

Effect on Clinical Work Practice of Establishing a Neonatal Intensive Care Unit at a Medical School-Affiliated Teaching Hospital

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Abstract

Objective: The aim of this study was to examine the effects of a newly established neonatal intensive care unit (NICU) on clinical work practice and educational activity at Nippon Medical School Musashikosugi Hospital.

Methods: This retrospective study analyzed the clinical records of all neonates admitted to the NICU from December 2010 through November 2013. Anthropometric data, clinical status, problems, and outcomes of patients and the related obstetrical history were extracted and analyzed.

Results: Of the 568 neonatal admissions, about half were related to preterm birth (49%) and low birth weight (55%). Forty-eight percent of patients were born via caesarean delivery. Maternal hypertension, diabetes, and thyroid disease were found in 8%, 5%, and 2% of cases, respectively. Mechanical ventilatory support was provided for 20% of patients. Neonates from multiple pregnancy and with significant congenital anomalies accounted for 17% and 10% of all patients, respectively. Five patients died during hospitalization. In addition training was provided in the NICU for an average of 10 residents and 20 medical students per year.

Conclusion: Since the NICU was established, closer cooperation beyond the framework of a single department has come to be needed. In addition, NICUs in teaching hospitals are expected to provide opportunities for medical students and residents to observe and participate in multidisciplinary medical care.

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Key words: neonatal intensive care unit, multidisciplinary medical care, teaching hospital

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Introduction

Neonatal intensive care has experienced tremendous progress in recent decades in Japan, achieving a neonatal mortality rate of 1.10 per 1,000 live births as of 2005¹. These dramatic improvements in outcome have been brought about through the combination of rapidly progressing technology and the development of regionalized perinatal care systems, in which facilities are stratified on the basis of the level of available care and cooperate with each other for maternal and neonatal transport²⁻⁴. The survival rate for very low birth weight infants (<1,500 g at birth) at principal referral neonatal centers in Japan has now reached as high as 90%⁵. Changing attitudes towards the start and continuation of active care for such premature infants has had a profound effect on the increasing demand for specialized care in neonatal intensive care units (NICUs). In addition, the number of high-risk neonates has also increased because of advancing maternal age, increasing frequency of multiple pregnancies due to infertility treatments, and complications of pregnancy, such as diabetes, hypertension, and thyroid disease. Under such circumstances, the inability to provide special care to all neonates requiring it has emerged as a pressing issue in national health programs. Although the Ministry of Health, Labour and Welfare has launched a project for the development of NICUs around the country, the resources for neonatal care facilities and staff remain insufficient. Nippon Medical School Musashikosugi Hospital, located in an area of significant population growth and adjacent to

a metropolitan area, recently established a 6-bed NICU and a 12-bed growing care unit to provide subsequent intensive care. The present study examined the effect of setting up an NICU on work practice in the medical school-affiliated teaching hospital.

Methods

All medical records of neonates admitted from December 2010 through November 2013 to the NICU, established at Nippon Medical School Musashi Kosugi Hospital in November 2010, were retrospectively analyzed. Admission criteria to the NICU are shown in **Table 1**. Patient information included gestational age in weeks, birth weight, mode of delivery, status and problems at birth, and outcomes during hospitalization. Maternal age and the use of infertility treatments, including artificial insemination by husband, in vitro fertilization and embryo transfer, or intracytoplasmic sperm injection, were extracted. Gestational age was based on maternal menstrual history or early prenatal ultrasound examination. Significant congenital anomaly was defined as a condition necessitating medical or surgical intervention or both.

