisy breathing (5, 7.9%), throat pain (4, 6.3%), seizure (5, 7.9%). System wise, respiratory (42, 66.7%), gastrointestinal (28, 44.5%) and neuromuscular (13, 20.6%) were commonly involved system. Most commonly admitted children were moderately (34, 54%) affected followed by severe (18, 29%) and mildly (11, 17) affected. Average length of hospital stay (LOS) was 4.85 days (median=4) as shown on [Table 1]. Eight (12.7%) children developed multisystem inflammatory syndrome in children (MIS-C) with predominantly male (7,87.5%). Three (37.5%) children received dexamethasone while one (12.5%) received intravenous immunoglobulin (IVIg) for the management of MIS-C as shown on [table 3]. Sixty (95.2%) children were survived and three (4.8%) died. [Table 4]

Nine (14.3%) newborns developed late onset neonatal Covid-19 with six (66.7%) male and three (33.3%) female. Similarly, six (66.7%) were term and AGA while three (33.3%) were preterm and LBW with average weight 2.85 kg and average age 20 days. They presented with fever (5, 55%), respiratory distress (5,55%), cough (2, 22.2%). Jaundice (22.2%) and cyanosis (11.1%). Eight (88.9%) neonates needed NICU admission and one (11.1%) needed ward admission. Six (66.7) were severely affected and three (33.3) were moderately. Eight (88.9%) needed respiratory support in the form of oxygen mostly via facemask, hood box, bubble CPAP and HFNC. One neonate needed mechanical ventilation. Average length of hospital stay was 7.3 days (median -4 days) table 2. Eight (88.9%) survived and one (11.1%) died as shown in table 4.

Table 1: Demography of Children with COVID-19

Characteristics	Number(%)
Age	
<1 months	9(14.3)
1-12 months	11(7.5)
1-5 year	14(22.2)
5-10 year	9 (14.3)
10-14 year	20(31.7)
Sex	
Male	35(56)
Female	28(44)
System Involved	
Respiratory	42(66.7)
Gastrointestinal	28(44.5)
Neuromuscular	13(20.6)
Symptoms	
Fever	48(76.2)
Cough	34(54)
Shortness of Breath	24(38.1)
Noisy Breathing	5(7.9)
Throat Pain	4(6.3)
Seizure	5(7.9)
Others	24(38.1)
Severity	
Mild	11(17)
Moderate	34(54)
Severe to Critical	18(29)
Admission Pattern	
PICU	36(57.1)
Covid Ward	27(42.9)
Length of hospital Stay(LOS)	4.8 days (Median=4 days)
MIS-C	8(12.7)
Respiratory support	
Needed	32(50.8)
Not Needed	31(49.2)

Table 2: Demography of Newborn with COVID-19

Characteristics	Number(%)
Total Newborn	9(100)
Sex	
Male	6(66.7)
Female	3(33.3)
gestational Age	
Term	6(66.7)
Preterm	3(33.3)
Birth Weight	
AGA	6(66.7)
LBW	3(33.3)
Average weight	2.85 Kg
Symptoms	
Fever	5(55.5)
Cough	2(22.2)
Shortness of breath	5(55.5)
Jaundice	2(22.2)
Cyanosis	1(11.1)
Pneumonia	3(33.3)
Sepsis	9(100)
Severity	
Mild	0(0)
Moderate	3(33.3)
Severe	6(66.7)
Admission Pattern	
NICU	8(88.9)
COVID Ward	1(11.1)
Length of hospital Stay(LOS)	7.33 days (Median;4)
Respiratory support	
Needed	8(88.9)
Not Needed	1(11.1)

Table 3: Demography of children with MIS-C

Characteristics	Number(%)
Mean age	3.38 year (Median=1.42)
Sex	
Male	7(87.5)
Female	1(12.5)
Mean weight	13.06 Kg (Median=9.75)
System Involved	
Respiratory	7(87.5)
Gastrointestinal	5(62.5)

Table 3 Continue...

Symptoms	
Fever	7(87.5)
Cough	3(37.5)
Shortness of Breath	6(75.0)
Others	3(37.5)
Admission Pattern	
PICU	5(57.1)
Covid Ward	3(42.9)
Length of hospital Stay(LOS)	8.50 days (Median=7 days)
Respiratory support	
Needed	5(62.5)
Not Needed	3(37.5)
CRP	
Increased	7(87.5)
Not Increased	1(12.5)
Treatment	
Dexamethasone received	3(37.5)
IVIg Received	1(12.5)

Table 4: Outcome of Children and neonates with COVID-19

Characteristics	Number (%)
Children	
Survival	60(95.2)
Death	3(4.8)
Neonates	
Survival	8(88.9)
Death	1(11.1)

DISCUSSION

Corona virus disease 2019 (COVID-19) is an acute respiratory infection caused by SARS-CoV-2. The disease spreaded all over the world so rapidly that WHO has declared global health emergency and pandemic on 30 January 2020.[2] As the disease emerges as pandemic, more evidence about the clinical profile and outcome are required. Impact and outcome of COVID on neonates are unknown and a major public health concern. However, evidence on neonatal covid is still limited.

According to previous study, all age groups of children are affected equally without gender difference.[17] However, in our study most common admitted children were age of 10-14 year (20, 31.7%) followed by 1-5 years (14, 2.2%) and male children (35; 56%) were commonly admitted as compared to female (28; 44%). Sayeeda Anwar et al from Bangladesh reported that maximum patients (30.6%) were of 11-15year old and most of them were male.[18] Similarly, Nagaraj MV et al also reported majority of children were male (52.5%).[19]

Initially it was thought that the disease is acute respiratory illness and affects the respiratory system mainly but it affects other systems also. In our study, the most commonly involved systems were respiratory (42, 66.7%) followed by gastrointestinal (28, 44.5%) and neuromuscular (13, 20.6%). Karthi Nallasamy et al observed that respiratory symptoms were predominant followed by gastrointestinal symptoms.[20] Respiratory symptoms are predominant due to angiotensin-converting enzyme 2(ACE2) receptor commonly expressed on type II alveolar epithelial cells in lung though which SARS-CoV-2 enters the cells.

