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ORIGINAL PAPER

Compliance to outpatient follow-up and hospital readmission After the second stage of the kangaroo method

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Abstract

Objectives: To assess compliance to outpatient follow-up after discharge from the second stage of the kangaroo method, and a rate of hospital readmission up to 30 days of corrected age. **Methods:** We ran a cross-sectional study with very low birth weight infants and/or children under 33 weeks of age born from January to December/2019 at the Januário Cicco Maternity School / Natal / RN. For data analysis we used the Shapiro-Wilk, Mann-Whitney and the Fishers Exact tests. **Results:** Of the 100 newborns included in the study, 13 did not return for outpatient follow-up. Among the 87 (100%) newborns in a row, 6 (6.9%) were readmitted for anemia requiring transfusion; 2 (33.3%) for urinary tract infection; 1 had regurgitation (16.5%); and 1 (16.5%) was undetermined. Newborns with follow-up had higher birth weight, fewer days in mechanical conditions and frequency of grade 3 and 4 peri-intraventricular hemorrhage compared with the no follow-up group. **Conclusion:** An important number of high-risk newborns did not return for outpatient follow-up, thus being an alert for the team that organized patient discharge. The low rate of readmission, in the first month of corrected age suggests a good condition of the patients at discharge. However, a longer period of observation should be used since the studies showed higher rates of readmission in those assessed up to 12 months of the corrected age.

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INTRODUCTION

A preterm newborn (PTNB) is every baby born before 37 weeks of gestation. The earlier the birth, the greater the baby's immaturity and probably the greater the presence of clinical complications in the neonatal period, with associated diseases that may accompany that person throughout life¹.

Thus, all newborns with birthweight below 1,500 g are considered at higher risk, and those who were born with less than 1,000 g and/or GA lower than 32 weeks are at extreme risk. Such criteria are used by services specializing in monitoring PTNBs to include them in their care protocols and care after hospital discharge. These are also the children who need the greatest vigilance by the Primary Care teams regarding their growth, development and especially their needs for specialized monitoring¹.

Advances in technology and perinatal care therapies have enabled greater survival of very low birthweight newborns². However, premature infants who are discharged from these units are usually affected by various morbidities resulting from prematurity, such as bronchopulmonary dysplasia, necrotizing enterocolitis, delay in neuropsychomotor development, and often have risky family situations, which demand a greater need for medical care and other areas of health, as well as increased risk of complications that result in hospital readmission³.

These premature infants experience long periods of hospitalization in the NICU, and readmission is disruptive for the family, in addition to having significant financial consequences. The readmission rate after discharge from the NICU at 30 days of corrected gestational age can serve as an indicator of the quality of services provided in the intensive care unit; for that we needed to assess the reasons for these readmissions, because they may not be associated to the clinical practices upon initial hospitalization⁴.

Preparing for discharge is an important step in the care of these newborns, the assisting team must be sensitive enough for it to be given as early as possible, but in a way that does not jeopardize the clinical stability of the newborn⁵. In addition, it is necessary that this patient has ensured multidisciplinary outpatient follow-up and control exams as needed.

In order to guarantee comprehensive and humanized care for the newborn, in 2015 the National Policy for Comprehensive Child Health Care was instituted, which has as one of its proposals the follow-up model after discharge shared between the Basic Health Unit and the specialized outpatient clinic, with the aim of providing care to the family and the patient at all levels⁶.

A challenge to this continuity of care is adherence to follow-up. Families that adhere show greater cognitive ability and better long-term prognoses, despite this knowledge, the rate of non-adherence or dropout is still considered high⁶. In this sense, it is important to understand that adherence presupposes a partnership between the caregiver and the person being cared for and involves several factors, such as: the caregiver's skills and knowledge, the professional's

communication and clarification, the characteristics of the disease and issues related to the social context and network support⁷.

At the Januário Cicco Maternity and School (MEJC), we seek to provide humanized care to these premature infants and their families, following the guidelines of the kangaroo method. In the first stage, they are received at the NICU; in the second, they were assisted in the kangaroo neonatal intermediate care unit and after discharge, shared follow-up is sought between the family healthcare unit and the reference outpatient clinic for the follow-up of prematurity at the Onofre Lopes University Hospital. However, we are not aware of the parents' compliance rate to this follow-up, the post-discharge complications of these patients and the relationship between these complications and the history of prematurity, and the care provided by our team.

Therefore, it is understood that a study that evaluates this evolution of premature infants up to the first month of corrected age is important to understand the service provided in this unit and present data that can contribute to its design.

