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The effects of efforts for improving regional neonatal transport conditions in Diyarbakır on infants

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Summary

Aim: To determine the effects of the efforts towards improving the status of neonatal transport on transport conditions and mortality rate of newborns who were referred to Diyarbakır Children's Diseases Hospital, Neonatal Intensive Care Unit (NICU).

Material and Method: The transport conditions of newborns referred to NICU between March 1, 2007 - August 31, 2007 (1st period, Group 1) and between January 1, 2008 and April 30, 2008 (2nd period, Group 2) were determined and the differences between the two periods were compared in terms of medical and paramedical findings after efforts for improvement (etics committee approval: 28.02.2007). Social Package for Social Sciences (SPSS) 11.5 program was used to analyze the data. Student's t and chi-square tests were used for statistical evaluation.

Results: A total of 1525 patients were hospitalized in the first period whereas 927 patients were hospitalized in the second period. Diagnoses and demographic characteristics of infants were similar in both groups. After the efforts carried out for improving neonatal transport, the 2nd group had a higher incidence of positive findings, such as presence of pre-transport communication, detailed discharge report, birth report, gender and identity, using of ambulance and transport incubator, proper use of intravenous fluids, the frequency of intubation of patients needing to be intubated. The frequency of hypothermia, hypoglycemia, hypotension and circulation disorder was found to be lower in the 2nd group. Transport Risk Index of Physiologic Stability-TRIPS score (20.07±13.41 vs 12.89±11.53; $p<0.0001$) and mortality rate (18.4% vs 14.1%; $p=0.007$) were significantly higher in infants in the 1st group.

Conclusions: In Diyarbakır region, neonatal transport conditions markedly improved as a result of efforts for rehabilitation of conditions. Constitution of regional neonatal transport systems in our country should be approached as an emergency action plan in basic healthcare policies. *(Turk Arch Ped 2011; 46: 188-93)*

Key words: Newborn, perinatal care, regionalization, transport

Introduction

In the last 10 years, rapid improvement in medical technology and medical care conditions in neonatal intensive care units (NICUs) has increased the survival rate of sick newborns and improved their prognoses markedly. In parallel to this, the concept of perinatal care has gained great importance. The quality of perinatal care is the main factor in decreasing maternal and neonatal mortality and morbidity rates (1). Modern countries have determined perinatal care conditions according to the principles of regionalization program. Neonatal transport is the most important component of regionalized perinatal healthcare system (2). As a result of regulation of perinatal healthcare services, development of regionalization and neonatal transport and recognition of the importance of these concepts, national politics have been developed in many modern countries (3-5). Although conditions for diagnosis, treatment and care have rapidly improved in NICUs, there are no legal regulations on regionalized perinatal care and transport of sich newborns in our country.

Diyarbakır Children's Diseases Hospital is a regional hospital with a NICU including 55 beds and possesing each of the three levels of care and a neonatal clinic for newborns at risk including 50 beds where mothers as well as newborns at risk are monitored and treated. Infants who need intensive care

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and monitoring are referred from 15 different provinces and districts (including Bingöl, Şanlıurfa, Bitlis, Van, Adıyaman, Hakkari, Muş, Ağrı, Elazığ, Adana and Tunceli) to this hospital. Since it does not include an obstetrics clinic, all patients are admitted from external centers. Therefore, transport of newborns admitted to NICU is very important.

In our study, transport conditions of newborns referred to the NICU in our hospital were examined in two different time intervals and the effects of efforts to improve the current status on conditions of neonatal transport were investigated.

Material and Method

Properties related to neonatal transport of newborns hospitalized and treated in Diyarbakır Children's Diseases Hospital NICU between March 1, 2007 - August 31, 2007 (1st period, Group 1) and between January 1, 2008 and April 30, 2008 (2nd period, Group 2) were determined and the differences of the two periods were evaluated after efforts for improvement of transport conditions (ethics committee approval: 02.28.2007).

For evaluation of neonatal transport conditions and standardization of data, instructions for admission to NICU for working hours and after hours and a NICU team were established and information was ensured to be recorded in full in the previously prepared form. Information present in the form was obtained by interviewing with the families face to face and from medical records and healthcare personnel performing the transportation. All written information sent along with the patient, clinical findings present in the study form and laboratory results were recorded. Demographic properties of the patients, diagnoses, communication before transport, presence of adequate epicrisis, transport with ambulance and transport incubator, presence of birth report-identity and gender expression, patency of venous access, state of intubation, circulatory disorder, hypoglycemia, hypothermia and hypotension and TRIPS (Transport Risk Index of Physiologic Stability) scores were evaluated statistically.

