

Quality Of Referral, Admission Status And Outcome Of Neonates Referred To Pediatric Emergency Of A Tertiary Care Institution In North India

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Abstract

Background: We evaluated quality of referral, admission status and outcome of neonates.

Methods: We enrolled newborns admitted between March 2016 and October 2016, excluding neonates referred from outpatient department. Information was collected from referral slips, interviewing accompanying persons and observation.

Results: 61% were referred from government hospitals with “Sick Newborn Care Units” contributing to maximum. Main mode of transport was ambulance in 80% and referral notes were available in the majority but incomplete in majority. Sepsis (39%), jaundice (16%) and birth asphyxia (13%) were most common diagnoses. Half of the newborns were hemodynamically unstable. 27% had poor circulation, 15% were hypoxic, 9% hypoglycemic and 8% hypothermic. 22% either died or “Left Against Medical Advice” with a high probability of death.

Conclusion: National ambulance service is utilized for transporting newborns. However, there are quality gaps which need attention to develop it into efficient referral system.

Introduction

Significant advances in neonatal care along with regionalization, referral, and transport systems have led to increasing survival of the very preterm and low birth neonates across the globe. Maternal and newborn care has rightly gained its due importance with the launch of several government health programs during the last decade. The awareness and willingness to get treatment for even very preterm infants have increased in the community. Janani Suraksha Yojana (JSY) and Janani Suraksha Karyakram (JSSK) have led to a dramatic increase in institutional deliveries. There has been an exponential increase in the number of special care neonatal units (SCNUs) at the district level due to the commitment of National Health Mission (NHM) and other international agencies. However, the actual requirement of such facilities is much higher. This has led to an increased number of sick mothers and neonates being brought to medical colleges and apex institutions. The availability of National Ambulance Service (NAS), which offers free services to mothers as well as newborn infants, has also facilitated the referral of patients to tertiary care institutions.¹

Although the free ambulance service is now available in almost all parts of the country, majority of these vehicles are not geared for neonatal transport. Also, they are often not manned by trained healthcare personnel. Therefore, though the ambulance service has succeeded in transporting a large number of sick neonates to tertiary centers quickly, the quality of care prior to and during transport is far from optimal. In addition, unlike developed countries, coordinated referral and transport programs do not exist in our country. Pre-referral consultation, communication and stabilization are not the routine. As a result, a large proportion of neonates reach the tertiary care centers in poor condition and either cannot be salvaged or have a prolonged complicated hospital course.^{1, 5}

Though the number of neonatal referrals to tertiary centers has increased exponentially, its effect on the quality of neonatal care has not been assessed in recent times. This information is essential for improving the quality of current referral and transport system. This study was planned to evaluate the quality of referral and transport in neonates presenting to pediatric emergency of a tertiary care hospital in North India. Other objectives included an analysis of clinical status at admission and final outcomes. We also studied the antibiotic usage prior to referral and bacterial/fungal isolates from the blood cultures drawn at the time of admission.

Material And Methods

The study was conducted in pediatric emergency of Postgraduate Institute of Medical Education and Research (PGIMER) Chandigarh, India. In this prospective observational study, we enrolled all consecutive neonates admitted to the pediatric emergency from March 2016 to October 2016. We excluded neonates referred from outpatient department (OPD) and other departments within the institution. The study was approved by the Institute Ethics Committee the Post Graduate Institute of Medical Education and Research, Chandigarh, India, and a written informed consent was obtained from one of the parents before enrolment of neonates. The study did not involve taking any blood sample, withholding of any treatment, or giving any additional treatment to subjects. The parents/guardians had full authority to enroll or withdraw the child from the study and this did not affect the care and treatment being given to their child. Confidentiality of the data/information obtained was maintained.

We obtained the details of referral and transfer from the referral note provided by the referring doctor. We interviewed the parents and/or accompanying person for additional information. The interview was conducted in a separate quiet room within 24 hours of admission, but only after the initial stabilization of the neonate and initiation of treatment. We waited until the parents/guardians were in a comfortable state of mind for the interview. We did not contact the referring teams. The referral notes were analyzed for four components - pre-transport stabilization, pre-transport treatment, pre-transport investigation and documentation of reason for referral. The referral notes were classified as '*complete*' if all four components were mentioned in the referral slip. If any of the four parameters was missing, they were classified as '*incomplete*'.