Results

Over the 36-month study period, the total number of neonates admitted was 568. Of these neonates, 433 (76%) were born in our hospital, and the remaining 135 (24%) were transferred from other hospitals. Mean gestational age and birth weight were 35.9±3.6 weeks (range, 23–41 weeks) and 2,375±623 g (range,

Table 1 Admission criteria to the NICU

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- Gestational age at birth less than 36 weeks
 - Birth weight less than 2,100 g
 - Apparent respiratory distress or depression or both
 - Significant congenital malformation
 - Presence of risk factors for perinatal infection (elevated inflammatory markers, rupture of membranes for longer than 24 hours, meconium staining, and birth canal colonization with group B *Streptococcus*) and metabolic maladaptation (hypoglycemia/hypothermia in a low birth weight infant or small for gestational age neonate)
 - Prominent jaundice
 - Feeding difficulties necessitating intravenous infusion
 - Judgment of the attending physician
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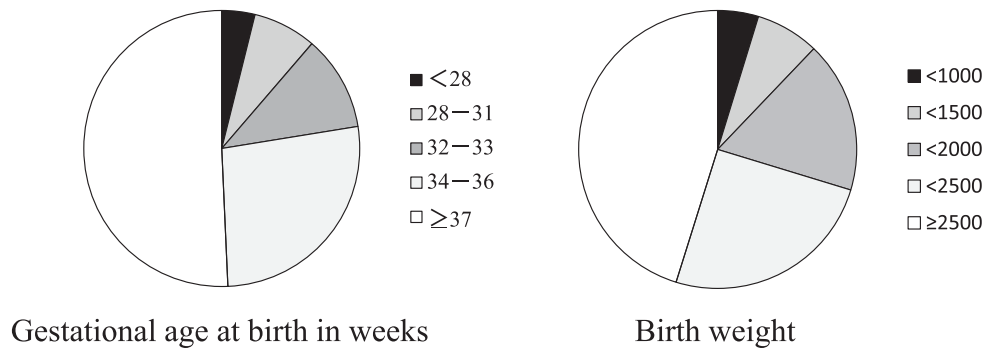


Fig. 1 Patients' population distribution

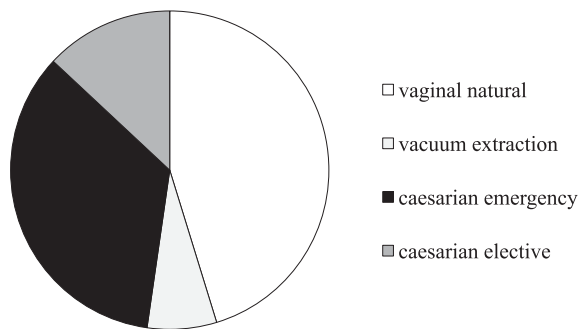


Fig. 2 Mode of delivery

496–3,998 g), respectively. Preterm infants ($n=278$) were 49% of those admitted and included 64 infants born at less than 32 weeks' gestation. Low birth weight infants ($n=312$) were 55% of those admitted and included 69 weighing less than 1,500 g at birth (**Fig. 1**). Neonates from multiple births were 17% of those admitted ($n=94$) and were most prevalent among late preterm births (33–36 weeks' gestation). The overall rate of caesarean delivery was 48% ($n=271$), with 73% of these ($n=197$) performed in emergency situations. Sixty-two percent ($n=169$) of operative deliveries were performed before pregnancy had reached term (**Fig. 2**).

The mean maternal age was 33.8 ± 4.5 years (range, 19–44 years). Complications of pregnancy were found as follows: hypertension, 8% ($n=45$); diabetes, 5% ($n=28$); thyroid disease, 2% ($n=11$); and collagen disease and chronic renal failure, 0.1% ($n=1$) each.