In this sense, the present study aims to evaluate compliance to outpatient follow-up and hospital readmission up to thirty days of corrected age after discharge from the maternity of newborns younger than 33 weeks and/or smaller than 1500g at birth, seeking to characterize these groups of patients.

METHODOLOGY

We developed a cross-sectional study. The study was carried out at the preterm follow-up clinic at the Hospital Universitário Onofre Lopes and at the neonatal ICU at Maternidade Escola Januário Cicco, a reference institution for high-risk pregnancies, located in Natal, Rio Grande do Norte – Brazil. Information obtained from medical records and from the database built in these services for the project “How do very low-birth weight preterm infants grow after discharge in Brazil? A multicenter cohort study (ABRACE)” approved by the Ethics and Research Committee according to the Certificate of Presentation for Ethical Appreciation (CAAE) nº 97359518710015327.

The inclusion criteria were patients born at Maternidade Escola Januário Cicco from January to December 2019, with more than 27 weeks and less than 33 weeks and/or very low birthweight (birth weight less than 1500g), whose guardians signed the Free and Informed Consent Term (TCLE). Patients transferred to other institutions during hospitalization, those who died before discharge or had a major congenital malformation were taken off the study.

Quantitative variables defined as risk factors were maternal age, gestational age at birth (estimated by first-trimester ultrasound, last menstrual period or the New Ballard method⁸), birth weight, time to reach full enteral nutrition (120ml /kg/day), length of stay, duration of mechanical ventilation and total oxygen therapy. With regards to categorical variables, newborn respiratory distress syndrome (RDS) was studied based on the use of intratracheal surfactant for early respiratory distress;

presence of Peri-Intraventricular Hemorrhage (PIVH), graded according to the classification of Papile et al.⁹, diagnosis given by transfontanelar ultrasound, performed by the institution's sonographer; diagnosis of necrotizing enterocolitis considered from Bell Stage II¹⁰; and the type of diet used until the consultation of the first month of corrected gestational age.

Hospital readmission was defined as the need to be readmitted to a healthcare service for any type of clinical complication up to thirty days of corrected age. The assessment of compliance to outpatient follow-up was obtained in the same consultation according to the presence of these newborns, considering that all patients who are discharged from the neonatal ICU and the Kangaroo Neonatal Intermediate Care Unit are referred for this follow-up.

Data normality was checked using the Shapiro-Wilk test. Parametric continuous data are presented as mean and standard deviation; while non-parametric data as median and 25th and 75th percentiles. Categorical data are presented as absolute (n) and relative (%) frequency. The Mann-Whitney test was used to compare the characteristics of newborns with and without follow-up at the 30-day corrected age consultation, as well as between newborns readmitted and not readmitted during this period. We used Fisher's exact test to compare frequency ratios between the groups. For all analyses, we used a statistical significance level of $p < 0.05$. All analyzes were performed using the statistical package IBM SPSS for Windows/v.26.0 (IBM Corp., Armonk, NY, USA).

RESULTS

127 patients were born at Maternidade Escola Januário Cicco with less than 33 weeks, more than 27 weeks and/or less than 1500g in the period from January to December 2019, of which 27 were excluded from the study: 7 for presenting congenital malformation, 11 for having died before discharge and 10 due to being transferred to another institution before discharge.

Thus, 100 were included in the analysis of the present study. There was a loss to follow-up of 13% (n = 13) at the 30-day corrected age consultation. Among the 87% of newborns followed at the consultation 30 days after birth, only 6.9% (n = 6) were readmitted during the period. The causes of readmission were anemia requiring transfusion 2(33.3%); urinary tract infection 2(33.3%); regurgitation 1(16.5%) and 1(16.5%) undetermined. Table 1 presents the gestational and clinical characteristics of the newborns.

Table 2 shows the comparison between newborns with and without follow-up at the 30-day corrected age consultation. There was no difference in maternal age, gestational age, length of hospital stay, length of oxygen use, time to reach full enteral nutrition, and in the proportion of RDS and necrotizing enterocolitis between newborns with and without follow-up. Newborns with follow-up had higher birthweight and fewer days on mechanical ventilation compared to those without follow-up. Grade 3 and 4 peri-intraventricular hemorrhage was more frequent in newborns without follow-up (38.5%) compared to those with follow-up (6.9%).

Table 3 shows the comparison of the characteristics of newborns who were not readmitted and those readmitted up to 30 days of corrected age. There was no difference in maternal age, gestational age, birth weight, length of stay, time on mechanical ventilation, time on oxygen use, time to achieve full enteral nutrition, the proportion of RDS, necrotizing enterocolitis, and peri-intraventricular hemorrhage between the two groups.