The respiratory and hemodynamic status of each neonate at arrival was assessed by the receiving physicians in emergency room and recorded in a structured performa. TOPS (Temperature, Oxygenation, Perfusion, and Sugar) score was calculated at admission. Temperature was measured by a digital thermometer placed in the axilla, oxygenation by pulse oximeter, perfusion by capillary filling time (CFT) at sternum, and blood sugar by glucometer. Hypothermia is defined as temperature below 36.5°C and assigned score of 1 while temperature $\geq 36.5^\circ\text{C}$ is normal and given score 0. Hypoxia is defined as saturation $< 90\%$ and assigned score 1 and saturation $\geq 90\%$ is assigned score 0. Prolonged CFT is defined as CFT $\geq 3\text{s}$ and assigned score 1 and while normal CFT is $< 3\text{s}$ and assigned score 0. Hypoglycemia is defined as random blood sugar below 40 mg/dL and assigned score of 1 while euglycemia is defined as random blood sugar $\geq 40\text{ mg/dL}$ and assigned score 0. A newborn was

categorized as hemodynamically stable if her/his heart rate was > 100/ min, capillary refill time was < 3 seconds, pulse oxygen saturation (SpO₂) was ≥ 90 % and both central and peripheral pulses were well palpable.^{2,3} The mode of transport as well as facilities available during the transport—vehicle, accompanying personnel, oxygen, monitors, duration of transport etc. were also assessed.

Outcome was classified as '*Satisfactory*' if the neonates was discharged to home, transferred within the institute or back-referred to a step-down unit in a stable state. '*Unsatisfactory*' outcome included "Left Against Medical Advice" (LAMA) and death. All 404 neonates admitted during the study period were enrolled as a convenient sample. Statistical analysis was done using IBM SPSS version 24.

Results

A total of 656 neonates were brought to pediatric emergency during the study period. Out of these, 404 were admitted, 58 were transferred to pediatric surgery and 194 were sent back to home after initial assessment or after a brief period of observation. More than two-thirds of neonates were male, and two-thirds were full-term. Half of the neonates were low birth weight (Table 1).

Table 1
Baseline characteristics of study population

	<i>Characteristic</i>	<i>No.</i>	<i>%</i>
Male Gender		277	69
Preterm		135	34
Birth weight	≥ 2500 g	209	52
	1500–2499 g	141	35
	1000–1499 g	45	11
	< 1000 g	09	02
Intrauterine growth ^a status	SGA	101	25
	AGA	296	73
	LGA	07	02
Referring institution	Government hospital	246	61
	Private hospital	116	29
	Self-referral	42	10
Place of delivery	Government hospital	275	68
	Private hospital	109	27
	Home delivery	20	05
^a as per Fenton's growth charts (SGA < 10th centile, AGA 10th to 90th centile, LGA > 90th centile) SGA- Small for Gestational Age, AGA -Appropriate for Gestational Age, LGA -Large for Gestational Age			

Pre-transport condition of baby was described in terms of temperature, oxygen saturation, and blood glucose, initiation of intravenous (IV) fluids, oxygen requirement, ventilation parameters, antibiotic administration, and hemodynamic stability. No information was documented about temperature in 98%, oxygen saturation in 89% and blood glucose in 93% of the cases. About half of the babies received IV fluids, antibiotics, and oxygen prior to referral.

Sixty-one percent of neonates were referred from government hospitals and 58% utilized NAS (National ambulance service). However, 39% of newborns were brought from private hospitals or home and used private ambulances or other vehicles (Table 2). The NAS transports were accompanied by an emergency medical technician (EMT) whereas, in almost all private transports, there was no accompanying healthcare personnel. Newborns were accompanied by mother in 61% of cases. Thermal support by blankets or towels was attempted in almost all cases, while basic monitoring was done in a quarter of transports. Fifty-six percent of newborns received oxygen during transportation. A referral note was

available in 87% of cases but was '*complete*' in only 15%. The reasons for referral were analyzed based on referral slip and personal interview of parents or accompanying persons. In two-thirds of cases, the reason for referral was mentioned as 'for further management'. At arrival, half of infants were hemodynamically unstable and only half had an intravenous access (Table 3).

