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Interfacility Neonatal Transport for Convalescent Care: Improving Regionalized Care

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Background: Transfer of infants who no longer need intensive or specialized care from tertiary to community hospitals or clinics contributes to efficient bed utilization in neonatal intensive care units (NICUs).

Methods: We retrospectively analyzed the records of all 1,503 infants admitted to our NICU during the 6-year period from April 2013 through March 2019 to evaluate the impact of interfacility neonatal transport for convalescent care.

Results: During the study period, our NICU accepted 33 infants from other tertiary NICUs and transferred 103 infants to other hospitals or clinics before their home discharge for convalescent care. Our NICU covered 39% of the total hospital days of infants accepted from other NICUs. Among infants transferred to other facilities, 81% born at our hospital were born to mothers transported to our obstetrics department as imminent high-risk deliveries; 94% of infants born at other hospitals were moved back to the referring facility.

Conclusions: Interfacility neonatal transport for accepting and transferring infants for convalescent care is now an integral part of NICU practice, to bridge gaps between higher-level care facilities and homes. Establishment of well-defined transfer criteria and appropriate allocation of medical and staff resources among relevant facilities are desirable. (J Nippon Med Sch 2020; 87: 334–338)

Key words: neonatal transport, regionalization, convalescent care

Introduction

The recent sharp decline in neonatal mortality is attributable not only to advances in technology but also to establishment of risk-appropriate regional perinatal care[1,2]. Regionalization stratifies hospitals and clinics by their available resources for neonatal care, from low-risk newborn nurseries to neonatal intensive care units (NICUs), and includes patient transport that aims to deliver optimal care to infants in need. The classification of care by level is usually done as follows: Level I nurseries provide basic care for well newborns; Level II units provide specialty care for moderately premature or ill infants (e.g., above 32 weeks' gestation and 1,500 g at birth), with the capability of mechanical ventilation; Level III units provide subspecialty care for very premature or sick infants (e.g., less than 28 weeks' gestation and 1,000 g at birth, or serious surgical condition), including those undergoing major surgery[3].

Initially, neonatal transport was only from facilities delivering lower-level care to those with tertiary NICUs. However, the care of premature and seriously ill infants who require prolonged hospitalization interferes with efficient NICU bed utilization, particularly for infants needing acute treatment, such as respiratory support. One proposal to solve this problem is to transport infants back to the referring hospital or clinic after their condition has been stabilized so that they can continue convalescent care closer to their homes[4]. The number of NICUs providing care for premature and sick infants in community hospitals has been increasing[5]. Consequently, interfacility neonatal transport in advance of home discharge is now possible and allows sharing of available hospital

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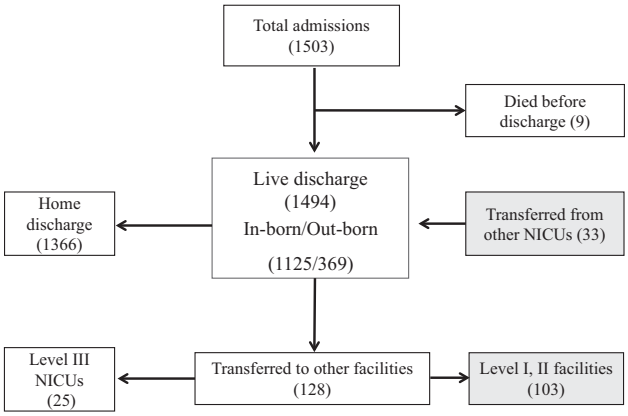

Fig. 1 Outcomes of infants enrolled in this study. Thirty-three infants from other NICUs and 103 infants from our NICU were transferred for convalescent transport before home discharge.

beds and medical and staff resources within a region. Development of regionalized care has resulted in a need for both appropriate selection of infants who require care at a tertiary NICU and development of an efficient transport system. Our NICU is one of the regional perinatal emergency service centers in Kanagawa prefecture and has six NICU and 12 growing care unit beds. We constantly care for very preterm infants of less than 28 weeks' gestation, although we transfer infants with major cardiac anomalies or neurosurgical disorders to other tertiary NICUs, where highly specialized surgical care is possible. Thus, the level of care available at our NICU is classified as between tertiary and Level II.

This study evaluated the performance of interfacility neonatal transport before home discharge. We describe our clinical experience and the role of non-tertiary NICUs in the setting of regionalization of care.