Out of 63 children, 36 (57.1%) children were admitted in PICU, NICU and 27 (42.9%) were admitted in Covid ward. 32 (50.8%) children needed respiratory support in the form of oxygen mostly via nasal prongs, facemask, bubble CPAP and HFNC. One neonate needed mechanical ventilation.

In our study, the rate of PICU admission was higher than the literature but this is due to institute policy. Initially all patients of covid were admitted in PICU and NICU. The rate of PICU admission was 2.8-8% in the recent study.[17]

Most commonly presenting complaint was fever (48, 76.2%) followed by cough (34, 54%) and shortness of breath (24, 38.1%). The other complains were noisy breathing (5, 7.9%), throat pain (4, 6.3%), seizure (5, 7.9%), sore throat, conjunctivitis, weakness, myalgia, body ache. nasal discharge. Albulabi W et al from Saudi Arabia also reported that fever was the most observed symptom (69%), followed by cough (34.3%).[17] In retrospective study by Preeti Singh et al from northern India, the most common presentation was fever followed by cough and fast breathing.[21] Observational studies across the world have reported similar frequency of symptom. A systematic review of 27 studies showed, fever to be present in half (41%–58%) followed by cough (39%–51%) and rapid breathing (6%–17%).[22]

In our study most commonly admitted children were of moderate (34, 54%) in disease severity followed by severe (18, 29%) and mild disease (11, 17%) based on the WHO COVID-19 clinical management Living guidance 25 January 2021 disease severity categories.[14] In the recent literatures, the severe disease ranges from 7% to 65%.[19, 23, 24]

Length of hospital stay (LOS) of covid-19 was average 4.85 days (median; 4 days) while in newborn length of stay was average 7.33 days(median; 4days). A systematic review and data synthesis of 52 studies by Rees et al reported that the median length of hospital stay(LOS) ranged from 4 to 53 days within China, and 4 to 21 days outside of China.[25]

In this study, 60 (95.2%) children survived and three (4.8%)died out of 63 children. Lara S Shekerdemian et al reported that the overall case fatality rate in the cross-sectional study was 4.2% up to the time of the report.[26] Preeti Singh et al from north India also reported that the mortality rate of patients with SARS-CoV-2 was 11.4% (29/255).[21]

In our study eight (12.7%) children developed MIS-C. A multicenter cohort from Israel by Itai Shavit et al reported 40.5, 45.3 and 14.2 percentages of children developed MIS-C during the alpha, delta and omicron variant waves respectively.[27] Similarly, Swann, O.V., Pollock, L., Holden, K.A. et al showed that, 5.6% (91/1617) of symptomatic children and young people developed multisystem inflammatory syndrome in children (MIS-C).[28]

Neonates: In our study, nine (14.3%) newborns developed late-onset neonatal COVID-19 with six (66.7%) term and three (33.3%) preterm. Similarly, six (66.7%) newborns were appropriate for gestational age (AGA) and three (33.3%) were low birth weight with average weight 2.85 kg and average age 20 days. Preterm birth (39%) and intrauterine growth retardation (10%) are neonatal outcome of COVID-19.[29] A systematic review with nine studies and 92 cases showed 63.8% preterm delivery and 42.8% low birthweight.[30]Another systematic review by Ziyi Yang, Min Wang, Ziyu Zhu & Yi Liu reported preterm birth (21.3%) and low birth weight (5.3%) as fetal and neonatal outcomes.[31]

The neonates presented with fever (5, 55%), respiratory distress (5, 55%), cough (2, 22.2%), Jaundice (2, 22.2%), cyanosis (1, 11.1%), sepsis and pneumonia. The findings are similar to the study by Zeng L, Xia S, Yuan W, et al with fever, shortness of breath, cyanosis, sepsis.[9] Similarly a meta-analysis of 13 publications (n = 114) reported fever, preterm births, neonatal pneumonia, and respiratory distress syndrome in infants born of COVID-19-positive mothers.[31]

Neonatal Jaundice may be presentation of covid-19 or may be a complication of prematurity. Six (66.7%) newborns were severely affected while three (33.3) were moderately affected. 88.9% (8) newborns needed NICU admission and respiratory support which is similar to multicenter study by Oncel MY et al and systemic review by Smith V, Seo D, Warty R, Payne O, Salih M, Chin KL, et a with NICU admission rate of 86.4% and 76.92% respectively.[30,32]

Eight (88.9%) newborns survived while one (11.1%) preterm died due to multi-organ failure. Death of the newborn would be due to COVID or complication of prematurity. A systemic review with nine studies and 92 cases showed there was neonatal death (1.2%).[30]

CONCLUSIONS

COVID-19 presentation in children ranged from mild to severe disease. Respiratory was most common involved system. Fever, cough and difficulty in breathing were common features in children while fever, difficulty in breathing and sepsis in neonates. Thirteen percent children developed MIS-C. Mortality was noted low that is 4.8% in children and 11.1% in neonates

RECOMMENDATIONS

1) For prevention of neonatal transmission of COVID 19, precaution should be taken during delivery and neonatal care.
2) Immunization of the children with COVID vaccine to prevent morbidity and mortality of children.

LIMITATIONS OF STUDY

This is a single centre study in private set up and there was low sample size.

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CONFLICT OF INTEREST None

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