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Research Article

A STUDY ON MODE OF TRANSPORTAION OF NEONATES TO A TERTIARY CARE PAEDIATRIC HOSPITAL AND ITS EEFECTS ON OUTCOME.

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Abstract

Background: Reducing the under-five mortality rate by two-thirds is the WHO target as per MDG 4.[1,2] Globally, the majority of U5mortality (45.1%) occurs during the neonatal period, majority of all neonatal deaths (75%) occurs during the first week of life. Most common causes for neonatal deaths due to prematurity (29%), asphyxia (23%), and sepsis (25%). These conditions can be effectively managed with an appropriate level of care, unfortunately not all medical centers provide specialized care for the neonates, hence these neonates have to be transported to the referral center, where the facilities are available.[3] Neonatal transport is one of the major predictors of the outcome of these transported sick neonates. A well-trained and dedicated transport team is the prerequisite for a better outcome, lack of it contributes to the mortality and morbidity in these neonates.[4]

Material and methods: In this observational study, all neonates up to 28 days of life required admission to NICU between January 2020 and December 2021 who are fulfilling the inclusion criteria were selected. After initial stabilization, neonate demographic details and the details Pre-transport, transport, and post-transport physiological parameters and significant interventions required during and within 1 hour after transport were analyzed. These neonates are followed up till discharge/death.

Results: In the present study 500 neonates are included in the study, the common indications for referral were prematurity (22.6%), respiratory distress (17.6%). The main mode of transport was by self-arranged private own ambulances (56.8%) which are lacking trained personnel, followed by government ambulances (29.4%). On arrival, the most common derangements seen are hypothermic followed by hypoxia,

hypotension, and hypoglycemia. Among the babies who succumbed, the majority were due to prematurity and its complication (32.69%), followed by, respiratory distress syndrome (15.38%) and perinatal asphyxia and its complications (13.46%).

Conclusion: Neonates with low birth weight, requiring prolonged transport, prolonged CFT, and requiring mechanical ventilation on arrival had higher mortality, which was seen with neonates who were not accompanied by trained staff.[5-7]

Keywords: Under-five mortality rate, Neonatal transport, Neonatal deaths, hypothermia, hypoxia, hypotension, and hypoglycemia

INTRODUCTION

Reducing the under-five mortality rate by two-thirds is the World Health Organization (WHO) target as per Millennium Development Goal (MDG) 4 and timely treatment of complications for newborns is one of the key strategies for achieving the same.[1,2] The phenomenal number of deliveries and poorly organized system of neonatal transport in developing countries are definite hurdles for the achievement of MDG 4. Globally, the majority of U5mortality (45.1%) occurs during the neonatal period, the majority of all neonatal deaths (75%) occur during the first week of life, and about 1 million newborns die within the first 24 hours. Of this prematurity (29%), infections (29%), asphyxia (23%), congenital malformations (8%), and other (11%) are important causes of neonatal death in the low and middle-income countries, while prematurity and malformation contribute to developed countries.[3,5]

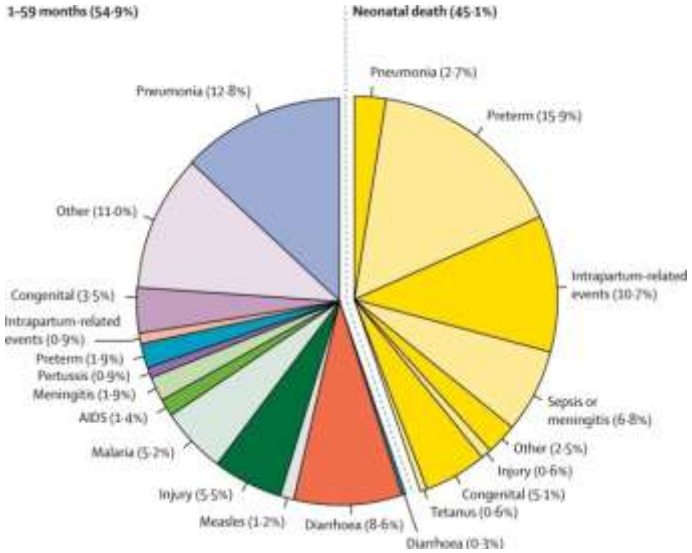

Figure 1: Global causes of under-5 deaths in 2015. [20]

