Background – The best way to transport high-risk infants is so called “In utero” transport. In many developed countries, perinatal regionalization programs have been established and expectant mothers and/or their neonates are assigned and referred to different centers according to the level of care they may need. Unfortunately, we do not yet have such a program in Iran; therefore, many of the premature and sick neonates must be transported to the few neonatal intensive care units (NICUs) that are available in Tehran. The present study looks into the problem of neonatal transport in Tehran.

Methods – In this study, 16 maternity hospitals in different locations of Tehran were selected randomly for participation in data collection between November 1st – 30th, 2002. Questionnaires regarding clinical data for the participating patients (critically ill neonates) were distributed to the head nurses of selected hospitals. Questionnaires catalogued which patients required transport to NICUs; data were analyzed using SPSS software.

Results – During the study period, 3,125 infants were born in the participating hospitals. Three-hundred and twenty patients (10.24%) needed transport but, of these, only 22 (6.87%) infants obtained admission to NICUs. The mean ± SD waiting time for obtaining admission was 110 ± 50 minutes and the mean ± SD elapsed interval between obtaining admission and exit from primary hospital was 50 ± 26 minutes. The reason for transport in 17 of the 22 cases (72.27%) was respiratory distress and in the remaining five (22.73%) the problem was surgical. Three premature infants (of the 22 total referral cases) died before they could get admission. The mean ± SD interval between leaving referring hospital and arriving at referral hospital was 46 ± 17 minutes.

None of the health care professionals who accompanied the infants had experience with neonatal tracheal intubation.

Conclusion – The neonatal transport in Tehran is not optimal and has many inadequacies regarding communication systems, optimal equipment, trained personnel, etc. We recommend that a perinatal regionalization system to be established in Iran in order to facilitate the detection of high-risk pregnancies and newborns, and to transport them, according to need, to different levels of perinatal care facilities.

Keywords: Neonate • perinatal • transport

Introduction

In 1976, the Committee on Perinatal Health, sponsored by the March of Dimes, in the United States proposed a system for regionalized perinatal care and defined three levels of hospital care, as a national model for the rapid development of neonatal referral centers. This model required the development of a neonatal transport system, which was associated with a significant reduction in the neonatal mortality rate.

Often high-risk pregnancies can not be detected and many of the sick and premature infants delivered in primary hospitals and maternity units where neonatal intensive care units (NICUs) are not available must be transported to NICUs.

In order that neonatal transport to be successful several factors are of significance such as:


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well-functioning equipment (e.g. transport incubator, ventilator...);
- trained personnel skilled in neonatal resuscitation and stabilization;
- well-functioning and well-equipped vehicles;
- good roads and highways; and
- good communication between primary and referral hospital.

In Tehran there are few NICUs where the trained personnel and necessary equipment are available for the care of high-risk neonates. Because of shortage of these facilities, many of the sick neonates who need to be transported cannot obtain admission. Even when they can obtain admission, their transport is delayed and very inefficient due to lack of good communication, transport vehicle, and trained personnel, etc. In this study, we attempt to clarify some of the inadequacies in regard to neonatal transport in Tehran and to give some suggestions to policymakers in order to improve neonatal transport and reduce neonatal morbidity and mortality.

**Patients and Methods**

In this study, 16 maternity hospitals without NICU facilities in different geographical locations of Tehran were selected randomly for participation during the month of November 2002. All infants born at these hospitals during that period who were candidates for transport to NICUs according to the universal standards were included in this study. By reviewing several transport protocols we prepared a questionnaire and distributed it to the head nurses of the neonatal units of the participating hospitals. The pediatricians of these hospitals determined the eligibility of the neonates for transport according to the above-mentioned criteria.

All of the information regarding the transport of these babies were extracted from the questionnaires and analyzed using SPSS software.

**Results**

In the participating hospitals, 3,125 infants were born during the study period. Of these, 320 (10.24%) needed admission to a special care unit due to complications such as respiratory distress and surgical problems. Of the 320 patients who required transport and admission, only 22 infants (6.87%) from 13 centers were able to obtain admission.

Fifteen (68.18%) of the infants who received transport were premature while seven (31.82%) were born full-term. The mean ± SD age of the infants at the time of request for transport was 3.8 ± 3.07 hours and the mean ± SD birth weight was 1.92 ± 0.28 kg. The reason for transport in 17 cases (77.27%) was respiratory distress and in five others (22.73%) transport was desired for surgical problems. Three of the fifteen premature infants (13.63% of all the infants requiring transport) died before they could obtain admission.

The mean ± SD waiting time for admission was 110 ± 50 min and the mean ± SD elapsed interval between receiving confirmation of admission acceptance, and exiting the primary hospital was 50 ± 26 min. The mean ± SD interval between leaving the referring hospital and arriving at referral hospital was 46 ± 17 min. In 16 cases (84.21%) the father accompanied the infant, while in 3 cases (15.79%) another relative accompanied the infant. Health care professionals also often accompanied the patient; in 15 cases (78.9%) a nurse and in 4 cases (21.1%) interns accompanied the patient.

