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Surgical Neonates During Covid -19 Era in A Tertiary Children Hospital in Kathmandu Nepal

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ABSTRACT

Introduction: Neonatal period is the most vulnerable age group of human life and performing any surgery in neonatal age group is itself most challenging and demanding. Neonatal surgery almost always involves emergency neonatal surgical conditions, especially congenital anomalies.

Aims: This study aims to evaluate outcome of surgical neonate admitted in the surgical intensive care unit (SICU) in the COVID -19 era compared to the preceding year

Methods: This retrospective cross-sectional analysis was carried out on neonates admitted to surgical intensive unit (SICU) from Pre- COVID [April 13 2019 - April 12 2020 (2076 B.S)] to extended COVID lockdown era [April 13 2020 - April 12 2021 (2077 B.S)] to convalescence period [April 13 2021 - April 12 2022 (2078 BS)]. Information on admission, demographics, diagnosis, operation procedures, SICU stay, and outcomes were retrieved from SICU and operation record files.

Results: A total of 535 neonates were admitted in SICU in three consecutive years. Amongst them, two surgically stable neonates were immediately transferred to NICU due to associated severe medical co-morbidities. Excluding these two neonates, a total of 533 neonates were studied during three years, of them, neonates admitted were between 160 (30%) [April 13 2019 - April 12 2020 (2076 B.S.)] in Pre- COVID era; 189 (35.7%) [April13 2020 - April 12 2021 (2077 B.S)] in extended lockdown era and 184(34.3%) [April 13 2021 - April 13 2022 (2078 BS)] during convalescence period. COVID positive neonates underwent surgical intervention and recovered well. Unfortunately, four COVID positive neonates expired [gastroschisis (3) and tracheo-oesphageal fistula (1)].

Conclusion: Despite the COVID pandemic and limitation in healthcare human resources, load of surgical neonate cases remained the same with observed slight decline in the neonatal mortality which was envisioned to be due to the strict adherence to aseptic protocol, hence such practice of taking precautions against sepsis is highly recommend at all times.

Keywords: *COVID-19, Mortality, Surgical neonates*

INTRODUCTION

Neonatal period is the most vulnerable age group of human life and performing any surgery in neonatal age group is itself most challenging and demanding. Neonatal surgery almost always involves emergency neonatal surgical conditions, especially congenital anomalies. [1]

Globally pandemic COVID -19 as declared by WHO,[2] has produced physical, psychological, social and financial problems worldwide. Health sector is the most affected sector worldwide. In a developing country like Nepal where, healthcare system is still in a developing phase can easily be affected by any kind of overwhelming problems. Healthcare system of Nepal has been hit rock-bottom by COVID -19. Even though incidence of COVID -19 infection in neonatal age group is not very high, but chaos brought by COVID -19 in the entire nation, in addition to considerable load

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of neonate and inadequate resources in their management continue to be an unconquerable challenge for paediatric surgeon in our part of world.

We aim to review the outcome of surgical neonates in the COVID -19 era as compared to the preceding year in surgical intensive care unit (SICU).

METHODS

All the neonates admitted in Surgical Intensive Care Unit (SICU) at Kanti Children Hospital (KCH) were retrospectively reviewed between April 14 2019 (Baisakh 2076 B.S.) to Chaitra 2078 B.S (3 years duration). April 13 2019 - April 12 2020 (2076 B.S.) is taken as pre-COVID era, while April13 2020 - April 12 2021 (2077 B.S) is considered as a COVID - lockdown era and April 13 2021 - April 13 2022 (2078 B.S.) is considered as a convalescence era.

The following were recorded for each patient: age at the time of presentation, sex of patient, weight of patient, diagnosis of disease, duration of hospital stay and immediate outcome were documented and analyzed. Similarly, some resources of KCH were arbitrarily examined like number of staffs, bed available during COVID time.

Data were assessed using the hospital information systems (SICU record books, OT register) and fed into an Excel (Microsoft Corporation, Redmond, WA, USA) datasheet. Descriptive statistics were performed with the same software. Chi square test and student-t test were used for statistical calculation.

Inclusion criteriaBabies less than 28 days old who were admitted in Surgical Intensive Care Unit during this period were selected.

Neonate who died or went on LAMA on the same day of admission

Exclusion criteria Neonate who were initially admitted in SICU (surgically stable) but were transferred to Neonatal Intensive Care Unit NICU considering severe associated co morbidities for NICU management.

