RESEARCH PAPER

Profile of Back-Referrals to Special Newborn Care Units

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Objective: To study the outcomes of neonates back-referred from a tertiary care centre to special newborn care units (SNCUs) for step-down care. **Methods:** This prospective cohort study was conducted at a tertiary care neonatal unit and SNCUs in neighbouring states. We studied preterm and term neonates back-referred to district SNCUs from September, 2018 to April, 2019. The infants were followed up till 3 months corrected age, for mortality, re-hospitalization, emergency visits and unscheduled outpatient visits. Preterm inborn neonates <32 weeks gestation discharged directly to home formed the controls. **Results:** 201 back-referred neonates (study cohort) and 55 preterm neonates discharged to home (controls) were followed up till 3 months corrected age. Amongst the back-referred neonates, 5% died, 7% required re-hospitalization, 11% made emergency visits, and 24% made unscheduled outpatient visits. These outcomes were similar to the controls. **Conclusion**: Back-referral of convalescing neonates is a safe method of utilizing the limited healthcare resources in tertiary care centers in developing country settings.

Key words: *Neonate, Re-admissions, Regionalization, Special care neonatal unit*.

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Neonatal mortality forms a large proportion of infant mortality for which several programs have been launched over the last decade. Prominent amongst them being promotion of institutional delivery, creation of Special Newborn Care Units (SNCUs) at district level and free national ambulance system (108) [1]. Programs like Janani Shishu Suraksha Karyakram and India Newborn Action Plan have brought much needed attention to the maternal and neonatal care [2,3]. As a result, there has been increasing referrals to tertiary care facilities [4]. Tertiary care centres are overloaded and end up providing level II and lower level of care in addition to level III care [5]. This is partly also due to lack of a functional regionalization. Regionalization of perinatal care classifies hospitals at risk-appropriate level and creates a 'system' for referral and back-referral to risk appropriate care. Perinatal regionalization has been recognized as an extremely effective way to reduce neonatal mortality [6].

At our center we have created linkages with district SNCUs and have been back-referring convalescent neonates for ongoing care for past five years. As there has been no formal assessment of the safety and efficacy of the procedure in the Indian context, we planned this study to determine the short-term outcomes of neonates back-referred from our centre to the SNCUs.

METHODS

This prospective cohort study was conducted in our tertiary care centre from 1 September, 2018 to 20 April, 2019. Approval was obtained from the institutional ethics committee and a written informed consent was obtained from all participants The study cohort comprised of all inborn (preterm) as well as out born neonates (term and preterm) back-referred to district SNCUs from our institution. Preterm inborn neonates less than 32 weeks of gestation at birth, who were discharged directly to home during the same period, were enrolled as comparison group. These neonates could not be back-referred as the parents did not agree to be shifted to a step-down hospital, or due to lack of appropriate care facility at the step-down hospital nearest to their home, or in view of the nature of their illness. Preterm neonates less than 32 weeks were chosen as the comparison group because their morbidities are similar to that of the inborn neonates who were back-referred. All back-referred and discharged to home neonates were followed-up from the point of their discharge till 3 months of corrected age for mortality, re-hospitalizations, emergency visits and unscheduled outpatient department (OPD) visits.

The back-referral is typically done when all acute medical problems have resolved and family is willing. All SCNUs are comfortable handling neonates more than 1200 g

but some are also able to manage babies weighing between 1000-1200g.

For this study, a telephonic contact was maintained with parents during the stay in SNCU and after discharge. The discharge criteria followed by SCNUs are that the neonate should have recovered from the primary illness, is maintaining vital parameters including temperature without any assistance, is accepting breast or spoon feeds well, has been gaining weight for at least three consecutive days, currently weighs more than 1500 g and mother is confident of handling the baby. We follow more or less similar criteria at our centre. The actual weight at discharge is often less than 1500 g if all other criteria are met.

Definitive contacts were made in person at 28 days of chronological age, and at 1-month and 3-month corrected age for assessment of the study outcomes. In cases where the family did not return for the scheduled follow-up visit, telephonic contact was made to reschedule the visit. If the family was unable to come (*n*=15) or the child had died (*n*=12), outcome information was collected telephonically.

