

Original Research Article

Factors affecting the outcome of neonatal transport in a tertiary care hospital in Bangladesh

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ABSTRACT

Background: Effective neonatal transport is crucial for survival of referred sick newborns and poor transportation is associated with higher mortality. In Bangladesh many births still occur at home, especially in rural areas and newborn transport system is not established contributing to adverse neonatal outcome. This study aimed to document the factors affecting the outcome of transport of sick neonates to a tertiary care hospital.

Methods: This prospective observational study was conducted at Department of Neonatology in Mymensingh Medical College Hospital over a period of 6 month extending from January 2023 to June 2023. Neonates were enrolled if referred within 28 days of life and excluded if they had major congenital anomalies. Data on pre-transport, during-transport and post-transport conditions were recorded using a structured questionnaire. Outcomes were categorized as uneventful or complicated transfers, with survival analyzed as a secondary outcome. Statistical analysis was performed using SPSS, with chi-square tests to assess associations ($p < 0.05$).

Results: Out of 384 referred neonates included in this study, 124 (32.3%) had uneventful transfer and 260 (67.7%) had complicated transfers. Prematurity, low birth weight, home delivery, delivery by untrained dai, self-referral, no prereferral treatment and counselling, lack of accompanying health personnel during transport, higher distance, transport without ambulance, lack of adequate support and monitoring equipment and treatment during transport was significantly associated with complicated transport ($p < 0.05$). Mortality was significantly higher in complicated transport group (38.9%) compared to uneventful transport (26.6%).

Conclusions: In conclusion, this study highlights significant gaps in neonatal transport practices revealing that both pre-transport and transport conditions critically influence outcomes. The findings underscore the urgent need for a specialized neonatal transport service to reduce neonatal mortality and morbidity.

Keywords: Newborn transport, Neonates, Uneventful and complicated transfers

INTRODUCTION

The neonatal period is recognized as the most vulnerable time in human life. During this period, a newborn

requires care and help for many biochemical and physiological adjustments. Unfortunately, many of the newborns fall from their lives in this period. Bangladesh has achieved its millennium development goal 4 target for under-five mortalities (48 per 1000 births by 2015)

ahead of time. However, unfortunately, neonatal mortality is still significantly high (20 deaths per 1,000 live births), which accounts for two third of all under-5 deaths.¹

Noninstitutional births constitute a significant proportion of total births and still, many deliveries are conducted at home, specifically in rural areas. Though institutional delivery and in-utero transport of newborns is safest, unfortunately, preterm delivery and perinatal illness cannot always be anticipated, resulting in the continued need for transfer of these babies after delivery.² These babies are often critically ill and the outcome is also dependent on the effectiveness of the transport system.³

Newborn transport is used to move sick neonates from a facility without specialized or intensive care needed for optimal care of the baby to hospitals with neonatal intensive care and other specialist services. Medical transport of high-risk and critically ill newborns requires skilled personnel and specialized equipment. The success of transport depends on the quality of care in the delivery room, the continuous and adequate attention to the NB in the neonatal unit before transfer, the choice of type of transport, the team that will be in charge of transport, adequate equipment, appropriate drugs and effective communication to the reference unit. Inadequate care in any phase may produce irreparable harm to the neonate.⁴

Safe neonatal transport has been a distant dream in most of the developing countries, including Bangladesh and has been found to be contributing to the increased mortality rates in these countries.^{5,6} In most of the developing countries there is no dedicated and specialized neonatal transport service.⁷ In Bangladesh, a referral transport system is virtually nonexistent. When no specialized transport service is available, most neonatal transports are self-transported with inexperienced staff and unequipped vehicles, without any pre-treatment stabilization or care during transport.