Mechanical ventilatory support was provided for 114 patients (20%), usually immediately after birth ($n=81$, 71%). Significant congenital abnormalities were present in 10% ($n=54$), with congenital heart disease being the most frequent (**Table 2**). Ten patients underwent surgery in our hospital during

Table 2 Significant congenital anomaly

- Chromosomal anomaly, 12 cases (trisomy 21, trisomy 18, or trisomy 13)
- Congenital heart disease: solitary ventricular septal defect, 18 cases; tetralogy of Fallot, 3 cases; transposition of the great arteries, 1 case; total anomalous of pulmonary venous return, 2 cases; cardiomyopathy, 1 case
- Atresia of the small intestine (including meconium peritonitis), 4 cases*
- Imperforate anus, 3 cases*
- Ovarian cyst, 2 cases*
- Hernia into the umbilical cord, 1 case*
- Pulmonary sequestration 1 case
- Congenital chylothorax, 1 case
- Cleft lip and palate, 2 cases

*Surgery performed in our hospital

the neonatal period: for atresia of the small intestine in 4 cases, imperforate anus in 3, ovarian cyst in 2, and hernia into the umbilical cord in 1. Four infants died during hospitalization: of lethal chromosomal abnormality in 1 case, septic shock in 1 case, and cardiopulmonary failure associated with extreme prematurity in 2 cases (**Table 3**).

Since the NICU was established in our hospital, an average of 20 bedside-learning medical students and 10 residents per year have been trained in the skills and knowledge of neonatal intensive care during their course programs of several weeks or months.

Discussion

The present analysis has shown that about half of the neonates admitted to the NICU were admitted for issues related to prematurity, with rates of preterm birth and low birth weight of 49% and 55%,

Table 3 Cases of postnatal death

Patient	Gestational age (weeks)	Birth weight (grams)	Time of death (days after birth)	Cause of death
1	28	1,073	0	hypoplastic lung
2	27	611	22	sepsis
3	29	870	0	trisomy 18
4	25	786	11	circulatory collapse

respectively. The current trend toward increasing use of infertility treatments is likely related to the increasing frequency of multiple pregnancies, which is also likely to result in premature births. In this study, neonates from multiple pregnancies were 17% of all NICU patients, and those born to mothers who had undergone infertility treatments were 10% of the total.

Although a large majority of pregnancies do not involve serious problems, if such problems occur, urgent procedures must be started for mother and neonate simultaneously. Indeed, among all NICU patients during the study period, 35% were born via emergency operative delivery, and 15% were provided mechanical ventilatory support soon after birth. Because most neonatal deaths occur within the first few days, particularly in the case of premature births, the advantage of the availability of immediate resuscitation following high-risk maternal transport is obvious^{6,7}. In response to this situation, the obstetrics department of our hospital began to receive an increasing number of pregnancies with threatened preterm delivery even in early gestation, and such pregnancies are expected to become more frequent. In addition to prematurity, congenital malformation is another major issue in perinatal medicine.

In the present study, neonates with significant congenital anomalies, including chromosomal abnormality, were 10% of all NICU patients, and 10 of them underwent surgery during the neonatal period in our hospital. In general, the risk of congenital malformation increases with advancing maternal age, as does the risk of complications of pregnancy, such as hypertension, diabetes, and thyroid disease. In this study the average age of mothers was 33.8±4.5 years, and 38% of mothers were older than 35 years. Furthermore, infants

released from the NICU have special concerns regarding daily health issues and developmental assistance, for which close cooperation with a general pediatrician is essential. In this regard, setting up an NICU involves the concept of multidisciplinary medical care, requiring more detailed discussion and consultation beyond a single department. In addition to clinical practice, medical school-affiliated hospitals are committed to educational activities for medical students and residents through the delivery of daily medical care to inpatients. However, high-level NICUs have previously mainly been established in community hospitals in Japan. Before the NICU was established in our hospital, bedside-learning medical students and residents had not been systematically trained in the skills and knowledge of neonatal intensive care. The NICU is a part of a hospital department operated by a highly specialized group of doctors and nurses. The NICUs of a medical school-affiliated teaching hospitals have a growing role to provide opportunities in education and practical training in this rapidly progressing field of medicine and also have a responsibility to promote basic research in perinatal medicine.

Conflict of Interest: This is no conflict of interest for all authors.

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