Regionalization of perinatal services necessitates those newborn babies requiring intensive care or special treatment need to be transported to higher centers for advanced care. It is preferable to safely and expeditiously transfer the mother to a facility with the necessary resources before the delivery of a high-risk newborn. Unfortunately, some infants requiring expert neonatal care are not identified before birth,

and others deliver too quickly to permit maternal transfer.[6]

Neonatal mortality is a major concern in low and middle-income countries. India as the second largest populated country in the world contributes to one-fifth of global live births and more than a quarter of neonatal death. In India alone around one million babies die each year before they complete the first 28 days of life contributing to one-fourth of the global burden.[7]Existing interventions can prevent two-thirds or more of these deaths if they reach those in need.[3,5] These conditions can be easily treated and effectively managed with an appropriate level of care, unfortunately not all the medical centers provide specialized care for the neonates, hence these neonates have to be transported to the tertiary care center where the facilities are available.

It has been studied that antenatal maternal transport has a very good outcome when compared to neonatal transport. It is estimated that antenatal maternal transfer is impossible in 50% of high-risk pregnancies. In these situations, neonatal transport must be performed by specially trained teams skilled in stabilization and effective management during transport.[8-12]

These critically ill neonates have to undergo various physical hazards during transport in the form of noise, vibration, deceleration or acceleration forces, and temperature instability all of which can destabilize the sick neonate who is already struggling hard to maintain normal homeostasis.[8]

A well-trained and dedicated transport team is the prerequisite for a better outcome. Lack of proper transport facilities is one of the common factors contributing to the poor outcomes in neonates.[12] Transport of neonate depends largely on the mode of transport, trained personnel accompanying the child, adequate equipment, and appropriate drugs. Instability or complications during the transport leads to increased morbidity and mortality in these vulnerable babies.[10] Hence, Neonatal transport is one of the major predictors of the outcome of transported sick neonates.

Neonatal transport remains a neglected topic so far, particularly in the context of developing countries. Evidence suggests that mortality in transported new-born is much higher than inborn.

Indira Gandhi Institute of Child Health is the tertiary care referral institute of Karnataka for all neonatal and pediatric cases, which receives several sick neonates daily not only from Karnataka but also from neighbouring states. Most of them are transported without proper stabilization from the referring hospitals. The care during their transport is also not satisfactory. Hence all supportive care in NICU for these sick neonates is sometimes futile. So, this study was designed to assess the condition of the neonate at arrival and to correlate it with the outcome determine morbidity and mortality factors, and compare the outcome in neonates accompanied by trained personnel and those neonates who were brought unaccompanied.

METHODOLOGY

This Hospital-based cross-sectional observational study on neonatal transport was conducted in the Department of Neonatology, Indira Gandhi Institute of Child Health (IGICH) Bangalore, between January 2020 and June 2021. This study was approved by the IGICH scientific and ethical

committee and informed consent was obtained from the parents.

a) Inclusion criteria:

1. All neonates up to 28 days of life require admission to the department of neonatology.
2. Informed written consent from parents/caretakers
3. Availability of details of neonatal transport.

b) Exclusion criteria:

1. Major or life-threatening congenital malformation.

The purpose of the study was explained to the parents and pre-structured Pro-forma is used for recording the relevant information from the individual subject selected for the study. Informed consent will be taken from parents/guardians.

Data including demographic parameters and transport details were recorded.

- Antenatal details –including immunization, check-ups, and other antenatal risk factors like pregnancy-induced hypertension, GDM, PROM, etc. are collected.
- Natal and postnatal history including mode of delivery, resuscitation details were recorded as per referral slip or by mother/attendees if referral slip not available. Active resuscitation means neonates requiring bag and mask ventilation and or chest compression and or intubation.
- Transport details included indication for transport, mode of transport, distance covered, accompanying person, intervention, and monitoring during transport and time of referral, time of arrival at IGICH, etc.
- Pre-transport and post-transport physiological parameters and significant interventions required during and within 1 hour after transport is analyzed. Pre-transport physiological parameters taken (if available) in the referring hospital closest to the time of transport will be captured. Post-transport physiological parameters are taken according to the CRIB 2 score at the time of admission.
- The length of stay in the ICU and total hospital stay is also analyzed. These neonates are followed up till discharge/death.