Table 2
Transport-related characteristics

	<i>Characteristic</i>	<i>No</i>	<i>%</i>
Mode of transport	Government ambulance	234	58
	Private ambulance	87	22
	Others(auto rickshaw, car, bus)	83	20
Accompanying healthcare personnel	Doctor	03	01
	Nurse	05	01
	EMT ^b	234	58
	None	162	40
Mother accompanied baby		246	61
Thermoregulation during transport	Blanket	157	39
	Towel	242	60
	Incubator	05	01
Oxygen given		227	56
Monitoring during transport		104	26
Intravenous fluid received (IVF)		194	48
Referral note	Complete	53	15
	Incomplete	262	72
	Lost before arrival	45	12
	Not provided	02	01
^b Emergency Medical Technician (in many states, majority of EMTs are pharmacists)			

Table 3
Status at admission

Characteristic		No	%
Hemodynamically stable		199	49
Intravenous access		185	46
Temperature	Euthermic ($\geq 36.5^{\circ}\text{C}$)	373	92
	Hypothermic ($< 36.5^{\circ}\text{C}$)	31	08
Oxygen saturation	Normal (≥ 90)	328	81
	Hypoxia (< 90)	62	15
	Not recorded	14	04
CFT (capillary filling time)	Normal ($< 3\text{s}$)	295	73
	Prolonged ($\geq 3\text{s}$)	109	27
Sugar	Euglycemic (RBS ≥ 40)	279	69
	Hypoglycemic (RBS < 40)	36	09
	Not recorded	89	22
TOPS ^c score	0	203	50
	1	59	15
	2	39	10
	3	11	03
	Not calculated	92	22
c Temperature, oxygen, perfusion, sugar,			

TOPS score for every baby was calculated at admission (Table 3). The majority arrived in euthermic state but 15% were hypoxic and 9% were hypoglycemic at admission. Figure 1 shows the classification of infants at initial triage. Half of the neonates had respiratory problems: either respiratory distress or respiratory failure at admission. About one-third required 'Continuous Positive Airway Pressure' (CPAP) support, 22% nasal prongs oxygen and 5% required intubation within 1 hour of admission. The commonest final diagnosis was sepsis (Fig. 2). The first blood culture drawn at admission was positive in 54 (19%) neonates. Gram-negative organisms were most common accounting for 45% of total cultures. *Klebsiella pneumoniae* was the most common Gram-negative organism. Together, *Klebsiella*, *Acinetobacter* and *Candida* accounted for more than half the positive blood cultures (Table 4). Out of all Gram-positive bacteria, 42% were Methicillin-sensitive. Of all Gram-negative isolates, 71% were resistant

to cephalosporin- cefotaxime, 31% to amikacin and 33 % to meropenem. Most of *Klebsiella* and *Acinetobacter* were multi drug resistant.

Table 4
Admission blood cultures

	Numbers	%
Total	54/282	19
Gram Positive	19	35
<i>Staphylococcus aureus</i>	03	05
CONS(CoagulaseNegative <i>Staphylococcus</i>)	16	30
Gram Negative	24	45
<i>Klebsiellapneumoniae</i>	14	26
<i>Stenotrophomonasmaltophilia</i>	01	02
<i>Acinetobacterbaumannii</i>	03	06
<i>Enterobacterasburiae</i>	02	04
<i>BurkholderiaCepacia</i>	04	07
Yeast	11	20
<i>Candidatropicalis</i>	04	07
<i>Candida krusei</i>	03	05
<i>Candida utilis</i>	01	02
<i>Candida albicans</i>	02	04
<i>Issatchenkiaorientalis</i>	01	02

It took less than 6 hours for 97% (N = 391) of neonates to reach our hospital. The time taken for transportation is shown in Fig. 3 below. Forty-one percent neonates received antibiotics prior to referral, most common being cefotaxime and amikacin, with a median (IQR) duration of 2 (0, 2) days and a range of 0–32 days. The outcome was 'satisfactory' in 78% (N = 315) and 'unsatisfactory' in 22% (N = 89).