Many of the babies transported in this way are cold, blue and hypoglycemic and 75 % of babies transferred this way have serious clinical complications.⁸⁻¹⁰ It is difficult to project the exact contribution of neonatal transport characteristics to neonatal mortality rate. However, a mortality rate of 25-35% has been reported in previous Indian studies among neonates transported to tertiary care centers.¹¹⁻¹³

Biochemical and temperature disturbances are more common in babies transported on their own and a specialized neonatal transport service could improve the survival of these babies.¹⁴ Even simple community-based interventions, prereferral stabilization and appropriate care during transport by a trained person may even be community health worker might go a long way toward better outcomes for referred neonates in developing countries.¹² For example, as temperature maintenance by transport incubator is not available at the majority of

places in resource-limited setups, kangaroo mother care used by an attendant or mother is a useful way to maintain temperature during transport.¹² Despite the magnitude of the need for an effective neonatal transport system, so far, few studies have examined transport characteristics in Bangladesh. This study aimed to document the factors affecting the outcome of neonatal transport to a tertiary care hospital.

METHODS

Study design

This prospective observational study was conducted at Department of Neonatology in Mymensingh Medical College Hospital over a period of 6 months extending from January 2023 to June 2023. Ethical clearance was obtained from the Institutional Review Board (IRB) of Mymensingh Medical College to undertake the current study. All the referred neonates admitted to these hospitals were enrolled in the study. A structured questionnaire was used to record information categorized into pre-transport, during transport and after transport information.

Inclusion criteria

Neonates referred from another hospital within the first 28 days of life.

Exclusion criteria

Neonates having Major congenital anomaly or surgical condition.

Data collection

Pre-transport information included gestational age, birth weight, sex, mode of delivery, place of delivery, persons conducting delivery, reason for referral and pre-referral treatment. The information recorded regarding transport procedure included type of vehicle, duration, member of the transport team, availability of essential support and monitoring equipment, during transport. The condition of the baby at arrival in NICU, which the attending physician assessed by recording axillary temperature, CBG, oxygen saturation and Capillary filling time using the standard techniques.

Outcome measurement

The primary outcome was recorded as whether it was an uneventful transfer or a complicated transfer. Uneventful transfer was defined as transfer without any adverse clinical event. Complicated transfer was defined as transfer with one or more adverse clinical event. All babies were investigated and managed based on their admission diagnosis using a standard protocol. The secondary outcome was recorded as whether babies survived or died. Newborns who left against medical

advice were not included in the survival analysis; however, they were studied regarding the status of their transport and primary outcome.

Data analysis:

After collection, data will be entered into a personal computer and will be edited, analyzed, plotted and will be presented in graphs and tables. Data will be analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0. The study variables were analyzed for their association with the outcome by applying the chi-square test. All p values <0.05 will be considered statistically significant.

RESULTS

From January 2023 to June 2023, 384 referred neonates were included in the study. Out of the study cases, we identified 124 cases (32.3%) of uneventful transfers and 260 cases (67.7%) of complicated transfers (Figure 1). The rate of complicated transfers was similar among male and female neonates (67.6% and 67.9% respectively).

Preterm neonates had a much higher rate of complications during transport (81.92%) compared to term neonates (55.56%). Similarly, low birth weight (LBW) neonates had significantly more complicated transfers (80.93%) than those with normal birth weight (50.89%). Neonates delivered at home faced higher complications (84%) and deliveries conducted by untrained personnel were associated with more complications (77.08%) (Table 1).

Additionally, self-transporters were associated with a significantly higher complication rate (92.17%) in comparison of hospital-referred cases (57.25%). Preferral treatment played a critical role, with neonates receiving treatment showing fewer complications (37.91%) than those who did not (87.45%) (Table 1).

Patients accompanied by health personnel had a significantly higher rate of uneventful transfers (90.91%) compared to complicated transfers (9.09%). In contrast, those accompanied by family members experienced far fewer uneventful transfers (28.73%) and a much higher

proportion of complicated transfers (71.27%) ($p<0.05$). Regarding the transport vehicle, neonates transported via ambulance had a significantly higher percentage of uneventful transfers (72.73%) and fewer complications (27.27%) ($p<0.05$). The time required for transport also played a critical role.