STATISTICAL ANALYSIS-

SPSS (Statistical Package for Social Sciences) version 20. (IBM SPASS statistics [IBM corp. released 2011] will be used to perform the statistical analysis

- Data will be entered in the excel spreadsheet.
- Descriptive statistics of the explanatory and outcome variables will be calculated by the mean, standard deviation for quantitative variables, frequency, and proportions for qualitative variables.
- Inferential statistics like
  - Chi-square test will be applied for categorical variables
- The level of significance is set at 5%
- Any other necessary tests found appropriate will be dealt with at the time of analysis based on data distribution.

SAMPLE SIZE ESTIMATION

Sample Size = $\{Z^2*(p)*(q)\}/\Delta^2$

The sample Size for the study is estimated using the above formula. Substituting the values-

Where,

Z value for the confidence level chosen = 1.64 (for 90% confidence level - from standard normal distribution);

p = 19.8% = 0.198 (from the article Deepak Rathod et al);
q = 1-p = 1-0.198 = 0.802
Δ = Margin of error which is acceptable = 0.15 (or 15%) the Sample Size calculated to be 497(rounded off to 500)

RESULTS

1. BIRTH DETAILS

96% of cases were institutional delivery. The most common place of delivery is a government hospital in 58.8% of cases, of which district hospitals are 38.8%, and community-level health care 16.8%, followed by private hospitals 38.4% and least at home and ambulance both contributing to 3.2%. Indicating increased awareness about the advantage of institutional delivery. >95% delivery is conducted by doctors or under doctor observation, followed by nurses alone in 3.4% deliveries, and last by relatives in 1% of cases mainly in the home. >82% babies cried immediately after birth, 17.6% babies didn't cry immediately after the birth of which 49 cases (9.8%) cases required active resuscitation as in fig 2.

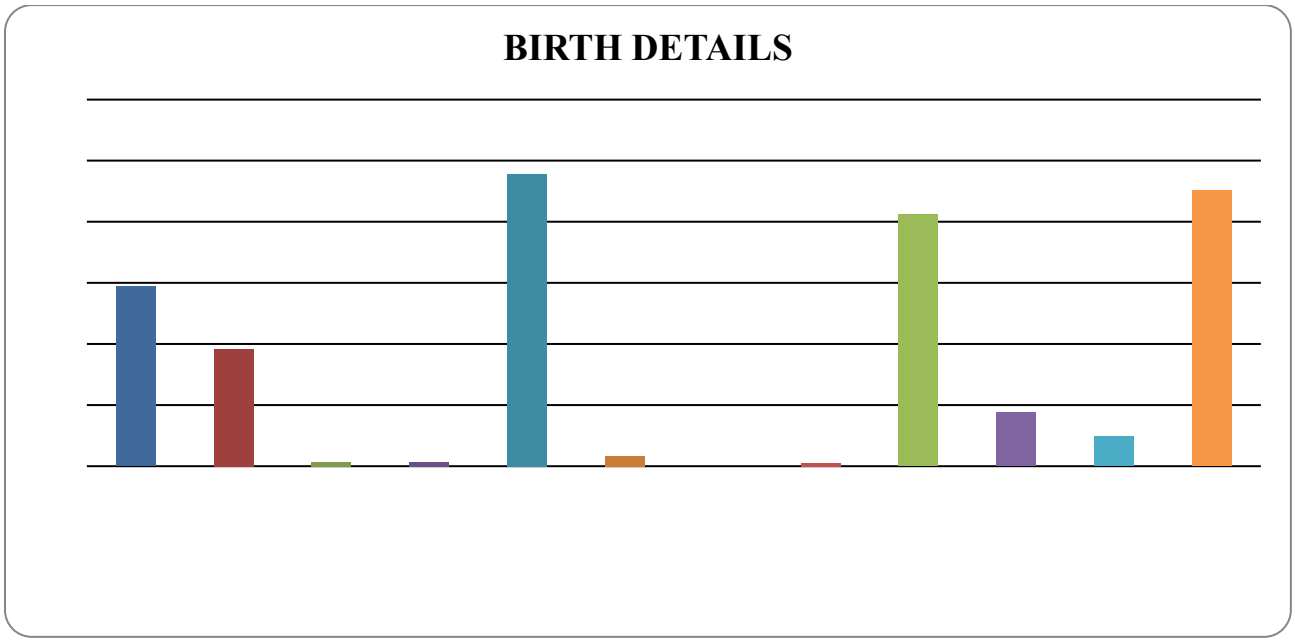

Figure 2: distribution in respect to birth details

2. BIRTH WEIGHT:

Most babies were 1500-2500 grams (40.2%) followed by 36.4% neonates with a birth weight of >2500 grams and 23.4% were weighing <1500gms (2.8% cases with birth weight <999 grams) as in Table 2.