DISCUSSION

Of the sample, 13 (13%) did not attend the consultation held around 30 days of corrected age. In a survey carried out by Freire L. et al¹¹, 596 children who were discharged from the neonatal ICU were evaluated for one year, of which 19.8% did not attend any outpatient follow-up consultation. In this study, factors associated with loss of follow-up were: gestational age at birth higher than or equal to 37 weeks, non-continuous use of medication and no need for resuscitation in the delivery room.

The characteristics of patients who did not show up for follow-up in our study are noteworthy because they have lower birth weight, longer use of mechanical ventilation and higher frequency of grade 3 and 4 peri-intraventricular hemorrhage, which portrays a greater severity in this group.

In this study, 6 (6.9%) were readmitted during this period. The low readmission rate may reflect good practices during intra-hospital care, efficient discharge preparation and family training for home care. Silva T et al¹² studied 61 newborns weighing less than 1500g or with a gestational age of less than 32 weeks up to two years after discharge from the ICU; 27 (44.3%) were readmitted in the first year of life, with 88.8% of these readmissions occurred before six months of life. Lee J. et al³ followed up 2,351 patients with gestational age between 22 and 32 weeks for an average period of 425 days after discharge, of which 33.6% required at least one episode of readmission. In the study carried out by Hayakawa L. et al¹³ 16 (30.2%) of the patients were readmitted in the first 6 months of chronological age. The greater number of readmissions found by these studies may reflect the longer follow-up period, our study proposed to follow a shorter follow-up period to assess readmissions related to complications in the third phase of the kangaroo method.

The main causes of hospital readmission were urinary tract infection (2) and anemia requiring blood transfusion (2). Studies with longer follow-up periods, such as those by Lee J. et al³ and Hayakawa L. et al¹³ showed respiratory causes as the main factors related to readmission. Our study had a shorter follow-up period, but included the period of seasonality of the respiratory syncytial virus, with no participant readmitted for this reason. The longer follow-up time increases the chances of these children contracting respiratory infections that have worse outcomes in patients with lower gestational ages. Lee J. et al³ identified that the number of children readmitted because of respiratory syncytial virus infection during the follow-up period

Table 1. Characteristics of newborns (n = 100).

Data presented as mean $\pm$ standard deviation, median (25 th ; 75 th percentiles). * n = 87	
Maternal age (years)	28,8 $\pm$ 7,3
Gestational age (weeks)	31,0 (29,0; 32,0)
Weight at birth (kg)	1.387 $\pm$ 357
Hospitalization duration (days)	51,0 (34,5; 63,0)
Use of mechanical ventilation (days)	0,0 (0,0; 7,0)
Oxygen use (days)	6,0 (3,0; 20,0)
Full enteral nutrition (days)	12,0 (10,0; 19,3)
SDR, n (%)	
Yes	31 (31)
No	69 (69)
Necrotizing enterocolitis. n (%)	
Yes	6 (6)
No	94 (94)
Intraventricular hemorrhage. n (%)	
No / grade 1/ grade 2	89 (89,0)
Grade 3 and 4	11 (11,0)
Exclusive breastfeeding. n (%)	
Yes	43 (49,4)
No	44 (50,6)

Dados apresentados em média $\pm$ desvio padrão, mediana (percentis 25; 75). * n=87

Table 2. Comparison of the characteristics of newborns with (n = 87) and without follow-up (n = 13) at the 30-day corrected age consultation. Data presented as mean $\pm$ standard deviation, median (25th; 75th percentiles) and absolute n and relative frequency (%). Equal letters (a and a) equal proportion. Different letters (a and b) proportion difference.

	With follow up	Without follow up	p
Maternal age (years)	30.0 (22.0; 33.0)	28.0 (24.5; 32.5)	0.947
Gestational age (weeks)	31.0 (29.0; 32.0)	30.0 (29.0; 31.0)	0.296
Birth at weight (kg)	1.370 (1.190; 1.670)	1.140 (910; 1.370)	0.021
Hospital stay duration (days)	50.0 (33.0; 63.0)	53.0 (34.5; 63.5)	0.678
Mechanical ventilation use (days)	0.0 (0.0; 6.0)	6.0 (0.0; 15.5)	0.049
Oxygen use (days)	6.0 (2.0; 20.0)	14.0 (4.0; 26.5)	0.110
Full enteral nutrition (days)	12.0 (10.0; 19.0)	12.0 (9.0; 22.0)	0.975
SDR. n (%)			
Yes	26 (29.9) ^a	5 (38.5) ^a	0.534
No	60 (70.1) ^a	9 (61.5) ^a	
Necrotizing enterocolitis. n (%)			
Yes	5 (5.7) ^a	1 (7.7) ^a	0.576
No	82 (94.3) ^a	12 (92.3) ^a	
Periventricular hemorrhage. n (%)			
No/ grade 1/ grade 2	81 (93.1) ^a	8 (61.5) ^b	0.005
Grades 3 and 4	6 (6,9) ^a	5 (38,5) ^b	

did not differ between children younger than or older than 30 weeks at birth; however, those younger than 30 weeks needed more oxygen supplementation and ventilatory support.