Statistical analysis: Mortality, re-admissions, visits to emergency and unscheduled OPD visits were calculated as percentages of eligible cohort. The outcomes of inborn neonates who were back-referred and the neonates discharged directly to home were compared by Chi square test with Yates correction.

RESULTS

A total of 215 inborn and outborn admitted neonates were back-referred from our centre to district SNCUs during the study period, and 201 could be contacted, forming the study cohort. In the same period, 60 neonates who were discharged directly to home were enrolled as control group and 55 could be followed up till the end of the study period. The profile of these infants is described in **Table I**.

Table II shows the broad group of illnesses these neonates had during their primary admission to our centre.

Table II Morbidities Among Neonates During Hospital Stay

Morbidity	*Back-referred neonates* (*n*=201)	*Neonates discharged home* (*n*=55)
Sepsis	131 (65)	39 (71)
Respiratory[a]	100 (51)	55 (100)
Neonatal jaundice	84 (42)	37 (67)
Gastrointestinal[b]	42 (21)	8 (15)
Hypoglycemia	31 (15)	9 (16)
Central nervous system[c]	21 (10)	4 (7)
Cardiovascular[d]	10 (5)	4 (7)
Acute kidney injury	11 (5)	1 (2)

Data in no. (%) *[a]Respiratory morbidities- hyaline membrane disease, broncopulmonary dysplasia, transient tachypnea of newborn, meconium aspiration syndrome, pneumonia and apnoea; [b]Gastrointestinal morbidities-necrotizing enterocolitis and feed intolerance; [c]Central nervous system morbidities - hypoxic ischemic encephalopathy and seizures; [d]Cardiovascular morbidities – patent ductus arteriosus and congenital heart disease.*

Reasons for back-referral were inadequate gestation and weight for discharge to home (66%), neonate still on gavage feeds (46%), weaning from caffeine (18%), mother not confident of taking care of the baby at home (17%), antibiotic completion (16%) and oxygen dependency (1%). The back-referred neonates stayed for a median of 10 days in SNCU. The median post menstrual age (PMA) at discharge from SNCU was 35 weeks for the inborn neonates and 39 weeks for the out born neonates. Eight (4%) neonates were re-referred from SNCU to our institute because of occurrence of new episode of sepsis or anemia. Amongst the back-referred neonates, 11 were taken by their parents against medical advice after short period of stay in SNCUs. The reasons given were poor cleanliness in the SNCU, lack of obstetrical care for the post-partum mother, poor water and sanitation facilities, and social issues like death or disease in other family members. These cases were also followed-up.

Table I Baseline Characteristics of Neonates Enrolled in the Study

Variable	*Back-referred neonates*		*Neonates discharged home*
	Inborn (n=139)	*Outborn (n=62)*	*Inborn (n=55)*
Female sex[a]	69 (50)	19 (33)	27 (50)
Gestation (wk)	31 (30,33)	36 (32,37)	30 (29,31)
Birthweight (g)	1305 (1155,1485)	2000 (1400,2615)	1222 (1020,1550)
Weight <3rd centile[a]	40 (29)	18 (29)	0
Hospital stay (d)	12 (8,21)	9 (6,16)	41 (23,64)
PMA at discharge (wk)	34 (32,35)	37 (34,39)	35 (33,37)
Weight at discharge (g)	1386 (1269,1510)	2100 (1500,2800)	1820 (1567,2243)

Data presented as median (IQR) or [a]no.(%). PMA-post menstrual age.

