

## Inter-Hospital Transfer of Neonates in the South of Vietnam-Relations to Prognosis and Outcome: A Prospective Cohort Study

Malene Mie Andersen<sup>1\*</sup>, Josefine I Mainborg Andersen<sup>1</sup> and Freddy Karup Pedersen<sup>2</sup>

<sup>1</sup>University of Copenhagen, Copenhagen, Denmark

<sup>2</sup>Department of Pediatrics and Adolescent Medicine, JMC, Rigshospitalet, Copenhagen University Hospital, Copenhagen, Denmark

\*Corresponding author: Malene Mie Andersen, University of Copenhagen, Copenhagen, Denmark, Tel: +45 60121309; E-mail: malenemie@yahoo.dk

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### Abstract

**Background:** Neonatal mortality remains an important health issue worldwide. In Southern Vietnam, Pediatric Hospital Number 1 offers the highest level of neonatal care, wherefore interhospital transportation of newborns hereto is frequent. The conditions during this transportation are likely to influence the prognosis of the neonates. The aim of this study was to map the neonatal transfers, and hereby identify areas in which improvement could be made to further enhance neonatal survival in the south of Vietnam.

**Methods:** A prospective cohort study was conducted at Pediatric Hospital No.1 in Ho Chi Minh City, Vietnam. During a one-month period, data was collected using standardized questionnaires on neonates transferred from the southern half of Vietnam.

**Results:** A total of 103 neonates representing 96 transfers were included. All neonates were transferred by ambulance and escorted by health personnel. The transfers of intermediate quality (51.5%) had the highest mortality and a significantly longer hospitalization ( $p=0.007$ ). Only 15.5% of the ambulances were adequately equipped to handle emergencies and few had monitoring equipment for neonates.

**Conclusion:** The neonates with a high risk of needing resuscitation were transferred with a more sufficient equipped and accompanied transport, implying a pre-assessment was made. Though for more than half of the neonates, pre-assessment was insufficient leading to an inadequate transport and a worse outcome. Several areas can be improved to enhance the quality of transportation. Focus on training in neonatal transportation along with a clear definition of the functions and actions required of the accompaniment during transfer could be of great benefit.

**Keywords:** Neonatal mortality; Intensive care units; Neonatal; Transportation; Vietnam

### Abbreviation:

PH1: Pediatric Hospital Number 1; HCMC: Ho Chi Minh City; NICU: Neonatal Intensive Care Unit; SCU: Special Care Unit; E.U.: Emergency Unit; LOC: Level Of Care; QOT: Quality Of Transport

### Introduction

One of the United Nation's Millennium Development Goals is "to reduce by two thirds the under-five mortality-rate" [1] In Vietnam WHO estimated that the under-five mortality was 23.8 per 1000 live births in 2010. Worldwide the rate was 60 per 1000 live births [2].

For the past two decades there has been a significant reduction in the under-five mortality rate. Studies have shown that this mainly is due to a reduction of the post neonatal mortality [3]. The mortality rate within the first four weeks of life has shown only limited progress in the last years [4], and globally 38% of the deaths of children younger than five years occurs in the neonatal period.

Inter- and intra-hospital transportation is highly risky. It exposes the neonate to a considerable risk of complications occurring on the way [5]. The decision to transport a patient to another facility is

therefore based on an assessment of the potential benefits of getting the patient to a place with better facilities for better care weighed against the potential risks of the transportation [6]. Much research has been made in western countries to minimize the risk of poor outcomes when transporting patients. There are still no fixed universal guidelines, but some general criteria, which should be met [5,6]. Recent research in the field shows that the use of a retrieval team is very beneficial in reducing the neonatal mortality. This offers the quality and experience needed for handling neonates [7,8].

No previous studies have looked at the actual methods and standards of the transports with relation to prognosis.

Pediatric Hospital No.1 (PH1) in Ho Chi Minh City (HCMC) offers the highest level of neonatal care in Southern Vietnam, and receives pediatric patients including severe ill newborns, transferred from 32 provinces in South Vietnam. Interhospital transportation is therefore important and frequent.

A recently concluded PhD-project made at the neonatal department at PH1 investigated the causes of neonatal death [9]. During the process of the this study, it was suggested that the conditions during transportation of the neonates were likely to influence the prognosis and mortality of the neonates. This research did not directly address the conditions of the transport.