Discussion

In this prospective observational study of 404 sick newborns referred to the pediatric emergency of a tertiary care institution of North India. We found that referrals from government hospitals brought in National Ambulance Service contribute to the majority of cases. This service has definitely improved the access and equity for a large proportion of the poor. However, important gaps in the quality of the whole

process were found. After the introduction of NAS and establishment of SNCUs under NHM, objective data about the quality of referral and transport has been scanty barring few studies from South India.^{1, 4}

- 5

Though a referral note accompanied majority of referred neonates, a large proportion of them were very sketchy and failed to provide complete information about the neonate. Data regarding pre-transport status like temperature, oxygen saturation, ventilatory and hemodynamic status and stabilization measures could not be retrieved in most of the cases. In a similar study from Saudi Arabia, quality of referral slip was found to be poor in 23% of cases.⁵ Proper referral note is a major means of communication between physicians at different levels of the healthcare system.^{6,7} It is well accepted that stabilization of neonate before and during transport improves the condition of the neonate in terms of temperature, oxygenation, blood glucose and blood pressure.⁸ Similar to the observations of Rathod et al⁴ and others, we did not find any prior communication between referring and receiving teams. The importance and impact of prior communication between referring and receiving centers is well described.¹² The most likely reason for this is lack of dedicated and publicized contact numbers by the referral centers.

As expected, we found a significant correlation between increasing TOPS score and mortality. A study done at Ahmedabad, India from July 2010 to July 2012 found that those newborns who did not have improvement in TOPS score after 1 hour had a poor outcome. They found the most altered parameter at admission to be hypothermia (55% incidence). A study done in Tamilnadu, India found hypothermia in 26% of babies at admission.⁹ In our study, only 8% were hypothermic with almost universal usage of blanket and towels for thermal support. This was in contrast to the study by Rathod et al from Southern India which found 80% of referred neonates to be hypothermic or in cold stress at arrival.⁴ The reasons for this difference could be related to temporal improvements as well as seasonal variations. Though mother accompanied more than half of the infants in our study, Kangaroo mother care (KMC) or skin to skin care with any other adult was not practiced. Skin to skin contact during transport is likely to be of great benefit in our country where the ambulances may not have adequate mechanisms for thermal support of the newborn.

We found poor circulation (27%), hypoxia (15%) and hypoglycemia (9%) to be more common derangements than hypothermia. The use of ambulances as a mode of transport was little higher in our study (58%) as compared to study done in Ahmedabad, India (47%).¹⁰ Narang et al reported limited use of ambulances and a general lack of accompanying trained healthcare personnel for road transport of sick neonates.¹¹ A previous observation of 2012-13 from Southern India reported that private ambulances or vehicles without emergency transport personnel were the main modalities, with government ambulances contributing to only 11% of transports.⁴ Our study found a substantial increase in uptake of government ambulance in 58% of transports and majority accompanied by a EMT. Even though, government ambulances were accompanied by dedicated emergency transport team (EMT), quality of transport was not optimal. The increasing usage of NAS is an indicator of easy access made

available by the government's program. The easy access to NAS is also brought out by the fact that the time taken for transport was less than 6 hours in the majority, though this is also a reflection of the geography and road network.

We found that admission blood culture grew an organism in one-fifth of study neonates. Though most common organisms were as expected, the growth of multi-drug resistant *Klebsiella* and *Acinetobacter*, is of major concern and creates worries about the practices in the referring hospitals. Rathod *et al* found 24% blood culture positivity with commonest organisms being *Escherichia coli* and *Staphylococcus aureus*.⁴ A study from Tamilnadu, India had found 12% rate of septicemia among referred morbid neonates.⁹

Ambulance services to transport sick newborns remain a challenge in our country.¹³ No doubt, the ready availability of a free ambulance service on dialing of a common nationwide number is a revolution in itself. However, it needs to be realized that ambulance in itself is only one component of a coordinated, efficient, safe referral and transport system. The development of a 'system' of safe referral and transport requires urgent attention of policy makers and planners.