Definitions:

Communication before transport: Provision of written or verbal communication with the physicians working in NICU of Diyarbakır Children's Diseases Hospital before transport.

Presence of adequate epicrisis: presence of demographic information, clinical findings, interventions and tests performed, prediagnosis, reason for referral and the signature and stamp of the referring physician in the epicrisis prepared by the center from which the patient is referred.

Birth report: Name and surname of the mother and baby, name of the center where the delivery took place, protocol number, gender information and the signature and stamp of the related physician.

Identity and gender information: presence of the name and surname of the mother and infant and identity and gender information on the wristband.

Hypothermia: An axillary body temperature of <36°C measured (Microlife digital thermometer, model MT 3001, Microlife AG Swiss Corp., Widnay, Switz) at the time of the first presentation to the unit (6).

Hypoglycemia: A blood sugar of <45 mg/dL at the time of the first presentation to the unit (7).

Hypotension: A systemic arterial blood pressure below the standard values for gestational week and age at the time of the first presentation to the hospital (8).

Peripheral circulatory disorder: This was defined as lengthening of capillary refill time (5 seconds before 30th gestational week, more than 3 seconds in other babies) (9).

Transport Risk Index of Physiologic Stability (TRIPS): This was used to evaluate the effects of neonatal transport conditions on the mortality rate in NICU (especially, in the first seven days of hospitalization) (10). Scoring system is shown in Table 1. Scoring was done by the physician who greeted the patient in the service.

Efforts for improving transport conditions of sick newborns include the following practices:

1. Educational efforts related to neonatal transport: Participation to education sessions of healthcare personnel

Table 1. TRIPS-Transport Risk Index of Physiologic Stability

Variable	TRIPS score	
Body temperature (C°)	<36.1 – >37.6	8
	36.1-36.5 ve 37.2-37.6	1
	36.6-37.1	0
Respiratory stress	Severe (apnea, gasping, intubation)	14
	Moderate (respiratory rate >60/dak, SpO_2<85%)	5
	Mild (respiratory rate 60/dak, SpO_2>85%)	0
Systolic blood pressure (mmHg)	<20	26
	20-40	16
	>40	0
Response to the stimulus	No response, convulsion, atonia	17
	Mild response, lethargy, mild crying	6
	Alertness, strong crying	0

working in institutions which refer sick newborns was arranged with statement of Diyarbakır Provincial Health Directorship for the province of Diyarbakır and with statement of Diyarbakır governorship for centers outside the province of Diyarbakır. In-service education meetings were held with the participation of associates from different universities in an organization of Diyarbakır Children's Diseases Hospital Surgeon General and Diyarbakır Children's Diseases Hospital NICU clinic under the name of "Organization of Perinatal Regional Care".

2. Related provincial health directorships were made to purchase ambulances, transport incubators, intravenous infusion pumps and pulse oxymeters and/or made to increase the number of these items.

3. Neonatal Ressusitation Programs (NRP) were carried out with trainers mostly composed of the personnel working in Diyarbakır Children's Diseases Hospital. Thus, communication between referring centers and centers accepting the referrals was increased.

4. Use of "Neonatal Transport Form" prepared by the personnel of Diyarbakır Neonatal Children's Diseases Hospital during referral of sick newborns was made compulsory (statement to provinces with the letter dated 11.21.2007 and with number 2413 written by Turkish Republic Ministry of Health Treatment Services General Directorship as a result of official correspondance).

5. Referrals which were carried out under inappropriate conditions from the date of 01.01.2008 were started to be officially reported by Diyarbakır Provincial Health Directorship and Diyarbakır Governorship to the related centers.

Statistical evaluation

SPSS (Statistical Package for Social Sciences) for Windows 11.5 was used for assessment of data obtained in the study. Demographic properties were evaluated by descriptive statistical analysis. Student t test was used for comparison of variables with normal distribution. Qui-square test was used for comparison of categorical variables. The results were evaluated at 95% confidence interval and a p value <0,05 was considered to be significant.

Results

A total of 2452 referrals were admitted in Diyarbakır Children's Diseases Hospital NICU during the study period. 1525 of the patients were hospitalized during the first period which lasted for 6 months (March 1 2007-August 31 2007) and 927 were hospitalized during the second period which lasted for 4 months (January 1 2008-April 30 2008). Demographic properties (Table 2) and diagnoses at admission (Table 3) of the patients were similar in both groups.