This study was therefore conducted with the aim to map the neonatal transport to a high level of care hospital. Hereby, it was sought to identify areas in which improvement could be made to further enhance neonatal survival in the South of Vietnam.

## Materials and Methods

The study was conducted as a prospective cohort study at PH1 in Ho Chi Minh City in Vietnam.

PH1 is the largest public pediatric hospital in the south of Vietnam, with approximately 1200 beds. They offer basic to intensive neonatal care (Level I-III) [10]. The neonatal department has 150 beds that are divided into three different levels; a neonatal intensive care unit (NICU), a special care unit (SCU) and a nursery.

Information were gathered about all neonates <28 days and/or <2000 grams arriving at PH1 from another hospital or health care facility from November

9th 2011 to December 9th 2011, from 10 am to 8 pm on weekdays and 10 am to 3 pm on Saturdays.

Data was collected through standardized registration forms in English and Vietnamese. The data collection consisted of four registration forms (copies in English can be found in Appendix A). The first aimed to map the means of transportation. The second was filled out by the receiving doctor in the Emergency Unit (E.U.) and aimed to describe the condition of the neonate upon arrival as well as a statement on whether or not they found the transportation appropriate. Both the third and the fourth form were copies of the second form, where vital parameters of the patient respectively 6 and 24 h after admission were registered in order to follow the development in the patient's condition.

The investigators were present in the E.U. at all times during the hours of data collection. Upon arrival of a newborn, the registration form mapping the transportation would be filled out by the accompanying health care professional and the investigators would make an inventory of the ambulance. The receiving doctor from the E.U. filled out the form describing the state of the patient and the events during the transport. Follow-up forms were completed on all patients transferred to NICU or SCU by the managing team, who had received careful instructions. Patients were admitted to NICU, SCU or nursery respectively depending on the needed level of care (LOC) and treatment. The decisions were based on the Washington State Guidelines [10].

Towards the end of the study, the length of admission and the final diagnosis for each patient were registered. The duration of admission was segregated in length of admission in NICU and in total.

The transports were classified into three groups by evaluating the necessity, quality and quantity of the equipment, medicine and accompaniment. A description can be found in Appendix B.

The study was conducted in accordance with the guiding principles of the Declaration of Helsinki. The Scientific Review Board and Ethical Committee of the study hospital and The Danish Data Protection agency approved the study. The study did not fall within the jurisdiction of The Danish National Committee on Health Research Subcommittee on Developing Countries. Spoken informed consent was obtained from a parent or guardian upon arrival of the ambulance thus before enrolment.

Statistical analyses were done in MS Excel and SPSS version 20. Exploratory data analysis was conducted on all data to confirm that the statistical analysis would yield valid results. Statistical analyses were performed using Chi square and logistic regression analyses. When analyzing length of admission the ANOVA test was used.

## Results

A total of 117 patients were registered. 103 neonates were included in the study. 14 neonates were excluded due to missing information about the transport (n=2), age exceeding the neonatal period or actual weight above

2000 g (n=10) or due to transfer to another department than the neonatal department (n=2).

A total of 96 transfers were received, hereof 95 by ambulance and one by taxi, as seven of the ambulances arrived with two neonates.

The neonates arrived from health care facilities from 21 of 32 provinces in southern Vietnam. 76.7% was transferred from a public provincial or district hospital and 18.4% was transferred from a private hospital.

All patients were categorized into three groups describing the level of risk associated with their transfer (Tables 1-3). The categorization was based on current literature [5,10-12]. (Further information can be found in Appendix C).

	Total (n=103)	High risk patients (n=59)	Moderate risk patients (n=17)	Low risk patients (n=27)	Missing
Gestational age <sup>1</sup>	36,6+3,4 [27-41]	35,3+3,9 [27-40]	38,5+1,4 [35-41]	38+1,5 [6-35]	5
Birth weight (g.) <sup>1</sup>	2585+787 [800-4500]	2393+902 [800-4500]	2965+490 [2000-3800]	2802+427 [2000-3600]	4
Actual weight (g.) <sup>1</sup>	2660+842 [800-4700]	2444+892 [800-4500]	3069+553 [2000-3800]	3008+631 [2200-4700]	18
Age (days) <sup>1</sup>	7,5+10,7 [0-45]	7,61+11,1 [27-40]	8+9,7 [0-30]	6,81+9,2 [0-30]	2

**Table 1:** Characteristics of the study population, <sup>1</sup>: Data is expressed as mean values+standard deviation [minimum-maximum values].

