Quality of Referral, Admission Status, and Outcome of Neonates Referred to Pediatric Emergency of a Tertiary Care Institution in North India

Neeraj Mishra, Shiv Sajan Saini, Muralidharan Jayashree, Praveen Kumar
Department of Pediatrics, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Abstract

Background: This study was planned to study the existing status of neonatal transport in North India after the introduction of National Ambulance Service (NAS). We evaluated the quality of referral, admission status, and outcome of referred neonates. Materials and Methods: We enrolled neonates admitted between March 2016 and October 2016, excluding neonates referred from the outpatient department. Information was collected from referral slips, interviewing accompanying persons and observation. Results: Sixty-one percent were referred from government hospitals with “sick newborn care units” contributing to maximum. The 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 the most common diagnoses. Half of the neonates were hemodynamically unstable. Twenty-seven percent had poor circulation, 15% were hypoxic, 9% hypoglycemic, and 8% hypothermic. Twenty-two percent either died or “left against medical advice” with a high probability of death. Conclusion: NAS is utilized for transporting neonates. However, there are quality gaps which need attention to develop it into efficient referral system.

Keywords: National ambulance service, neonate, referral, sick newborn care unit, transport

INTRODUCTION

Significant advances in neonatal care along with regionalization, referral, and transport systems have led to increasing survival of the preterm and low birth neonates. The awareness to get treatment for even very preterm infants has increased in community. Janani Suraksha Yojana and Janani Suraksha Karyakram have led to increase in institutional deliveries. There has been an exponential increase in the number of special care neonatal units at the district level due to the commitment of National Health Mission and other international agencies. This has led to an increased number of sick mothers and neonates being brought to medical colleges. The availability of free National Ambulance Service (NAS) has facilitated the referral of patients to tertiary care institutions.[1]

Although the free ambulance service is now available in almost all the parts of the country, majority of these vehicles are not geared for neonatal transport. Furthermore, they are often not manned by trained health-care personnel. Therefore, although the ambulance service has succeeded in transporting a large number of sick neonates to tertiary centers quickly, the quality of care before and during transport is far from optimal. In addition, unlike developed countries, coordinated referral and transport programs do not exist in our country. Prereferral consultation, communication, and stabilization are not the routine.[1,2]

Although the number of neonatal referrals to tertiary centers has increased, its effect on the quality of neonatal care has not been assessed in recent times. This study was planned to evaluate the quality of referral and transport in neonates...
presenting to the pediatric emergency of a tertiary care hospital. Other objectives included an analysis of clinical status at admission and final outcomes.

**Materials and Methods**

The study was conducted in the pediatric emergency of Postgraduate Institute of Medical Education and Research Chandigarh, India. In this prospective, observational cohort study, we enrolled all consecutive neonates admitted to the pediatric emergency from March 2016 to October 2016. We excluded neonates referred from the outpatient department and other departments within the institution. The study was approved by the Institute Ethics Committee of Postgraduate Institute of Medical Education and Research, Chandigarh, India, and a written informed consent was obtained from one of the parents before enrolment. The parents/guardians had full authority to enroll or withdraw the child from the study. Confidentiality of the data/information obtained was maintained.

We obtained the details of referral and transfer from the referral note and from parents. The referral notes were analyzed for four components: pretransport stabilization, pretransport treatment, pretransport investigation, and documentation of reason for referral. The referral notes were classified as “complete” if all the four components were mentioned in the referral slip. If any of the four parameters was missing, they were classified as “incomplete.”

The hemodynamic status of neonate at arrival was assessed. Temperature, oxygenation, perfusion, and sugar (TOPS) score was calculated. 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 the temperature below 36.5°C and assigned score of 1 while temperature ≥36.5°C is normal and given score 0. Hypoxia is defined as saturation <90% and assigned score 1 and saturation ≥90% is assigned score 0. Prolonged CFT is defined as CFT ≥3 s and assigned score 1 while normal CFT is <3 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 ≥40 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 s, pulse oxygen saturation (SpO2) was ≥90%, and both central and peripheral pulses were well palpable.