Table 2. Demographic properties of the patients admitted to the neonatal intensive care unit

Characteristics of the patients	1st group (n=1525)	2nd group (n=927)	p
Gender. n (%)			
Female	750 (49.2)	430 (46.4)	0.179
Male	775 (50.8)	497 (53.6)	
Body weight*. g	2519.7±899.3	2558.7±873.2	0.289
Gestational week*.	36.1±3.8	36.3±3.9	0.237
Mode of delivery. n (%)			
Vaginal	949 (62.2)	562 (60.6)	0.428
Cesarean	576 (37.8)	365 (39.4)	
Referral place. n (%)			
Diyarbakır provincial center	960 (63)	617 (66.6)	0.071
Outside of Diyarbakır provincial center	565 (37)	310 (33.4)	

* Values are given as mean ± standard deviation (SD)

Table 3. Referral diagnoses of the patients

Diagnoses	1st group (n=1525) n (%)	2nd group (n=927) n (%)	p
Respiratory problems	551 (36.1)	311 (33.5)	0.194
Premature birth	350 (23)	188 (20.3)	0.121
Perinatal asphyxia	201 (13.2)	143 (15.4)	0.120
Sepsis	163 (10.7)	98 (10.6)	0.928
Other conditions	260 (17)	187 (20.2)	0.057

Charactersitics of transport conditions by groups are presented in Table 4.

Following efforts to improve neonatal transport conditions the rates of positive findings including cummunication before transport, adequate epicrisis, use of ambulance and transport incubator during transport, presence of birth report, presence of identity and gender information, adequate intravenous fluids and intubation of newborns who need to be intubated showed a significant increase in the second group. Negative findings including hypothermia, hypoglisemia and hypotension were found with a significantly lower rate.

TRIP score in the first group was found to be higher (12.89±11.53 v.s 20.07±13.41; p<0.0001). 280 of the patients in the first group (18.4%) and 64 of the patients in the second group (14.1%) were lost. 216 of the deaths in the first group (77.1%) and 64 of the deaths in the second group (48.9%) occured in the first seven days of hospitalization. General mortality rates and the mortality rate in the first seven days were significantly higher in the first group (p=0.007 and p<0.0001, respectively).

Discussion

Currently, pregnancies and fetuses at high risk can be prenatally determined with a high rate and deliveries are provided to take place in centers appropriate for risk levels. However, the risk status can not always be predicted and the newborn has to be referred to an appropriate center after delivery (11-13). For centers which admit all their patients from external centers transport conditions of the patients are very important in terms of social and legal events including mainly mortality and morbidity. Our study was performed to evaluate the effects of the efforts for improving neonatal transport conditions in Diyarbakır and in its vicinity on the newborns referred to the neonatal intensive care unit.

Great advances have been made in transport of sick newborns from the time when the first transport incubator was used by Dr. Joseph B. De Lee in 1901 and when the first automotive ambulance was used in Chicago in 1906 (14,15). Ambulances and transport incubators are continued to be used to maintain body temperature during transport as essential components. During transport performed in inappropriate conditions, the most frequently observed problem is hypothermia and this an important factor increasing the rate of mortality and morbidity (16,17). In our country, studies performed in previous years reported that the rate of transport of patients with ambulance was in a rather wide range of 11% and 81%, 7.8% of the patients were referred with transport incubator and 18-74% of the patients were presented with hypothermia (18-21). In our study, it was noted that the rate of patients referred by ambulance increased from 55.8% to 91.4% and the rate of patients referred with transport incubator increased from 39.1% to 86.1% following efforts for improving transport conditions. In our study, the rate of hypothermia decreased in the newborns as a result of the increase in the rate of transport by ambulance and transport incubator (78.4% vs 22.6%). We think that this change is related to purchase of medical devices used during transport and consciousness about performing neonatal transport in better conditions as a result of in-service education.

Hypoglycemia is the most important metabolic problem which can lead to mortality and severe morbidity in newborns. Factors including abscence of intravenous fluid, inappropriate fluid, inadequate amount of fluid and especially hypothermia lead to hypoglycemia during transport (22). Tekin et al.(19) found that 63.3% of the patients did not have intravenous access and Gülez at al.(21) found that 77.2% of the patients did not have intravenous access in the studies they performed. Türkyılmaz et al. (21) found hypoglycemia in 32% of the