Materials and Methods

The Institutional Review Board of Nippon Medical School Musashi Kosugi Hospital approved this retrospective cohort study. Demographic and clinical data of all infants admitted to our NICU during the 6-year period from April 2013 through March 2019 were retrieved from their medical records. Gestational weeks, birth weight, reason for hospitalization, length of hospital stay, and respiratory support at the time of transfer were included in the analysis. Facility level-of-care was classified as follows. A tertiary NICU provides highly complex care for very preterm infants (<28 weeks' gestation) and for neonates requiring major surgery. Level II NICU care is delivered to moderately preterm infants of (<34 weeks' gestation), and level I care is routine nursery care of newborns and mothers. The provision of transport before home discharge was determined by discussion between our NICU and the regional facility, both for acceptance and transfer of infants, after resolution of acute medical conditions in patients not requiring intensive or specialized care.

Results

Demographic and Clinical Characteristics of Infants Admitted to Our NICU

During the study period, 1,503 infants were admitted to our NICU from the obstetrics department of the hospital (in-born) or after transfer from other hospitals or clinics (out-born). Nine infants died before discharge from our NICU; the remaining 1,494 live-discharged infants were included in the study. Of those, 1,125 were in-born and the remaining 369 were out-born (**Fig. 1**). Gestational age at birth was <28 weeks for 62 (4.1%) infants, 28-31 weeks for 118 (7.9%) infants, 32-36 weeks for 564 (37.8%) infants, and 37 weeks or later for 739 (49.5%) infants. The gestational age of 11 infants (0.7%) was uncertain because they were born to mothers without known pregnancy histories.

Birth weight was <1,000 g for 71 (4.8%) infants, 1,000-1,499 g for 96 (6.4%) infants, 1,500-2,499 g for 699 (46.8%) infants, and 2,500 g or more for 628 (42.0%) infants. Respiratory support was needed by 366 infants (24.5%) and was provided by mechanical ventilators, continuous positive airway pressure (CPAP), or high-flow nasal cannulas (HFNCs).

Infants Transferred to Our NICU from Other NICUs

Of the 369 out-born infants, 33 (8.9%) were transferred from other NICUs after their acute clinical problems resolved and their condition was stable but nevertheless required continuing convalescent care. Gestational age and birth weight were distributed as follows. Gestational age was <28 weeks for 10 (30.3%) infants, 28-31 weeks for 10 (30.3%) infants, 32-36 weeks for 11 (33.3%) infants, and 37 weeks or more for 2 (6.1%) infants. Thirteen infants (39.3%) weighed less than 1,000 g at birth, seven (21.2%) weighed 1,000-1,499 g, 12 (36.4%) weighed 1,500-2,499 g, and one (3.0%) weighed 2,500 g or more (**Fig. 2**). Median age at admission to our NICU was 27 (range, 7-120) days. All infants were eventually discharged to home from our NICU. Their median length of stay in our NICU was 25 (range, 7-76) days. The total number of hospital days, from birth to home discharge, was 2,465. The infants spent 969 days in our NICU before home discharge. One infant was prescribed home oxygen therapy;

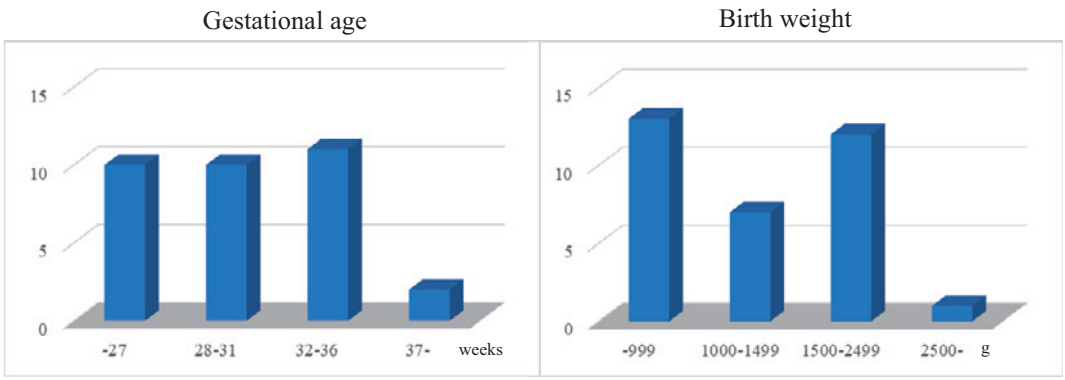

Fig. 2 Demographics of the 33 infants transferred from other NICUs. The vast majority of infants were preterm and had low birth weights.

the others did not require supplemental oxygen at the time of discharge. All infants are scheduled for regular follow-up clinic visits after home discharge.