Table 2: distribution as per birth weight

Birth weight (in grams)	**Total cases**	**Percentage**
<999	14	2.8
1000-1499	103	20.6
1499-2500	201	40.2
>2500	182	36.4

3. GESTATIONAL AGE:

Out of 500 babies, 231 neonates (46.2%) were term, 83 neonates (16.6%) were late preterm, 186 neonates (37.2%) were early preterm as in Table 5.

Table 3: distribution according to maturity.

Maturity	Total	Percentage
Preterm	265	53
Term	229	45.8
Post-term	6	1.2
Total	500	100

4. PREHOSPITAL THERAPY:

Out of 500 babies, 42% cases were admitted to another hospital for > 24 hours, and received oxygen support in 41.2% cases, 1.8% had received pre-hospital fluid bolus for shock, 1.6% cases received inotrope support, 3.2% had received dextrose, 7.8% cases received AED's and 10% cases required intubation in a previous hospital stay as in Figure 3.

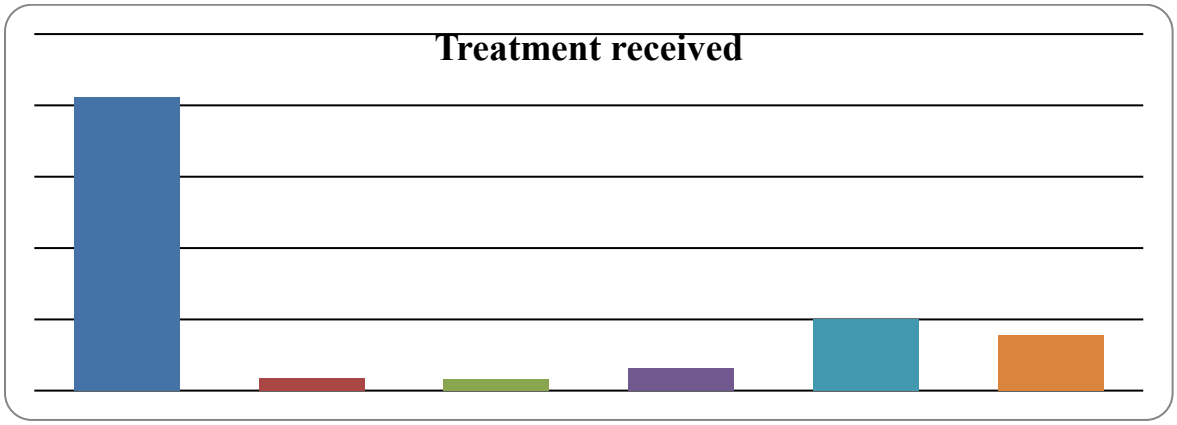

Figure 3: details of treatment received at the primary hospital

5. MODE OF TRANSPORT

In our study the mode of transport in the majority was by self-arranged private ambulances (56.8%), followed by government ambulances (29.4%), private hospital ambulances (10.3%), and by other vehicles (4.4%) as in fig 4.