Characteristics of the transports			
Duration of transport	Range 10-360 min		
	Mean: 119 min		
	Yes:	No:	Information missing:
N=77	N=20		
Adequate treatment judged by receiving doctor	74.80%	19.40%	N=6
Classification of the Quality of Transport (QOT)			
Good QOT	Intermediate QOT	Bad QOT	
Number=16	Number=53	Number=34	
15.50%	51.50%	33.00%	

Ambulances well equipped for a case of emergency including qualified medical	Ambulances that could not be classified in the other 2 groups.	Ambulances with no relevant equipment, medicine and unqualified
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**Table 2:** Characteristics and classification of the transports.

Risk profile of the patient		
High risk	Moderate risk	Low risk
N=59 (57.3%)	N=17 (16.5%)	N=27 (26.2%)
Unstable neonates or with high risk of circulatory or respiratory failure	Stable neonates but with a moderate risk of circulatory or respiratory failure	Stable neonates with low risk of circulatory or respiratory failure occurring.

**Table 3:** Risk profile of the patient.

A correlation of the patient risk profile of the interhospital transfer and the quality of transport (QOT) was performed. There was a weak statistically significant association showing that high-risk profile neonates had a 1.6 times higher chance of being transferred with a good quality transport compared to low risk profiles ( $p=0.03$ ).

To evaluate the independent significance of the equipment and accompaniment as risk factors, the QOT were segregated into a categorization of the quality of equipment and the quality of the accompaniment.

This did not yield any significant results that could indicate either the equipment or the accompaniment as independent risk factors.

### Mortality

The neonates who had not received adequate treatment during transport according to the receiving doctor had a higher mortality (20%) compared to those who had received adequate treatment (12.3%,  $p=0.3$ ).

There was a trend towards increasing mortality when the neonate had undergone a longer transportation. The mortality was 6.7% for transfers shorter than 30 min increasing to 18.2% for transfers exceeding 120 min.

There was a lower mortality for the patients transferred with transport of bad quality (9.1%) and the highest mortality was found in neonates transferred with transports of intermediate quality (18%,  $p=0.57$ ).

### Length of Admission in Total and in NICU

There was a statistical significant correlation between a length of admission greater than eight days and a transfer exceeding 120 min ( $r(96)=0.226$ ,  $p=0.027$ ). Furthermore, neonates that received NICU-care during their hospitalization and had a long interhospital transfer, had a 4.3 times higher risk of spending more than eight days in NICU ( $p=0.011$ ).

Neonates who had not received adequate treatment during transport according to the receiving doctor had in average 19.9 days of admission, whereas those having received adequate treatment had 15.9 days of admission. This trend was not statistically significant.

The patients transported with a bad QOT had the shortest hospitalization (mean: 11.35 days, CI: 8.8-13.9), whereas the admission length was 17.9 days (CI: 8.6-27.3) for the good QOT and 19.55 days (CI: 16.1-23) for the intermediate QOT, the latter having the longest time of admission compared to the bad QOT ( $p=0.007$ ). There was no statistical significance in length of hospitalization between intermediate and good QOT ( $p>0.05$ ).

Neonates transported with a good QOT had a mean length of admission in

NICU of 14.57 days (CI: 6.17-22.98), intermediate QOT spent an average of

12.06 days (CI: 6.4-17.7) and bad QOT spent 10.33 days (CI: 2.7-22.8) hospitalized in the NICU. There was no statistical difference between the groups.

### Needed Level of Care (LOC)

Neonates transported with a good QOT had a 3.6 times higher risk of needing intensive care compared to the bad QOT (CI: 1.44-9.02,  $p=0.003$ ). There was a trend towards a greater need for a higher LOC with increasing transportation time, though this could not be statistically substantiated.

The neonates who had not received adequate treatment during transport according to the receiving doctor, had a Relative Risk of 1.37 (CI: 1.06-1.72,  $p=0.054$ ) for needing the highest LOC at admission.

### Observations on Location

During the one month on location, a number of qualitative observations with importance to the improvement of the inter-hospital transport were made.