Outcome was mainly assessed by mortality in SICU and transfer of neonate to surgical ward.

RESULTS

A total of 535 neonates were admitted in SICU in three years. Amongst them, two neonates were immediately transferred to NICU due to associated severe medical co-morbidities (surgically stable). Excluding these two neonates, a total of 533 neonates were studied in three years. Numbers neonates admitted were 160 (30%) in Pre -COVID year to 189 (35.7%) in lockdown period and 184(34.3%) during convalescence period (Table 1).

Male-female neonate ratio was 2.4:1. Average weight of neonate was 2.67 ±0.6 kg (1- 6 kg). Average age of the neonate at the time of admission was 6.9 ±7.2 (Day 1 of life to 28 days). Average SICU stay was 5.7± 4.5 days (1 – 33days), Table 1. While comparing the weight, sex and age of presentation between these three years, there was no statistically significant changes (p value= 0.6, 0.9 and 0.5 respectively) whereas hospital stay between this three years was found statistically significant (p value 0.018), Table 1.

Table 1. Patient characteristics (N=533)

Year	Number of patients	Mean age of patients (days)	Sex of patient (Male-female ratio)	Mean weight of patients (kg)	Mean SICU stay (days)
Pre-covid	160 (30%)	6.98±6.7	2.3:1	2.65±0.6	5.59±4.8
Lockdown	189 (35.5%)	6.88±7.5	2.4:1	2.6±0.6	6.1±4.0
Convalescence	184 (34.5%)	7.1±7.3	2.5:1	2.69±0.6	5.49±4.6
Total	533 (100%)	6.9 ±7.2 (min – max: 1-28)	378 (70.9%): 152(29.1%) [2.4:1]	2.67±0.6 (1-6)	5.73±4.5 (1-33)
p-value		**0.5** NS	**0.9** NS	**0.6**NS	**0.018** S

Student T test is used for statistical calculation, where S= Statistically significant and NS = Statistically not significant

Table 2a. Spectrum of surgically manage neonates

Disease	Pre-covid		Lockdown		Convalescence		Total	p- value*
	A	B	C	D	E	F		
ARM	32	0	37	2	33	4	108	0.41
OA TEF	8	17	9	9	4	9	56	0.10
IA	15	10	19	2	14	4	64	0.58
HPD	9	3	10	1	13	4	40	0.19

NEC	6	4	10	3	7	4	34	0.14
Omphalocele	3	-	1	-	2	-	6	0.92
Gastroschisis	4	7	6	-	3	1	21	0.004
Adhesive obstruction	3	-	-	-	-	-	3	0.00
CDH	-	-	3	-	1	1	5	0.51
Malrotation of gut	2	-	5	1	2	3	13	0.40
IHPS	7	-	10	-	8	-	25	0.46

A= Repair/anastomosis/stoma, B= Post-operative mortality, C= Repair/anastomosis/stoma, D= Post-operative mortality, E= Repair/anastomosis/stoma, F= Post-operative mortality

Chi square test is used for statistical calculation.

ARM= Anorectal malformation, OA TEF= Esophageal atresia with trachea-esophageal atresia, IA= intestinal atresia, HPD= Hirschsprung's disease, NEC= Necrotising enterocolitis, CDH= Congenital diaphragmatic hernia, IHPS: Hypertrophic pyloric stenosis

Table 2b. Spectrum of conservatively managed surgical neonates

Disease	Pre-covid			Lockdown			Convalescence			Total
	A	B	C	D	E	F	G	H	I	
ARM	4	1	-	7	1	2	6	1	1	23
OA TEF	-	3	-	-	4	6	1*	3	6	23
IA	-	1	1	-	2	1	-	2	3	10
HPD	3	-	-	4**	-	-	2	2	1	12
NEC	-	-	-	-	-	2	-	-	2	4
Omphalocele	7	1	1	5	1	1	5	2	2	25
Gastroschisis	-	-	-	-	1	1*	2**	-	1	5
Adhesive obstruction	-	-	-	5	-	-	12	-	-	17
CDH	-	-	1	-	2	1	-	-	2	6
Malrotation of gut	-	-	-	-	-	-	-	1	-	1
IHPS	-	-	-	-	-	-	-	-	-	

