who were followed up at 12 months were on metformin with MDI, metformin with basal insulin and metformin monotherapy, respectively.

During the one year follow-up, the HbA1c was 10.5% (at baseline), 8.5% (at 6 months) and 8.1% (at 1 year). Correspondingly, the BMI z-scores were +3.9 (at baseline), +3.7 (at 6 months) +3.8 (at 12 months). Two episodes of hypoglycemia observed during the study period. Both episodes occurred early morning with autonomic symptoms and both subjects were on insulin therapy). On follow-up, two children with hypertension had normal blood pressure, two adolescents had reduction in LDL levels, and one child with diabetic nephropathy had control of microalbuminuria and no adverse reactions to therapy.

In our series, 28.5% were asymptomatic and 14.2% presented as emergencies. It is very important that pediatricians recognize existence of hyperosmolar non-ketotic coma [8] as a diabetic emergency in obese adolescents requiring aggressive fluid therapy vs DKA where over-hydration results in cerebral edema. We observed significant complications at diagnosis, endorsing ISPAD guidelines which recommend early screening of vascular complications in T2DM [3]. Asymptomatic phase results in prolonged exposure to hyperglycemia and early complications. On follow-up, safety of metformin, good improvement in HBA1C, static BMI *z*-scores observed. Similar safety profile, reduction in BMI *z*-score of -0.045 and a reduction of HbA1C of -1.3 has been reported [9,10]. Strengths of our study include management as per ISPAD guidelines and one year follow-up period. Inability to quantify adherence of lifestyle measures and 33.3% drop-out at 12 months are limitations in our study.

Adolescents with T2DM have heterogeneous presentation, significant comorbidities and complications; familial clustering and good biochemical response to metformin therapy observed.

Contributors: The study was conceptualized by HKP, SW and ST; study design was framed by HKP and KN. UG: data collection; HKP, SW, UG: analysis; HKP, KN, SW, ST: clinical management of cases. All authors approve the final manuscript.

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Outcome of Covid-19 Positive Newborns Presenting to a Tertiary Care Hospital

Neonatal data regarding SARS-CoV-2 is sparse from India. On review of hospital records from April- August, 2020, 18/423 (4.25%) neonates were SARS-CoV-2 RT-PCR positive. 15 (83.3%) neonates recovered and 3 (16.6%) succumbed. Only 50% of the positive babies had positive mothers/ caretakers, a contact could not be traced in others.

Keywords: *Contact tracing, Horizontal transmission, Vertical transmission.*

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The symptoms of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) positive cases are highly variable and within the paediatric population, neonates and infants are more severely affected. Neonates can acquire infection vertically during delivery or horizontally from caregivers. As neonatal data on the disease is limited, we, herein, share our experience.

Medical records of all out-born neonates presenting for admission to the NICU from April 1 to August 31, 2020 were reviewed. Clearance from institutional ethics committee was taken.

For planned referrals and untested neonates in the

emergency ward, mother and baby's SARS-CoV-2 reverse transcriptase-polymerase chain reaction (RT-PCR) of nasopharyngeal swab was requested. If positive, babies were transferred to the COVID19 positive NICU and managed as per standard NICU protocols. Repeat testing for SARS-CoV-2 infection was carried out as per Indian Council of Medical Research/ Ministry of Health and Family Welfare guidelines every 5-7 days, if baby remained symptomatic or developed new onset symptoms. Expressed breast milk of SARS-CoV-2 negative (RT-PCR of nasopharyngeal/ throat swab) mothers donated to the hospital human milk bank was administered to stable feeding babies. When mothers were available and the baby's clinical condition was satisfactory, direct breastfeeding was allowed. Kangaroo mother care (KMC) was not practiced at the time as guidelines regarding KMC in coronavirus disease (COVID-19) were not clear. Data was entered and analyzed on Microsoft Excel.

Of the 423 outborn neonates; 18 (4.25%) tested positive for SARS-CoV-2 by RT-PCR of nasopharyngeal swabs. These included a pair of dichorionic diamniotic twins. Four babies were preterms (youngest weighing 1000 g), and 9 were delivered by caesarian section, with the most common indication being meconium stained liquor. All positive neonates had symptoms warranting neonatal intensive care unit (NICU) admission. Clinical presentation was varied, with respiratory distress being the most common, which could be attributed to neonatal respiratory or cardiac problems. Six babies required ventilation (**Table I**). Fever was the other common symptom, but a focus could not be elicited in any case.

Of interest to note was case 7, first of a pair of twins admitted for meconium aspiration syndrome and late onset *Pseudomonas aeruginosa* sepsis. Baby had persistent thrombocytopenia despite two weeks of appropriate antibiotics treatment, and clearance of bacteria on repeat blood, cerebrospinal fluid, urine and endotracheal cultures. She developed ascites, cholestasis, elevated lactate dehydrogenase (13,700 U/L), deranged coagulation profile and elevated Interleukin-6 (13.58 pg/ mL). She required invasive mechanical ventilation, inotrope support, intravenous immunoglobulin and low molecular weight heparin. Upon retesting, baby continued to show SARS-CoV-2 positivity till day 21, and died on day 28. Multisystem inflammatory syndrome (MIS-C) was suspected in this case [1,2].

Fifteen neonates survived and were discharged home, and three died after 2-28 days of stay. Median (IQR) duration of hospital stay was 10 (9,16) days. Retesting was done as per protocol for 14 babies (remaining three became asymptomatic, and one died). Eight babies were negative on first retest, one on second retest (one succumbed before second) and four continued to be positive after third retest. Of the four babies who continued to test positive, three were critically sick and required ventilation and intensive care stay for more than 2 weeks.