The assessment of feeding at 30 days of corrected age showed a high rate of exclusive breastfeeding of 43 (49.4%), in the study carried out by Maia et. al.¹⁴ with very low birthweight

newborns, only 22 (25%) received exclusive breastfeeding one week after discharge. In a study carried out by Silva T et al¹², 44.3% of the patients were readmitted at least once in the first year of life and, at the time of hospitalization, 88.9% of these premature infants had already been weaned, in addition to that, only 3 of those who were breastfeeding only required rehospitalization. These

Table 3. Comparison of the characteristics of newborns readmitted (n = 81) and not readmitted (n = 6) at the 30-day corrected age medical visit. Data presented as mean $\pm$ standard deviation, median (25th; 75th percentiles) and absolute n and relative frequency (%). Equal letters (a and a) equal proportion. Different letters (a and b) proportion difference.

	Readmitted	Not readmitted	p
Maternal age (years)	26.5 (21.3; 39.3)	30.0 (22.0; 33.0)	0.933
Gestational age (weeks)	29.0 (27.8; 30.5)	31.0 (30.0; 32.0)	0.078
Birth weight (kg)	1.315 (1.001; 1.582)	1.370 (1.190; 1.670)	0.471
Hospital stay duration (days)	49.0 (40.0; 63.3)	51.0 (32.0; 63.0)	0.782
Mechanical ventilation use (days)	1.0 (0.0; 4.8)	0.0 (0.0; 6.5)	0.853
Oxygen use (days)	9.0 (4.3; 26.5)	6.0 (2.0; 19.0)	0.502
Full enteral nutrition (days)	15.0 (11.5; 21.3)	12.0 (9.5; 19.5)	0.406
SDR. n (%)			
Yes	3 (50.0) ^a	23 (28.4) ^a	0.358
No	3 (50.0) ^a	58 (71.6) ^a	
Necrotizing enterocolitis. n (%)			
Yes	1 (16.7) ^a	4 (4.9) ^a	0.307
No	5 (83.3) ^a	77 (95.1) ^a	
Periventricular hemorrhage. n (%)			
No/ grade 1/ grade 2	5 (83.3) ^a	76 (93.8) ^a	0.357
Grade 3 and 4	1 (16.7) ^a	5 (6.2) ^a	
Exclusive breast feeding. n (%)			
Yes	2 (33.3) ^a	41 (50.6) ^a	0.676
No	4 (66.7) ^a	40 (49.4) ^a	

data showed the importance of breastfeeding for preterm infants as a protective factor against readmission. Our study, despite not having shown an association, most of the readmitted patients were not exclusively breastfed. The small sample and short follow-up time may have limited the importance of this data.

The mean maternal age showed no statistical difference between the groups, but in a study carried out with mothers of very low birth weight newborns with a mean gestational age of 28 weeks, Furmam et. al.¹⁵ showed an association between higher maternal age and the maintenance of exclusive breastfeeding, which is a protective factor for readmission.

Bastani F et al¹⁶ studied the effect of family-centered care in reducing the readmissions of preterm infants and found the importance of family involvement in the care of these patients as a factor that implies a lower rate of readmissions. This assessment was not carried out in our study, but family involvement in hospital care should be a goal for these newborns to have higher quality post-discharge care with greater compliance to outpatient follow-up and less hospital readmissions.

A significant proportion of the evaluated patients did not comply with outpatient follow-up, and this group had a higher frequency of conditions associated with an unfavorable outcome, which shows the importance of seeking strategies, so that we do not lose this follow up. Qualitative study carried out by Silva et al¹⁷ through interviews with specialized service and primary care workers, points to the importance of articulating these two services with encouragement from ICU professionals so that there

is a bond between the family and the basic healthcare unit even during the hospitalization in order to ensure continuity of care.

In this study, we observed that hospital readmissions after discharge from the NICU were low during the period evaluated, which may be related to adequate care, but may also reflect a short follow-up period with a small sample.

Thus, the importance of efforts to increase compliance to outpatient follow-up to improve care is highlighted. Added to this is the need to continue this study for a longer period of time and with a larger sample of patients so that risk factors can be assessed more clearly.

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