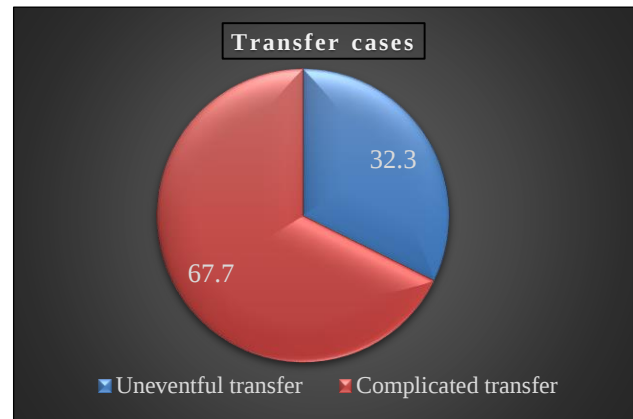


Figure 1: Distribution of neonates by transport complication.

Study subjects transported within less than one hour had a significantly higher rate of uneventful transfers (81.03%) than those transported in 1–6 hours (25.12% uneventful) or more than 6 hours (20.87% uneventful). Correspondingly, complications increased with transport duration: 18.97% for less than one hour, 74.88% for 1–6 hours and 79.13% for over 6 hours ($p<0.05$) (Table 2). Neonates transported with essential equipment had a significantly higher rate of uneventful transfers (89.47%).

Complications were markedly fewer with equipment (10.53%) than without it (73.99%) ($p<0.05$). Participants receiving treatment during transport had an exceptionally high rate of uneventful outcomes (94.74%) and very few complications (5.26%), whereas those not receiving treatment had significantly lower uneventful transfers (21.41%) and higher complications (78.59%) ($p<0.05$) (Table 2). Mortality rate in complicated transport group was 38.9% and in uneventful transport group was 26.6%. Mortality was significantly higher in complicated transport group compared to uneventful transport ($p<0.05$) (Table 3).

Table 1: Comparison of uneventful and complicated transfer in relation to pre-transport variable.

Variables (N, %)	Uneventful transfer (n=124)		Complicated transfer (n=260)		P value
	N	%	N	%	
Sex					
Male (n=216)	70	32.4	146	67.6	0.09
Female (n=168)	54	32.1	114	67.9	
Gestational age					
Term (n=207)	92	44.44	115	55.56	<0.05
Preterm (n=177)	32	18.08	145	81.92	

Continued.

Variables (N, %)	Uneventful transfer (n=124)		Complicated transfer (n=260)		P value
	N	%	N	%	
Birth weight					
LBW (n=215)	41	19.07	174	80.93	<0.05
Normal (n=169)	83	49.11	86	50.89	
Place of delivery					
Home (n=250)	40	16	210	84	<0.05
Institutional (n=134)	84	62.69	50	37.31	
Persons conducting delivery					
Professional (n=192)	80	41.67	112	58.33	<0.05
Untrained Dai (n=192)	44	22.92	148	77.08	
Referring centre					
Hospital (n=269)	115	42.75	154	57.25	<0.05
Self (n=115)	9	7.83	106	92.17	
Prereferral treatment and counselling					
Yes (n=153)	95	62.09	58	37.91	<0.05
No (n=231)	29	12.55	202	87.45	

Table 2: Comparison of uneventful and complicated transfer in relation to transport variable.

Variables	Uneventful transfer (n=124)		Complicated transfer (n=260)		P value
	N	%	N	%	
Accompanying person					
Health personnel (22)	20	90.91	2	9.09	<0.05
Family member (362)	104	28.73	258	71.27	
Transport vehicle					
Ambulance (77)	56	72.73	21	27.27	<0.05
Other than Ambulance (307)	68	22.15	239	77.85	
Time required for transport (Hour)					
<1 (58)	47	81.03	11	18.97	<0.05
1-6 (211)	53	25.12	158	74.88	
>6 (115)	24	20.87	91	79.13	
Availability of essential support and monitoring equipment					
Yes (38)	34	89.47	4	10.53	<0.05
No (346)	90	26.01	256	73.99	
Treatment during transport					
Yes (57)	54	94.74	3	5.26	<0.05
No (327)	70	21.41	257	78.59	

Table 3: Comparison of uneventful and complicated transfer in relation to mortality.