A= Conservative, B = LAMA, C= Pre-operative mortality, D= Conservative, E= LAMA, F= Pre-operative mortality, G= Conservative, H= LAMA, I= Pre-operative mortality

*covid case

ARM= Anorectal malformation, OA TEF= Oesophageal atresia with trachea-oesophageal atresia, IA= intestinal atresia, HPD= Hirschsprung's disease, NEC= Necrotising enterocollitis, CDH= Congenital diaphragmatic hernia, IHPS: Hypertrophic pyloric stenosis

Table 3. Miscellaneous neonatal surgical conditions

Year	Bladder exstrophy	Cloacal exstrophy	Tumour	Vitellointestinal duct	Meconium ileus	Duplication cyst	Liver abscess
Pre-covid	2	1	2	1	-	-	-
Lockdown	3	-	4	-	1	-	1
Convalescence	2	1	5	3	-	1	-
Total	7	2	11	4	1	1	1

Table 4: Covid cases during study period (n=9)

Year	Hirschsprung's disease	Malrotation of gut	IHPS	Gastroschisis	SAIO	OA + TEF
Lockdown	2	1*	1*	-	-	-
Convalescence	-	-	-	3#	1	1#
Total	2	1	1	3	1	1

* Means operated cases # Means expired

Table 5: Comparison of mortality

Year		No of patients (n=533)	Mortality	Total mortality	P value
Pre-covid	Operated	137	42	43 (26.8%)	0.199[NS]
	Non-operated	23	1		
Lockdown	Operated	136	18	31 (16.5%)	
	Non-operated	53	13		
Convalescence	Operated	128	31	47 (25.5%)	
	Non-operated	56	16		
Total		533		121 (22.7%)	

NS= Chi square shows statistically not significant

Surgical diagnosis of 533 neonates were :- anorectal malformations: 128 (24%); oesophageal atresia with trachea-esophageal fistula:79 (14.8%)], intestinal atresia:74 (13.9%)], Hirschsprung's disease: 54 (10.1%)], necrotisisng enterocolitis: 38 (7.1%), subacute intestinal obstruction 21 (3.9%), malrotation of gut 15(2.8%), congenital diaphragmatic hernia:12 (2.3%), omphalocele 32 (6%), gastroschisis 27 (5.1%), infantile hypertrophic pyloric stenosis 26(4.9%) and other pathologies in 27 (5.1%). There were no statistically significant demographic difference seen in these neonates between these three years, except for gastroschisis and subacute intestinal obstruction (Table 2a, 2b, 3).

During the study period, COVID positive neonates were 9(2.4%) out of which, 4 were diagnosed in extended lockdown period and 5 in convalescence period. Two COVID positive neonate underwent surgical intervention for Malrotation of gut (1) and hypertrophic pyloric stenosis (1)). Other COVID positive neonates were gastroschisis (3), Hirschsprung disease (2), tracheoesophageal atresia (1) and subacute bowel obstruction (1), Table 4. Among them, four neonates, three gastroschisis and one tracheoesophageal atresia. unfortunately succumbed to death.

Of the 533 neonates, the non-operated neonates forming 132 (24.8%); conservatively managed were 73 (55.3%), neonatal death occurred in 34 (25.7%) and 29 (5.4%) left against medical advice, Table 2b. Surgical intervention were carried in 401(75.2%) Table 5, out of which post-operative mortality occurred in 91(22.7%) whereas remaining 310 (77.3%) were transferred to ward. Thus, overall mortality in SICU was 125 (23.4%). Mortality rate during these three years were 26%, 16.5% and 25.5% respectively and was statistically insignificant (Table 4).

DISCUSSION

Healthcare has been a necessity since antiquity and many changes including techno-rational, technical and managerial have occurred since then for improving quality as well as containing cost of healthcare. With the advent of modern lifestyle, complex communicable condition like COVID -19 and non-communicable diseases are becoming prevalent which require long-term management and complex healthcare interventions.

In a developing healthcare system like in Nepal, which is yet to be organized in terms of current evidence, concepts and best practices, neonatal surgical healthcare is still in primitive stage. The actual data regarding neonatal surgical neonate load in Nepal is not available but this burden is still increasing and contributing significantly to the causal list of neonatal mortality. Despite this rise in neonatal surgical mortality, neonatal surgery fails to receive enough attention and importance in health care policies and surgical neonate remains the most neglected cohort during policy making.