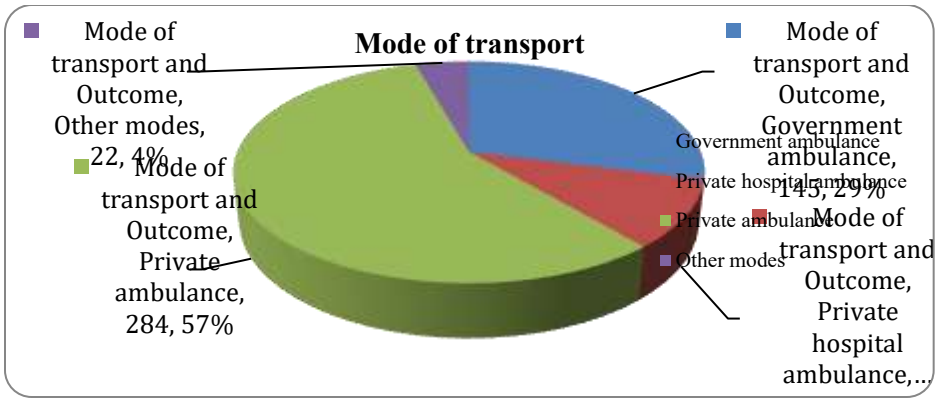

Figure 4: mode of transport

6. DISTRIBUTION OF NEONATES IN RELATION TO TRANSPORTATION DETAILS

Out of 500 cases transported 33.8% of cases were contacted for the requirement of higher care and the main mode of contact is by referral letter, only 24.6% of parents were explained about the transportation risk and probable outcome before transport. In 53.8% cases were accompanied by trained personnel but of which 13% cases were transported with trained staff.

Table 4: distribution of neonates in relation to transportation details

Travelled details		N=500	Percentage
Contact before transport	Yes	169	33.8
	No	331	66.2
Counseled on the risk associated with transport	Yes	123	24.6
	No	377	75.4
Trained personnel accompanied	Yes	269	53.8
	No	271	54.2
Monitoring during transport	Yes	171	34.2
	No	329	65.8

7. DISTRIBUTION OF NEONATES IN RELATION TO DISTANCE COVERED AND TIME TAKEN TO REACH REFERRAL HOSPITAL.

Table 5: distribution of neonates in relation to distance covered and time taken to reach referral hospital.

		N=500	Percentage
Distance traveled	1-10 km	109	21.8
	10-20 km	111	22.2
	20-30 km	81	16.2
	>30 km	199	39.8
Duration of travel	1-30 min	149	29.8
	30-60min	139	27.8
	60-90 min	37	7.4
	>90 min	175	35

8. MODE OF TRANSPORT AND PHYSIOLOGICAL DERANGEMENTS

On the arrival at our institutes, it was found that 11% of cases were in shock, >50% cases were with respiratory distress, 52% cases with hypothermic, of which 24.8% were in cold stress 27.2% had moderate to severe hypothermia. 32.4% of the neonates having saturation <92% at room air, respiratory distress in 26.2% cases,9.8% of the babies MAP were < 40 mm Hg hypoglycemia seen in 3.6% cases at admission. Most of the cases were seen cases transported in self-arranged private ambulances which were lacking trained personnel and monitoring during transport.

9. DURATION OF TRAVEL AND OUTCOME

Cases with transport duration of more than 60 minutes had poor prognosis as in table 25

.

Table 6: duration of transport and outcome

Travel duration (in minutes)	Outcome			Total
	Discharged	LAMA	Death	
<30	121	19	9 (6%)	149
30-60	120	13	6 (4.3%)	139
60-90	20	0	17 (45.9%)	37
>90	139	16	20 (11.5%)	175

Chi-square – 51.957, P-value- 0.0001 (significant)

10. TRAINED PERSONNEL ACCOMPANIED AND OUTCOME

Cases transported without accompanying trained personnel associated with mortality twice that of cases accompanied by medical staff as in table 26.

Table 7: trained personnel accompanied and outcome

Medical staff accompanied	OUTCOME			Total cases
	Discharged	LAMA	Death	
Yes	190	25	14 (5%)	229
No	210	23	38 (14%)	271

Chi-square – 7.868, P-value- 0.005 (significant)

SUMMARY

- This hospital-based observational study included 500 neonates, among these 500 neonates 52 neonates (10.2%) expired.
- The common indication for referral was prematurity (22.6%), respiratory distress (17.6%), congenital malformation (11.6%), sepsis (10.4%), perinatal asphyxia (9.6%) hyperbilirubinemia (9.2%), convulsions

(4.8%), abdominal distension (3.8%) and hypoglycemia (1.8%).