Variables	Survived (250)		Expired (134)		P value
	N	%	N	%	
Uneventful transfer (n=124)	91	73.4	33	26.6	<0.05
Complicated transfer (n=260)	159	61.1	101	38.9	

DISCUSSION

Our multicenter study provides critical insights into the variables affecting neonatal transfer outcomes. Through extensive data analysis, we identified substantial differences between uneventful and complicated transfers, underscoring the necessity for focused interventions to improve neonatal care during transport. Specifically, our findings reveal that certain pre-transport

factors, such as gender, gestational age, birth weight and delivery location, have a significant influence on the likelihood of transfer complications, highlighting areas where strategic improvements could yield better outcomes. In our pre-transport analysis, notable differences emerged between complicated and uneventful transfers. Male infants and those with lower gestational ages were more frequently associated with complex transfers. In our sample, male infants constituted 61.11%

of the complex transfers, compared to 38.89% of the uneventful transfers ($p<0.05$), while preterm infants represented 81.92% of complicated compared transfers versus 18.08% of uneventful transfers ($p<0.05$). These findings align with previous research suggesting that male neonates and term births are linked to higher risk levels during neonatal transport, potentially due to increased vulnerability associated with male infants and lower gestational resilience in term neonates.^{15,16}

Birth weight further differentiated the two groups; this finding highlights the susceptibility of low-birth-weight infants during transport, echoing other studies that underscore the elevated risk for infants with lower birth weights the elevated.^{17,18} Low birth weight often correlates with a range of health vulnerabilities, making these infants more prone to complications when subjected to the stresses of transfer. The location of delivery also had a marked impact on transfer outcomes. Infants delivered outside healthcare facilities, especially those born at home, demonstrated a significantly higher complication rate (92.17%) compared to those offered in hospitals (57.25%) ($p<0.05$).

This trend suggests that non-hospital deliveries may lack adequate initial stabilization and medical preparedness, leading to poorer outcomes during subsequent transfers. These findings emphasize the importance of accessible prenatal and delivery services to mitigate risks associated with out-of-hospital births.^{19,20} Transport-specific variables further illustrated the complexities influencing transfer outcomes. The presence of health personnel during transport was 9.09% in complicated transfers and 90.91% in uneventful transfers ($p<0.05$), underscoring the crucial role of trained staff in reducing risks during neonatal transport.

Previous studies reinforce the necessity of having skilled personnel on hand during neonatal transfers, as they can make timely interventions that might prevent the escalation of complications.^{16,18} Additionally, the mode of transport was significant; ambulances were used in 72.73% of uneventful transfers, contrasting with 27.27% in complicated transfers ($p<0.05$). This supports findings from other studies that advocate for the use of well-equipped ambulances, as they offer neonatal support systems that reduce adverse outcomes during transport.^{17,19} The duration of transport was another critical factor. The transfers lasted for one to six hours in 25.12% and in 74.88% cases in complicated and uneventful groups, respectively ($p<0.05$).

Extended transport times are associated with increased mortality in neonates, highlighting the urgent need for streamlined transfer procedures to minimize time in transit. Efficient logistics and rapid response systems could play a significant role in improving outcomes, as prolonged travel can exacerbate neonatal health risks.^{16,20} Mortality outcomes sharply contrasted between groups. In the complicated transfer group, mortality rates were as

high as 38.9%, whereas only 26.6% of infants in the uneventful group did not survive ($p<0.05$). This stark disparity illustrates a broader trend in neonatal care, where complications during transport correlate with increased mortality rates.^{15,18}

This study has several limitations. It relied on retrospective data collection, which could introduce recall bias or inaccuracies in recorded information. Limited data on the long-term outcomes of neonates' post-transport could provide a more comprehensive understanding of the impact of transport conditions on neonatal health. Additionally, the study did not account for the socioeconomic status of the families, which could influence both the quality of transport and neonatal outcomes.

CONCLUSION

In conclusion, this study highlights significant gaps in neonatal transport practices revealing that both pre-transport and transport conditions critically influence outcomes. Prematurity, low birth weight, home delivery, delivery by untrained dai, self-referral, no prereferral treatment and counselling, lack of accompanying health personnel during transport, higher distance, transport without ambulance, lack of adequate support and monitoring equipment and treatment during transport was significantly associated with complicated transport. Mortality was significantly higher in complicated transport group compared to uneventful transport. The findings underscore the urgent need for a specialized neonatal transport service, proper stabilization before transfer and improved transport conditions to reduce neonatal mortality and morbidity.

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