Outcome was classified as “Satisfactory” if the neonates were 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 (IBM Corp. Armonk, NY, USA). The study results were described as percentage and mean (standard deviation) or median (interquartile range) according to distribution of data. Comparisons of proportions were done by Chi-square test or Fischer exact test as applicable. The mean and median were compared using t-test or Mann–Whitney U test as applicable.

**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 home after initial assessment. More than two-thirds of neonates were male (n = 277, 69%), and one-third were preterm (n = 135, 34%). Half of the neonates (n = 195, 48%) had birth weight <2500 g. One fourth (n = 101, 25%) of neonates were small for gestational age as per Fenton’s chart.

Pretransport 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 neonates received IV fluids, antibiotics, and oxygen prior to referral.

Sixty-one percent of neonates were referred from government hospitals and 58% utilized NAS. However, 39% of newborns were brought from private hospitals or home and used private ambulances or other vehicles (Table 1). The NAS transports were accompanied by an emergency medical technician (EMT)

| Table 1: Transport-related characteristics |
|-------------------------------------------|
| Characteristic                             | n (%)   |
| Mode of transport                          |         |
| Government ambulance                       | 234 (58) |
| Private ambulance                          | 87 (22)  |
| Others (auto rickshaw, car, bus)           | 83 (20)  |
| Accompanying healthcare personnel          |         |
| Doctor                                     | 3 (1)   |
| Nurse                                      | 5 (1)   |
| EMT*                                       | 234 (58) |
| None                                       | 162 (40) |
| Mother accompanied baby                    | 246 (61) |
| Thermoregulation during transport          |         |
| Blanket                                    | 157 (39) |
| Towel                                      | 242 (60) |
| Incubator                                  | 5 (1)   |
| Oxygen given                               | 227 (56) |
| Monitoring during transport                | 104 (26) |
| IVF                                        | 194 (48) |
| Referral note                              |         |
| Complete                                   | 53 (13)  |
| Incomplete                                 | 304 (75) |
| Lost before arrival                        | 45 (11)  |
| Not provided                               | 2 (1)   |

*EMT (in many states, majority of EMTs are pharmacists). IVF: Intravenous fluid, EMTs: Emergency medical technicians
whereas, in 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 slips 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 neonates were hemodynamically unstable and only half had an intravenous access [Table 2].

There was significant correlation between different components of referral and outcome. With complete referral notes (n = 60), “satisfactory outcome” was observed in 72% (n = 43) of cases with P < 0.03. There is a good correlation between hemodynamic status at admission and outcome. The neonates who were hemodynamically stable (n = 267, 66%) at arrival in our hospital, 85% (n = 226) had “satisfactory” outcome with Chi-square P < 0.001. Similarly, the neonates who were transported in hypoxic, hypothermic or hypoglycemic state had poor outcome.

TOPS score for neonates was calculated at admission. Only half of the neonates (n = 203, 50%) had zero TOPS score at arrival [Table 2]. The majority arrived in euthermic state but 15% were hypoxic and 9% were hypoglycemic at admission. Half of the neonates had respiratory problems at admission. About one-third required “continuous positive airway pressure” support, 22% required nasal prongs oxygen and 5% required intubation within 1 hour of admission. The commonest final diagnosis was sepsis [Figure 1]. The blood culture at admission was positive in 54 (19%). 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. 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.