Conclusion

This prospective observational study of neonatal transport revealed an increasing uptake of National Ambulance Service for transport of sick newborns to tertiary care institutions. There are substantial improvements in the condition of neonates at arrival, esp. temperature, however, the overall scenario is far from optimal. Though referral notes accompanied most, their content was grossly inadequate and there was no prior communication between the referring and referral centers. The concept of referral needs change from simply provision of free ambulance to 'referral, communication, and transport and back-referral system'. Other components of transport like communication, pre-transport stabilization, intra-transport support and monitoring require urgent attention to improve the outcomes of referred neonates.

Declarations

Ethics approval and consent to participate - Ethics approval was taken from the Ethics Committee of the Post Graduate Institute of Medical Education and Research, Chandigarh, India. Written consent for participation in the study was obtained from one of the parents. All methods carried out in the study were as per relevant guidelines and regulations.

Consent for publication - NA

Availability of data and materials - The datasets generated and/or analyzed during the current study are not publicly available because the data contains names of the participant and names of referring healthcare facilities but are available from the corresponding author on reasonable request.

Competing interests – None

Funding – None

Authors Contribution –

NM - Design, data acquisition and analysis of manuscript

PK - Design and finalize the manuscript.

SJ - Data analysis and revision of manuscript

JM - Design and interpretation of data

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Figures

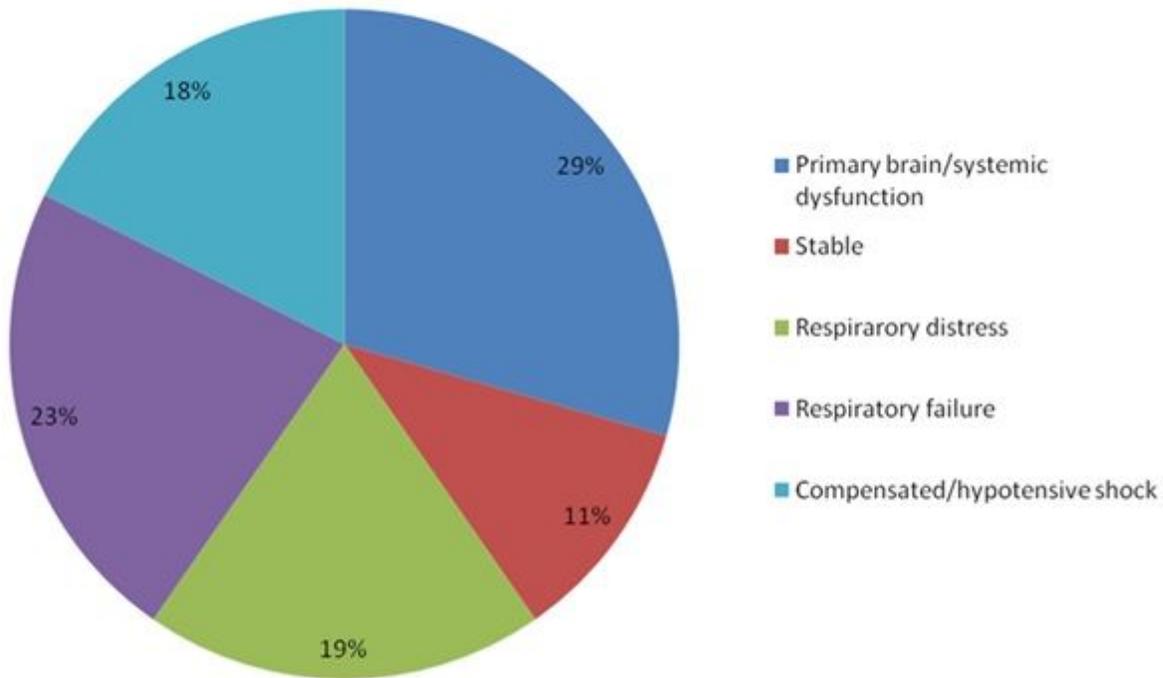


Figure 1

Triage classification at arrival

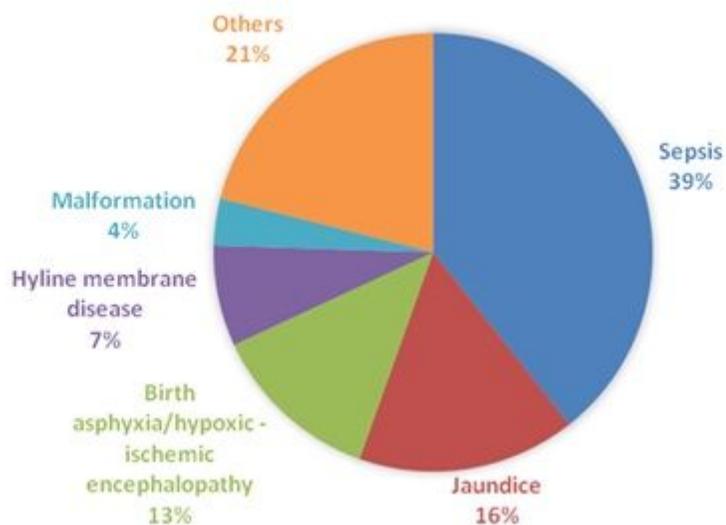


Figure 2

Final Diagnosis

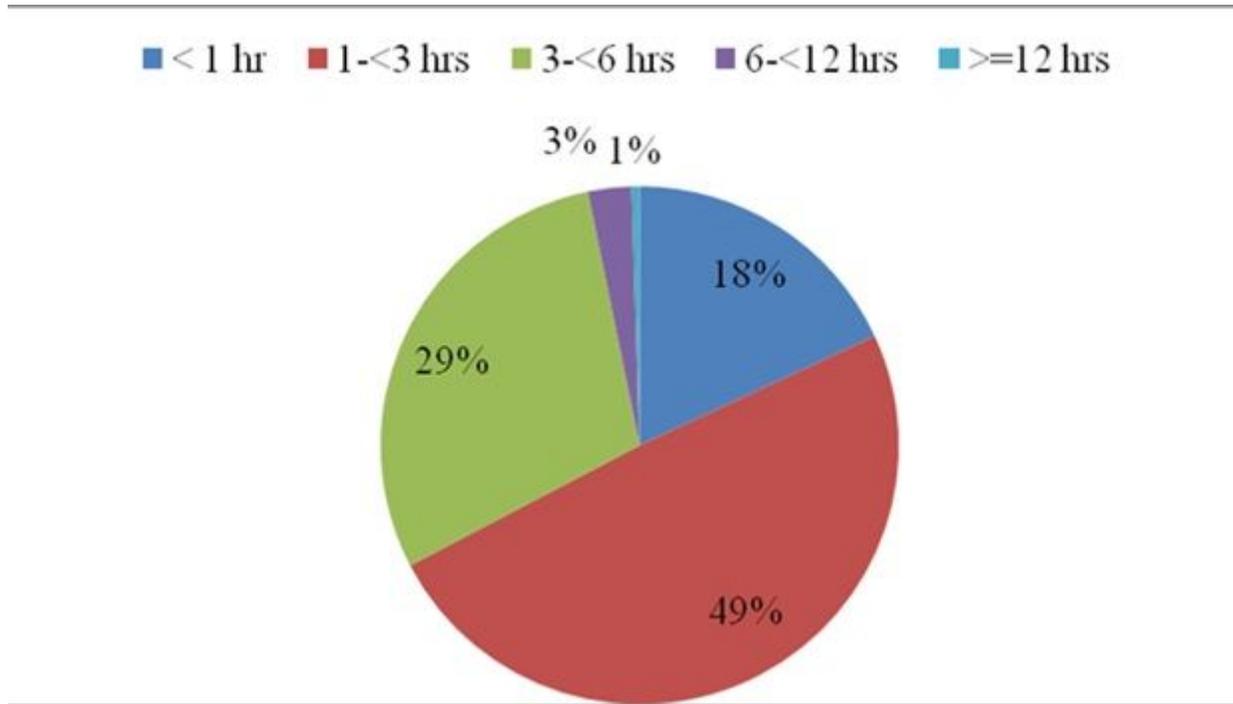


Figure 3

Time taken for transportation