Infants Transferred from Our NICU to Other Hospitals or Clinics

Of the 1,494 living infants discharged from our NICU, 128 (8.6%) were transferred to other facilities before home discharge. Twenty-five (19.5%) were transported to tertiary-level NICUs for advanced treatment, mainly for major cardiac surgery. The remaining 103 (80.5%) were transferred to other hospitals or to the original referring clinics after their acute medical conditions resolved and their condition was stable but nevertheless required continuing convalescent care (**Fig. 1**). Sixteen of the 103 infants in the latter group were in-born; 87 were out-born. None of the infants required supplemental oxygen or intravenous infusions at the time of transfer. Fifteen of the 16 in-born infants (93.8%) were born preterm with low birth weights. Thirteen (81.3%) were born to mothers who were transported to the obstetrics department of our hospital because of high-risk pregnancies (**Fig. 3a**). The median hospital stay of those in-born infants was 47 (range, 8-113) days, and all were transferred to Level II NICUs. Only five of 87 out-born infants (5.7%) had a birth weight of <2,500 g, and 82 (94.3%) were returned to the hospitals or clinics where they were born (**Fig. 3b**). The median hospital stay for out-born infants was 4 (range, 1-15) days.

Discussion

Our NICU had a clinically important impact on regional interfacility neonatal transport before home discharge, both on the acceptance of infants and transfer of infants to convalescent care. The first evaluation in this study was the acceptance of infants who had received acute treatment at another tertiary or higher-level-of-care NICU, were clinically stable, and were transported to us. Those infants accounted for 8.9% (33/369) of all out-born admissions to our NICU. Most were born preterm and had low birth weights. Twenty-six of the 33 (78.8%) received mechanical ventilation during the initial NICU stay, and seven of the 26 (26.9%) still required respiratory support on admission to our NICU. All were extubated, but four were on CPAP and three were on HFNCs. The safety of infants on respiratory support is a concern, especially after transport. Closer-than-usual attention was paid to the practice of weaning from pressure or flow support for those infants. All but one infant, who was prescribed home oxygen therapy, were eventually discharged home without need for supplemental oxygen. Our NICU covered 39.3% (969/2,465) of the total hospital stay, from birth to home discharge, after transfer to us from other NICUs. The acceptance of infants who no longer required intensive care at other high level-of-care facilities contributed to efficient utilization of NICU beds within the region, especially for treatment of acute medical conditions, which demand considerable medical and staff resources. Convalescent transport facilitated frequent family visits and encouraged parents to participate in the care of their infants, by decreasing financial and emotional stress. It also strengthened the relationship between the infants and their care providers in the community, allowing a smooth transition to support and follow-up after home discharge[4,6,7].

The second evaluation was transfer of infants from our NICU to other hospitals or clinics. Concurrent with ac-