Upon contact-tracing, 9 mothers and 1 caretaker (paternal aunt) were positive. Three of the positive mothers tested negative prior to delivery but tested positive on re-screen. Only one mother was symptomatic with fever. No contact was identifiable in 8 babies which may imply low viral load in the caregivers.

We, herein, highlight the clinico-demographic details and outcomes of SARS-CoV-2 positive neonates presenting to the outborn unit of a tertiary care pediatric hospital. All positive neonates in our study were symptomatic and respiratory symptoms were the most common. Fever was seen in one-sixth, unlike children and adults where fever is a predominant symptom [3-6]. Like older children, the overall prognosis of SARS-CoV-2 infection in neonates is better than adults [3-8], unless they have other co-morbidities e.g., total anomalous pulmonary various connection or polycystic kidney disease with renal failure seen in our series. Though systematic reviews attribute neonatal symptoms to COVID-19, most of our cases had symptoms which could be explained by neonatal illnesses [5].

A limitation of our study was that viral titers were not done. Neonates who remained PCR-positive for a long duration may imply a higher viral load. Although the frequency of SARS-CoV-2-positive neonates is extremely low, a significant

Table I Diagnosis, Treatment and Outcome of SARS-CoV-2 Positive Neonates (*N*=18)

Characteristics	*No. (%)*
Diagnosis[a]	
Respiratory distress	5 (27.8)
Meconium aspiration syndrome	3 (16.7)
Respiratory distress syndrome	1 (5.5)
Aspiration pneumonia	1 (5.5)
Fever	3 (16.7)
Seizures (metabolic)	2 (11.1)
Neonatal jaundice	2 (11.1)
Management [b]	
Respiratory management	
Oxygen therapy	1 (5.5)
Non invasive ventilation	2 (11.1)
Invasive ventilation	4 (22.2)
Inotropes	2 (11.1)
Antibiotics	9 (50)
Blood products	3 (16.7)
Intravenous fluids	7 (38.9)
Phototherapy	3 (16.7)
Supportive therapy	4 (22.2)
Outcome	
Length of hospital stay, d[c]	10 (9,16)
Mortality	3 (16.7)

[a]*Feeding difficulty, Pierre Robin Sequence, Total Anomalous Pulmonary Venous Communication (TAPVC), Hirschsprung's Disease, Polycystic Kidney Disease with Acute Kidney Injury (PKD), Diarrhea;* [b]*Intravenous immunoglobulin and low molecular weight heparin in one baby.* [c]*values in median (IQR).*

proportion of the affected neonates requiring intensive care and mechanical ventilation suggests that the disease in neonates is more severe than older children [3-8], which correlates with our study as well.

Contributors: BS, SR, VD, SP, MB: conceived, designed the study, finalized the manuscript; BS,VD,SR: data collection, data analysis, writing manuscript; BS,VD,SR,SP: data collection, data analysis, managed the babies; BS,VD,SR,SP: Literature search, interpretation of data, writing manuscript.
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Hematopoietic Stem Cell Transplantation for Children With Inborn Errors of Immunity

This is a retrospective analysis of clinical characteristics of children with inborn errors of immunity who underwent hematopoietic stem cell transplant (HSCT). Although the mean age at diagnosis was 24.4 months, it was 51.9 months at HSCT. There is an urgent need to improve awareness, expand donor registries and initiate newborn screening for inborn errors or immunity.

Key words: *Primary immune deficiency disorders*.

Inborn errors of immunity or primary immune deficiency disorders (PIDDs) occur with a frequency of 1 in 5000 to 1 in 1000 [1], and are frequently misdiagnosed resulting in avoidable morbidity and mortality [2]. Diagnostic tests and hematopoietic stem cell transplant (HSCT) are not uniformly accessible [3].

Government Medical College, Kozhikode, a tertiary care hospital in Kerala, and CSIR Institute of Genomics and Integrative Biology, Delhi have been conducting a program on primary immune deficiency disorders over the last five years. Although HSCT is often the only curative option, we are dependent on centers outside the state. The study was designed to document the clinical characteristics of children who underwent HSCT for an inborn error of immunity.

Hospital records of children with PIDDs who attended the immune deficiency clinic from June, 2015 to May, 2020 were obtained and data of those who underwent HSCT were analyzed. Only children who had completed at least 3 months post-HSCT were included. Variables studied included age at onset diagnosis and at HSCT, gender, relationship with stem cell donor, time since HSCT and diagnostic genetic or phenotypic marker. Quantitative variables were entered on an Excel data sheet and frequency and associations calculated using the statistical package Epi Info (version 7.2.3.1).

HSCT was performed in 13/67 (19.4%, 11 boys). The indications included Wiskott-Aldrich syndrome (4, 30.8%), and leukocyte adhesion deficiency, severe combined immune deficiency, and *X*-linked agammaglobulinemia in two each (15.4%) congenital neutropenia Fanconi anemia, and hyper IgM syndrome were diagnosed in one child each. The median (IQR) age at diagnosis of children who underwent HSCT was 14 months (first quartile, III quartile). The median (IQR) age at HSCT was 27.5 (first quartile, III quartile) months and the median (IQR) interval between diagnosis and HSCT was 7 (first quartile, III quartile) months. Recurrent pneumonia was the commonest presenting feature in 7 (54%) children, followed by frequent skin and soft tissue infections in 6 (46%) and recurrent otitis media in 4 (30.8%). Frequent abscesses, recurrent diarrhea and bleeding were presenting features in 2 (15%) children each. HSCT was done in an asymptomatic child with Fanconi anemia after his elder sister succumbed to the same disease.

Of the 13 children who underwent HSCT, 9 (69%) children had a matched sibling donor and 2 children each (15%) had matched unrelated donor transplants (MUDs) [4] and haploidentical stem cell transplants. Reduced intensity conditioning (RIC) [5] with treosulfan and fludarabine was