During COVID -19 pandemic, entire nation went through chaos and difficult period in many aspects like health, wealth, healthcare planning etc. Management of surgical neonate was also affected. Even though impact of COVID -19 in newborn is unknown, the pandemic led to limited neonatal surgical services during the period with unmatched increasing burden of neonate and limited healthcare resources, making neonatal surgical management more

challenging as well as demanding.[3] However, direct impact of COVID -19 on neonatal surgical diseases is not known but its indirect impact well verged.

The information gathered from this study almost reflects the neonatal surgical condition of Nepal as this institute is the single Government Tertiary Care Paediatric Hospital in Nepal with fully run COVID paediatric ICU. Even though neonatal surgery is surgical emergency, most of the neonate reached to us around seven days of life. This reason for this delay in presentation presume to be lack of neonatal surgical facility in other part of country, limited paediatric surgeon, unclear complexity of disease itself, poor referral system, lack of antenatal screening etc. Congenital surgical diseases are more common in male neonate than female just like in this study.[4,5] A report by Puri et al. showed that prematurity and low birth babies increases the odds of neonatal surgical mortality by 3.38 and 4.11 times respectively.[7] However, with the advancement in perioperative support system and efficient human resources, this mortality has seen to decrease in high-income countries. Increasing neonate flow with limited healthcare resources availability has a negative impact on surgical outcome as well as will provide quality-less service. Congenital anomalies affected significantly in higher proportion in male babies than their female counterparts just like in this study.[6]

Incidence of neonatal surgical diseases and COVID -19 doesn't have any direct association but COVID pandemic may jeopardize their management indirectly. Neonatal surgical diseases were found to be similar in this study in terms of incidence, hospital admission and management and outcome. Anorectal malformations (ARM) and gastrointestinal atresias including oesophageal atresia, were mainly met. Few of the studies did show similar trend with ARM and intestinal atresias being the most common neonatal surgical diseases in developing countries. Mortality rate in ARM in present study is 5.6% which is comparable to any other study done in developing nation.[8,9] Mortality rate in oesophageal atresia and intestinal atresia were 59.6% and 28.4% respectively. Mortality rate in intestinal atresia in developing countries ranges from 21-45% and it is <15% in European countries.[10] Mortality rate in aforementioned conditions was observed more during lockdown and convalescence periods which may be due to disease severity, delayed presentation, associated other anomalies or sepsis.

Two Hirschsprung's disease patient who were covid positive were managed conservatively by rectal wash, whereas one COVID case with acute malrotation of gut underwent surgery immediately.

Neonate with subacute intestinal obstruction were managed conservatively including one COVID case. Acquired causes of acute abdomen like necrotizing enterocolitis, intestinal perforation, and peritonitis in neonatal period give high mortality. NEC has the highest rate of gastroenterology mortality for preterm infants and is the most common reason for emergency surgery in neonates.[11] Mortality rate of this conditions were found to be 39.4% in this study which is similar to other studies.[2,3,8,10]

Hypertrophic pyloric stenosis was confirmed in 26 cases (4.8%). One neonate was suffering from COVID and was operated immediately. The outcome is similar to other centers.[12]

Incidence and outcome were almost similar for congenital anterior wall defect like omphalocele and gastroschisis. Mortality rate of these anomalies were 12.2% and 48.1% respectively. Complexity of disease associated other anomalies, lacking of standard SICU management and lacking of treatment guidelines result in higher mortality in such cases which is almost similar to other studies also.[12-14] Three gastroschisis cases were COVID -19 positive and unfortunately all ended in neonatal demise.

Bladder and cloacal exstrophy; tumour like sacrocccygeal teratoma and cystic nephroma; patent vitellointestinal duct, meconium ileus, duplication enteric cyst and liver abscess comprised of other anomalies admitted in surgical ICU.

Amongst 22.7% of neonatal surgical mortality in this study, 19 cases died during COVID era before undergoing operation while 49 died during postoperative period, explained by complexity of problem, associated other anomalies, delayed presentation, sepsis, lack of healthcare resources and treatment guidelines etc.

CONCLUSION

Despite of the COVID pandemic and limitation in healthcare human resources, load of surgical neonate cases remained the same with observed slight decline in the neonatal mortality which was envisioned to be due to the strict adherence to aseptic protocol, hence such practice of taking precautions against sepsis is highly recommend at all times.

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