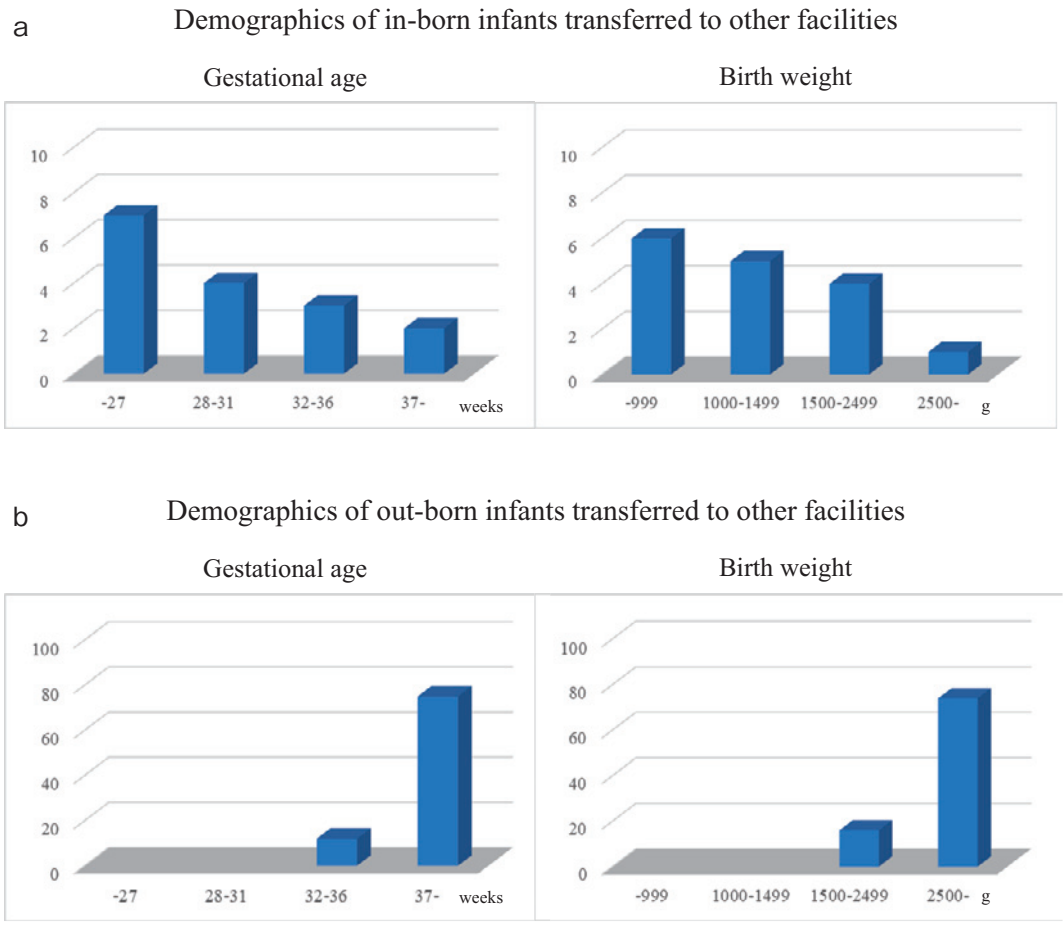

Fig. 3 (**a**) Demographics of in-born infants transferred from our NICU to other facilities. Most were preterm and had low birth weights. (**b**) Demographics of out-born infants transferred from our NICU to other facilities. In contrast to in-born infants, only a few were preterm with low birth weights.

ceptance of convalescent care transport from other NICUs, we transferred infants for the same purpose after their acute medical conditions had resolved. Of the 103 infants transferred from our NICU, some were in-born infants sent to other Level II NICUs; others were out-born infants returned to the referring hospitals or clinics. High-risk deliveries are not always predictable; consequently, emergency transport, either maternal or neonatal, across regions is frequently required because of overcrowding in the nearest NICU. We found that 81.3% (13/16) of the in-born infants in this series were born to mothers who were transported to us for an imminent high-risk delivery. Eleven of the 13 infants had a very low birth weight (<1,500 g), and nine received mechanical ventilation during their NICU stay, which was longer than that for infants accepted from other NICUs, because supplemental oxygen was discontinued at the time of transfer. In contrast to these infants, out-born infants were returned to their original referring hospital or clinic after shorter lengths of stay because we actively promoted family bonding for infants who were not seriously ill. Despite the benefits of convalescent transport, the change in setting and caretakers, and the increased risk associated with rehospitalization, can increase parental anxiety[7,8]. Fortunately, there was no unplanned rehospitalizations or emergency room visits before the first scheduled clinic follow-up after home discharge. To avoid such events, close communication between the involved facilities is necessary in order to ensure a clear understanding of the criteria describing the clinical status of the infants.

In conclusion, our NICU played an important role in interfacility neonatal transport before home discharge for convalescent care. We both accepted and transferred infants, which helped bridge the gaps between higher-level care facilities and home. Efficient regionalization is essential to maintain the quality of perinatal health care service provided by the involved hospitals and clinics. The burden of selecting eligible infants for convalescent care and organizing their transport will likely increase in the

future. Appropriate allocation of medical and staff resources for tertiary and non-tertiary NICUs requires careful discussion and planning.

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Conflict of Interest: The authors declare no conflicts of interest.

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