Out of these 19 health care personnel who accompanied the patients, only 8 (42.1%) had participated in neonatal resuscitation workshops. None of the transported infants was intubated but all of them had intravenous lines.

In 11 cases (57.9%) the transport vehicle was a hospital ambulance while in rest of the cases, it was a private ambulance. None of the ambulances had optimal equipment such as proper-sized bag and mask, transport incubators, monitors, equipment for temperature regulation, or transport ventilators. In seven cases, (36.84%) a transport incubator was used and in 12 cases (63.16%) blankets were used to warm the baby during transport. Cardiopulmonary resuscitation (CPR) was performed on one premature infant during transport. It was unsuccessful and the patient died before reaching the referral hospital. Three other premature infants had mechanical ventilation intermittently with bag and mask during transport but none was intubated. None of the health care professionals who accompanied the babies had experience with neonatal tracheal intubation.

**Discussion**

In most developed countries, critically ill
neonates are often born in specialized centers either because the referral center routinely delivers care to at-risk perinatal populations, or due to prenatal detection of a problem. These babies are called "inborn." A large number of outborn neonates, however, require emergent transfer to a tertiary care center, often due to medical, surgical, or rapidly emerging postpartum problems. Since the outcome of an outborn neonate with major medical or surgical problems remains worse than an inborn infant, primary emphasis should always remain on prenatal diagnosis and subsequent maternal transfer whenever possible. Despite advanced training and technology, mothers usually make the best transport incubators (i.e.: in utero transport).

In 1976, the Committee on Perinatal Health, sponsored by the March of Dimes, of the United States proposed a system for regionalized perinatal care and defined three levels of hospital care, as a national model for the rapid development of neonatal referral centers. This model required the development of a neonatal transport system, which was associated with a significant reduction in the neonatal mortality rate.1 According to the regionalization programs which were established during the early 1970s in most of Europe and North America, three levels of perinatal and neonatal care are defined and expectant mothers are assigned to these levels early in pregnancy according to their needs.2-4

Despite the fact that intrauterine transport is the best mode of transporting premature and high-risk fetuses to specialized centers, this procedure is still not practiced in Tehran. The reasons for not practicing this method in Tehran are several, including:

- many obstetricians invest a majority of their time working in private hospitals. Compared to public hospitals, private hospitals lack many of the necessary hospitals for care of high-risk neonates. Those high-risk neonates born in private facilities must be transferred to public hospitals to receive the required care;
- lack of a regionalization program for perinatal and neonatal care;
- inadequate number of specialized centers for care of high-risk deliveries (care of mother and neonate);
- lack of adequate communication between primary and referral hospitals;
- the few available NICU facilities are located in pediatric hospitals, which are far away from maternity units;
- lack of good transport resources; and
- lack of a centralized transport unit to arrange transports to specialized centers.

According to the present study, less than 7% of the high-risk neonates delivered in Tehran could get admission to specialized care centers. The outcome of more than 90% of these deliveries is not known by us and is a subject for another study. The present study shows that the referring hospitals spend a considerable amount of time to get admission from the referral hospitals. This lapsed time sometimes causes significant morbidity and mortality in the sick newborns. One of the most important factors in this delay is the lack of a centralized transport unit in Tehran for arranging all neonatal transports.

To achieve safe and rapid transport, there should be a centralized unit in each region that receives all requests for the transport of sick infants and arranges their transport to different referral hospitals in the region according to their needs and levels of required care.1 Unfortunately, there is currently not such a center in Tehran and the referring hospitals and families have to check many hospitals hoping that they may be able to find a place to which they can transport their sick infant. Unfortunately, families and staff spend a valuable amount of time in this process and this time is very critical and important in neonatal care.

Another important problem in neonatal transport in Tehran is the lack of adequate communication between referring and admitting physicians. The information given to the referral hospitals is, in most cases, insufficient and given by a nurse or paramedical personnel rather than a physician. One of the main factors in successful transport is the stabilization of the neonate before transport.2-7 This is not often practiced in Tehran and sick infants are transported before they are stabilized. This is one of the main factors that increases the morbidity and mortality of these infants.

Equipment such as transport incubators, monitors, and tools for mechanical ventilation are inadequate and malfunction in many cases during transport. Even when equipment are available, the transport team often can not use them effectively due to lack of training.

In summary, the present study shows that all
aspects of neonatal transport including communication, skills and knowledge of health care professionals, facilities, and equipment are very inadequate and inefficient in Tehran.

Considerations for policymakers

We suggest that a perinatal regionalization program, as exists in many developed countries, be established as soon as possible in Iran in order to decrease maternal-neonatal morbidity and mortality. For the time being, we recommend the followings:

- Establishment of a centralized transport unit in each medical university which will receive all requests for transport from its surrounding territory and will arrange for transport.
- A good communication system between referring and referral hospitals through the transport unit.
- Delivery of the required information to the referral hospital by the referring physician.
- Training of all health care professionals responsible for the care of neonates in neonatal stabilization and resuscitation.
- Availability of well-functioning equipment for the resuscitation and transport of the critically ill infants.

References