- In our study the mode of transport in the majority was by self-arranged private ambulances (56.8%), which were lacking trained staff, followed by government ambulances (29.4%), private hospital ambulance (10.3%) and by other vehicles (4.4%).
- The maximum number of babies accompanied by attenders only (54.2%), who were transported in a self-arranged private ambulance. Only 13% of cases were accompanied by a well-trained staff during transport, rest 32.8% were accompanied by untrained medical staff.
- 2/3rd of cases were shifted to us without any pre-information about the patient. 33% of cases had proper referral records for the requirement of higher care and details of stabilization before transport. Only 24.6% of parents were counseled before transport.
- On arrival 52% of babies were hypothermic, >50% cases were with respiratory distress, of which 32.4% had spo2 <92%, 9.8% cases in shock, hypoglycemia seen in 3.6% cases.
- Most of the physiological derangements at admission were seen with the cases that were transported in self-arranged private ambulances which was lacking trained staff and monitoring during transport. All these were modifiable risk factors that can be averted by proper stabilization before transport and maintaining it during the transport.
- Among the babies who succumbed, the majority were due to prematurity and its complication (32.69%), followed by, respiratory distress syndrome (15.38%) and perinatal asphyxia and its complications (13.46%).
- Among the neonates who succumbed the common parameters altered were tachycardia, hypoxia, prolonged capillary refilling time followed by hypothermia, hypoglycemia.
- Neonates transported by 108 ambulances and private hospital ambulances had better outcomes than those who transported ina self-arranged private ambulance.

DISCUSSION

The present study was done to assess the effect of the available neonatal transport system on morbidity and mortality; including modes, organized transport, special needs, and care during transport; to discuss the effects of these determinants have on the overall survival of these newborns.[13-15]

Indication of transport:

In the previous study done by Narang et al (2013)[15] showed respiratory distress syndrome (43%) followed by prematurity (22%) were the common indications for referral. In a South Indian study conducted by Rathod et al (2015), sepsis and asphyxia were the common indications for referral.

In the current study common indication for referral was prematurity (22.6%), respiratory distress (17.6%), congenital malformation (11.6%) sepsis (10.4%), perinatal asphyxia (9.6%) hyperbilirubinemia (9.2%), convulsions (4.8%), abdominal distension (3.8%) and hypoglycemia (1.8%). Similar to the study done by Jasbir et al(2021) and Sundrani EJ et al(2019) which are suggesting higher admission of premature cases, suggestive of secondary to maternal

complications and an increase in the use of artificial reproductive technology.

Mode of transportation:

Transport of sick newborns, preterm and low birth weight babies to the appropriate health facility is an important link in the chain of interventions required to produce a good neonatal outcome. In the present study, the utilization of ambulance services was 95% (government ambulance service (108 and NAGU-MAGU) -29%, private hospital ambulances – 9.8%, and self-arranged private ambulance 56.8%). Though 108 ambulances are commonly used (29%) for the transport of sick cases, it was noticed that these ambulances are not equipped with appropriate heating systems and monitoring and interventions for neonates during transportation. As a result, they contribute to additional neonatal morbidity.

The present study showed a majority of the babies who were transported had hypothermia (52%) followed by hypoxia, respiratory distress, lethargy, hypotension, and hypoglycemia at the time of presentation to a higher-level center. Similarly, the other studies were done by Rachan et al, Narang M et al, Punith P et al, Jasbir et al and Dalal E et al also showed the babies who were transported to a tertiary center, majority of them presented with hypothermia. This indicates a poor way of transportation and improper way of stabilization and continued support which worsens the mortality and morbidity of the newborns.

Distance and duration about transportation and its outcomes:

The present study also evaluated the duration of transport about various morbidities, since transport duration can have adverse consequences on newborns. Based on the distance and duration of transport the comparison was done with the morbidity of the neonates. The present study showed longer the duration of transport higher was the associated physiological derangements and mortality. Mortality was twice higher when compared between the neonates travelled for longer than 1 hour to those reached within 1 hour. This study correlates with other studies done by Narang M et al and Shankar J et al who also showed that the longer duration of transport more is the mortality and morbidity.

The neonates in this study showed distance of travel directly correlating with physiological derangements. Neonates who travelled >20km had higher incidence of hypothermia 80% vs 50% in <20 km. Similar findings showed in Gustvo et al more clinical deterioration in newborns who travelled >60km.

- The development of efficient transport systems is crucial to the implementation of the regionalization of perinatal care.
- Transportation of the sick or preterm babies to a center with expertise and facilities for the provision of multi-organ intensive care improves outcomes.
- Neonates needing special or intensive care should preferably be transported by a skilled transport team through organized teamwork.
    - Appropriate equipments and vehicles customized for neonates should be available for safe transport.
    - Pre-transport stabilization is the most vital step in the whole process of transport.

- The outcome in the neonates transported was significantly better than those neonates brought unaccompanied stressing the importance of using organized transport with the trained personnel.
- Adequate and timely communication with the family, referring hospital and the support group is essential.

CONCLUSION

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