It took <6 hour for 96% (N = 388) of neonates to reach our hospital. The time taken for transportation is shown in Figure 2. Forty-one percent neonates received antibiotics prior to referral, most common being cefotaxime and amikacin, with a median and interquartile range of 2 (0, 2) days and a range of 0–32 days. Final outcome was assessed as satisfactory or unsatisfactory. The outcome was “satisfactory” in 78% (N = 315) and “unsatisfactory” in 22% (N = 89).

| Characteristic                                      | n (%) |
|----------------------------------------------------|-------|
| Hemodynamically stable                             | 199 (49) |
| Intravenous access                                 | 185 (46) |
| Temperature                                         |       |
| Euthermic (≥36.5°C)                                | 373 (92) |
| Hypothermic (<36.5°C)                              | 31 (8) |
| Oxygen saturation                                   |       |
| Normal (≥90%)                                      | 328 (81) |
| Hypoxia (<90%)                                     | 62 (15) |
| Not recorded                                       | 14 (4) |
| CFT                                                |       |
| Normal (<3 s)                                      | 295 (73) |
| Prolonged (≥3 s)                                   | 109 (27) |
| Sugar                                              |       |
| Euglycemic (RBS ≥40 mg/dl)                         | 279 (69) |
| Hypoglycemic (RBS <40)                             | 36 (9) |
| Not recorded                                       | 89 (22) |
| TOPS score                                         |       |
| 0                                                  | 203 (50) |
| 1                                                  | 59 (15) |
| 2                                                  | 39 (10) |
| 3                                                  | 11 (3) |
| Not calculated                                     | 92 (22) |

TOPS: Temperature, oxygen, perfusion, sugar, CFT: Capillary filling time, RBS: Random blood sugar

![Figure 1: Final diagnosis](image1.png)

![Figure 2: Time taken for transportation](image2.png)
Satisfactory outcome included discharge to home, back referral in stable state or transfer within the institute. Unsatisfactory outcome included death and “LAMA.”

**Discussion**

In this study of 404 neonates, we found that referrals from government hospitals brought in NAS contribute to most cases. This service has 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 sick newborn care units, objective data about the quality of referral and transport have been scanty barring few studies from South India.[12,5]

Though a referral note accompanied in majority, a large proportion of them failed to provide complete information. In a similar study from Saudi Arabia, quality of referral slip was found to be poor in 23% of cases.[2] Proper referral note is a major means of communication.[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 al.[5] 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.[9] 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 (Chi-square \( P < 0.001 \)). Mortality increased with increasing TOPS score [Figure 3]. A study done at Ahmedabad, found that those neonates who did not have improvement in TOPS score after 1 h had a poor outcome. They found the most altered parameter at admission to be hypothermia (55% incidence). A study done in Tamilnadu, found hypothermia in 26% of babies at admission.[10] 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. which found 80% of neonates to be hypothermic at arrival.[5] The reasons for this difference could be related to temporal improvements as well as seasonal variations. Although mother accompanied more than half of the neonates in our study, kangaroo mother care was not practiced.

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%).[11] Narang et al. reported the limited use of ambulances and a general lack of accompanying trained health-care personnel for the road transport of sick neonates.[12] A previous observation of 2012–13 from Southern India reported that private ambulances were the main modalities of transport.[5] Our study found a substantial increase in the uptake of government ambulance in 58% of transports and majority accompanied by an EMT, however quality of transport was not optimal. 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.

The admission blood culture grew an organism in one-fifth of study neonates. Although the most common organisms were as expected, the growth of multi-drug resistant Klebsiella and Acinetobacter, is of major concern. Rathod et al. found 24% blood culture positivity with commonest organisms being Escherichia coli and Staphylococcus aureus.[1] A study from Tamilnadu had found 12% rate of septicemia.[10] Ambulance services to transport sick neonates remain a challenge in our country.[11]

**Conclusion**

This study revealed an increasing uptake of NAS for transport of sick neonates to tertiary care institutions. There are substantial improvements in the condition of neonates at arrival, especially temperature, however, the overall scenario is far from optimal. Although referral notes accompanied most, their content was grossly inadequate. 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, pretransport stabilization, intra-transport support, and monitoring require urgent attention to improve outcome.

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**Conflicts of interest**

There are no conflicts of interest.

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