Table 4. Characteristics of transport conditions by groups

Characteristics	1. grup (n=1525)	2. grup (n=927)	p
Communication before transport*	16 (1)	246 (26.5)	0.0001
Presence of adequate epicrisis*	140 (9.2)	373 (40.2)	0.0001
Transportation by ambulance*	851 (55.8)	847 (91.4)	0.0001
Transportation by transport incubator*	596 (39.1)	798 (86.1)	0.0001
Presence of birth report*	940 (61.6)	863 (93.1)	0.0001
Presence of identity and gender information*	966 (63.3)	886 (95.6)	0.0001
Patency of venous access*	946 (62)	855 (92.2)	0.0001
Patient transported as intubated*	168 (11)	153 (16.5)	0.0001
Presence of circulatory disorder*	123 (8.1)	53 (5.7)	0.029
Presence of hypothermia *	1195 (78.4)	210 (22.7)	0.0001
Presence of hypoglisemia *	560 (36.7)	90 (9.7)	0.0001
Presence of hypotension *	156 (10.2)	69 (7.4)	0.02
TRIPS score**	20.07±13.41	12.89±11.53	0.0001

* results are given as n (%)

** Values are given as mean ± standard deviation (SD)

newborns referred from outside the province and Gülez at al (20) found this rate to be 31.2%. In our study, hypoglycemia was found in 36.7% of the patients in the first group which was similar to the results obtained in previous studies performed in our country. It was found that 41.6% of the patients did not have intravenous fluid and 14.2% of the fluids were found to be inappropriate for the newborn. It was observed that these rates significantly improved following efforts for improving neonatal transport conditions.

Circulatory disorder is another important condition during neonatal transport. Conditions which may lead to problems during transport should be considered previously and vital findings should be provided to be in balance. Tekin et al.(19) found circulatory disorder in 46,2% of the newborns referred. They found 56,8% of the patients had oxygen support and 3% were intubated when referred (19). In our study in which similar results were obtained, the rate of hypotension and circulatory disorder was found to be decreased and the rate of intubation of the patients who needed intubation was found to be increased as a result of the approaches to improve neonatal transport conditions. We believe that these positive developments are related to in-service education given to healthcare personnel, protection of the patients from hypothermia and increased use of medical devices (ambulance, transport incubator, pulse oxymeter and intravenous fluid pumps) as emphasized in previous studies (23,24).

When sick newborns are admitted to the centers they are referred, a written document prepared by the physician including information about history and clinical course, investigations, treatment and interventions performed in the referring center should be available. In addition to this written document identity and gender information should be available and communication should absolutely be performed before transport (25). In our country, there is still no official regulation providing the standardization of the epicrisis paper which includes birth report, identitiy and gender information and written referral information. Unstandardized referrals are known to lead not only to medical problems, but also social and legal problems (including mixing of patients and wrong designation of gender) (26). In our study, the rates of absence of pre-transport communication (compromising service work force and coordination), abscence of written epicrisis (causing to lack of medical data and delay in approach to the patient) and abscence of birth report and identity and gender information (leading to legal complications) were found to be decreased in the second group. These positive results may be related to in-service education meetings, putting of the transport paper used for neonatal transport into practice which was prepared by our unit via the official notice of the Ministry of Health in our region and increase in sensibility of the workers in referring centers on the subject as a result of negative legal experiences.

Before and during the transport 5 H rule should be kept in mind (hypothermia, hypotension, hypoglycemia, hypoxia and hypo-hypercapnia) (27). Hypothermia, hypotension and hypoglycemia included in this statement to remind the problems which should be noted and corrected by the healthcare team before and during the transport were found with lower rates after efforts for improving neonatal transport conditions. This shows that the approaches actualized were efficient. In addition, following the efforts for improving neonatal transport conditions, improvement in TRIPS score and decrease in general mortality and in the mortality during the first seven days are important findings supporting this view. Again, this view is in accordance with the literature reporting that the mortality and morbidity rates decreased after establishment of transport system (28,29).

It is known that neonatal mortality rate in Diyarbakır is rather high (20/1000) and the fact that neonatal transport conditions are not at a desired level is an important factor affecting this high rate (30,31). Therefore, transport conditions for sick newborns should be addressed by scientific and specialized institutions as in many modern countries and managed with a regionalization sample included in health politics (32,33).

Consequently, it was found that the neonatal transport conditions of the patients referred to our unit could be improved with a series of approaches. We believe that these efforts will not be sufficient to decrease neonatal mortality and morbidity rates to the desired levels in this region without works of regionalization of perinatal care. The concept of establishing neonatal transport system which is the main component of regionalization of perinatal care by providing rational conditions should be addressed as an urgent action plan in basic health politics.

Conflict of interest: None declared.

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