- The quality of the inventory of the ambulances was very uneven. There was practically no standardizing of the equipment and medicine available, and it was therefore not easily accessible, seldom sterile and often dysfunctional.
- Transports often held more than one patient and often patients of different ages.
- There were often several family members with two-three sets of luggage accompanying the patient in each ambulance. As a consequence, a family member would hold the infant meanwhile the accompanying health person would be in the front seat.
- The qualifications of the accompaniment varied greatly, and none seemed to have received special training in transfer.
- It seemed that the treatment initiated by the local health facility was continued during transportation. However, new treatment was seldom initiated as to optimize the condition of the neonate.
- Monitoring of the patients condition was sparse as there was a minimum of monitoring equipment and no observational charts.
- The perception of the transport seemed to be more focused on the ambulance as a method of transport as opposed to an actual continuation of the hospitalization.
- The cultural aspect and hierarchic tradition seemed to reflect in a general reservation against taking action during transfer.
- All transports were primarily directed to the Emergency Unit, where no neonatal specialist was present and the capacity for handling neonates was limited.

- The overall standard of PH1 is very high with high quality equipment and professionalism among all staff members. However, due to the large patient load, the departments and hallways were always filled with both patients and family members.

## Discussion

The transportation of neonates from the provinces to the main pediatric hospital in the south of Vietnam occurs under reasonably good standards. It was registered that practically all transports were by ambulances and with the accompaniment of a nurse or a doctor. However, this study revealed several areas in which improvements could be made to further enhance the quality of the transportation and the prognosis of the neonates transferred. Patients, who underwent a longer duration of transport, overall had the poorest outcomes compared to patients who underwent a short duration of transport. The mortality and needed level of care upon arrival were higher and they had a longer time of admission in total and in the NICU. This might not be surprising, but emphasizes the importance of a clear and relevant indication for transfer as well as optimal conditions during transportation [5,11].

In addition, many health facilities in the provinces of southern Vietnam seemed to lack the expertise and practice of handling ill neonates. A hotline managed by neonatologists at PH1, could assist the referring doctors in their decisions whether or not to transfer a patient. This could reduce the number of unnecessary transfers, as well as heighten the quality of the pre-transfer assessments and stabilization.

Furthermore, the inventory in the ambulances should be revised and standardized in order to be able to handle emergencies during transfer. Interestingly, it seemed as though a pre-assessment was sometimes made prior to referral. The high-risk neonates were more frequently being transferred in a transport of good quality compared to the low-risk neonates. At the same time, it was the neonates with a transfer of intermediate quality who had the highest mortality. This implies that for a smaller group of either very unstable or stable patients, a proper pre-assessment was made towards a sufficient transport. On the contrary, for more than half of the transferred, there was a lack in the equipment or accompaniment leading to a higher mortality.

Another concern was the lack of monitoring, care giving and initiation of treatment during transfer. More than 75% of the transports had medical staff accompaniment (a nurse with more than one year of neonatal experience or a doctor). However, no standardized observation was made nor was any new initiative taken as to optimize the condition of the neonate during transfer. To address this, courses in the transportation of neonates could be initiated. These courses could be customized for Vietnamese tradition and should regularly be renewed. NICU at PH1 already offers basic and advanced courses in neonatal care for nurses, which could be broadened to involve transportation practices and offered to all nurses involved with transportation.

Lastly, there is a need for clear transportation guidelines. A clear definition of the function of the escort as well as the procedures and actions expected during transfer need to be defined and described. To help accomplish this, the use of flowcharts and checklists for the equipment could be beneficial as well as monitoring equipment and observations charts.

One of the major challenges in this study was the lack of information about the condition of the neonate at the referring hospital. This could indeed have influenced the outcome of the neonate. However, information on the primary disease and transfer diagnosis was taken into account. Combined with the state of health of the neonate upon arrival, a risk profile of the patient was assessed as an indicator of the severity of the patient's condition prior to arrival at PH1 (Appendix C).

Another challenge was that the study population only included patients who reached PH1. It is therefore possible that the very sick neonates were either not transported or died during transportation. However, it can be argued that the role of the transport in this group was marginal.

Moreover, it was not possible to collect data all 24 h of the day. Therefore, a timeframe was defined based on the E.U. admission records, as to include the most possible transfers.

Finally, a comparative cohort with neonates who had not undergone transportation would have given the study more statistical power.

In conclusion, in southern Vietnam all neonates are transferred by ambulance and escorted by health personnel, though there are ways in which the transfers can be improved. An approach could be to focus on courses in neonatal transportation along with a clear definition of the role of the accompaniment during transfer.

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