Table III Outcomes of Neonates Back-Referred and Neonates Discharged to Home

Outcome	*Back-referred neonates (n=201)*				*Inborn neonates discharged to home (up to 3 mo CA) (n=55)*
	28 d chronological age (n=136)[a]	*28 d chronological age to 1 mo CA (n=196)*[b]	*1-3 mo CA (n=192)*[c]	*Inborn back-referred neonates (up to 3 mo CA) (n=139)*	
Death	5 (4)	4 (2)	2 (1)	7 (5)	1 (2)
Re-hospitalization[d]	4 (2)	8 (4)	2 (1)	12 (9)	3 (5)
Death or re-hospitalization	8 (6)	12 (6)	3 (2)	19 (14)	4 (7)
Emergency visits[e]	12 (9)	5 (2)	5 (2)	14 (10)	3 (5)
Unscheduled OPD visits	6 (4)	14 (7)	28 (15)	29 (20)	11 (20)

Data in no. (%). CA-corrected age. [a]65 neonates were still admitted in the tertiary care hospital or SNCU at day 28 follow–up; [b]5 neonates died before 28 days and [c]4 neonates died between 28 days chronological age to 1 month CA; [d]includes all re-hospitalizations following scheduled outpatient (OPD) visits, unscheduled OPD visits or emergency visits; [e]includes emergency visits that resulted in death or re-hospitalization. All P>0.05.

Table III shows the outcomes at 3 months corrected age, of the inborn back-referred and directly discharged to home neonates. There was no statistically significant difference in the outcomes.

'Aspiration', pneumonia, apnea, sudden infant death and perinatal CMV were the causes of death in five, two, two, one and one of these infants, respectively. Sepsis was the leading cause of re-hospitalization. The cause of death was assessed from the information provided by parents, admission slips and death certificates that were issued to the families of the deceased neonates.

DISCUSSION

In this prospective cohort study of 201 back-referrals from a tertiary care hospital in India to SNCUs of neighbouring states, 5% of neonates died, 7% required re-hospitalization, 11% made emergency visits and 24% made unscheduled OPD visits during a follow-up period till 3 months corrected age. In the present study, re-admission rates and visits to emergency department were comparable to previous studies of follow-up of high-risk neonates [7-11]. The median duration of stay in any healthcare facility for the back-referred neonates in our study was 24 days, which is comparable to previous studies of NICU graduates [12-14].

The median duration of stay for the back-referred neonates in the SNCU was 10 days for the inborn neonates. These many days of hospital stay at tertiary centre could be saved for other needy neonates. The median discharge weight of the inborn neonates who were discharged from the tertiary centre was 1820 g while the median weight at discharge for inborn neonates from SNCU was 1612 g. The most likely reason for this was a higher proportion of SGA neonates in the inborn cohort who were back-referred (29%) vs comparison group (0).

In view of non-availability of retinopathy of prematurity (ROP) screening services at many SNCUs, parents have to bring the babies back to tertiary care centres on more than one occasion, while still admitted to SNCU. This creates hazardous conditions for the high risk preterm and sometimes a financial burden on the family. Another major bottleneck was transport for back-referral.

The design of the study was built upon what was happening in normal practice. Hence, it was a challenge to find suitable comparison groups, especially for the out born neonates who were back-referred. We did not perform a cost-benefit analysis or estimate the number of extra neonates who might have benefitted from tertiary care. Our study involved a government tertiary care centre in northern India and SNCUs of the surrounding states, and practices may vary in other parts of the country.

We have shown in this study that back-referral of convalescent neonates can be done safely and effectively. With the establishment of a large number of SNCUs and newborn stabilization units (NBSUs), and availability of national ambulance system, it is an opportune time to work on the optimization of the functional aspects of referral, back-referral, inter-facility communication and safe transport.

Ethics clearance: Institutional ethics committee of PGIMER; No. NK/4722/MD/763; dated November 21, 2018.
Contributors: SC: prepared the draft protocol for the study, collected and analysed the data, and wrote the manuscript; SKA: critically reviewed the study protocol and the manuscript; SSS critically reviewed the protocol and manuscript; SV: critically reviewed the protocol, manuscript and supervised statistical analysis; PK: conceived the study, designed the study, critically reviewed the study for important intellectual content and approved the final manuscript.
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WHAT THIS STUDY ADDS?

- Back referral of neonates to special case neonatal units (SNCUs) has comparable mortality, re-hospitalization and unscheduled hospital visits to those discharged directly to home from tertiary facility.

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