

## DETERMINANTS OF READMISSIONS IN HEALTHY LATE PRETERM AND EARLY TERM NEONATES-A PROSPECTIVE OBSERVATIONAL STUDY

<sup>1</sup>Dr Ankur Rawat, <sup>2</sup>Dr Sudhanshu Tiwari\*, <sup>3</sup>Dr Tanushree Negi, <sup>4</sup>Dr Shikha Pandey

1. MD Pediatrics, Dept of Pediatrics, Military Hospital Mathura, India
2. MD Pediatrics, Dept of Pediatrics, Military Hospital Jaipur, India
3. MDS, Department of Dentistry, Kothiwal Dental College and Research centre, India
4. MS Ophthalmology, Dept of Ophthalmology, Military Hospital Jaipur, India

**\*Corresponding Author:**

**Dr Sudhanshu Tiwari**, Dept of Pediatrics, Military Hospital, Jaipur, Jaipur-302006, India  
drsudhanshuafmc@gmail.com

### Abstract

**Introduction:** The advancement of modern Neonatology has led to more and more survival of babies at lower gestation age. Late preterm babies (born between 33 completed weeks of gestation and before beginning of 38 week of gestation) are the largest growing set of babies among premature babies. They look developmentally and physically more mature and hence often overlooked. They constitute one of the largest subsets of babies requiring hospitalization. This study was conducted to look at the readmission rates of late and early preterm babies in the first month of life with aim to look at various determinants of readmissions.

**Aim:** A study on readmission of late-preterm and early-term neonates in the first month of life following normal hospital discharge

**Materials:** Hospital based prospective observational study from Apr 2016 to Oct 2017 in a tertiary care hospital in western India to study the readmission rate of late-preterm and early-term neonates in the first month of life following normal hospital discharge.

**Result:** There were total 22 (7.1%) admissions among the study population, of which 13 (9.3%) were late preterm neonates and 9 (5.3%) early term neonates. Common causes of readmission were Neonatal hyperbilirubinemia in 12(55%) followed by feeding issues in 8 (36%), hypernatremic dehydration in 5 (23%) and late onset sepsis in 2 (9%) neonates.

**Conclusion:** Late preterm babies are vulnerable group of population as highlighted by their high rates of readmission. Jaundice and feeding problems were the most common diagnoses associated with readmission.

**Keywords:** Neonates, readmission, pre-term neonates, hyperbilirubinemia, feeding problems

### Introduction

Early readmission of newborn following initial discharge after birth reflects the inadequate assessment of newborn's readiness for discharge by health care team. Thorough knowledge about the causes, frequency and variation in the rate of newborn readmissions at varying gestational age may assist in developing quality improvement interventions

The neonatal mortality rate in India currently is 22.73 as per UNICEF Global Database figures of 2019 (1). Worldwide around 11% all neonates are born preterm (2). Out of these preterm neonates nearly 75% are late preterm neonates. (3) With the advancement and growth of modern Neonatology, the survival rates of preterm babies is continuously

increasing and so is the incidence of preterm birth increasing all over the world. Late preterm neonates are defined as babies born before 37 completed weeks of gestation and after completing 33 weeks (2). Several recent studies of late-preterm infants have documented increased short-term medical risks during birth, increased hospitalization and re-hospitalization, increased adverse long-term outcomes (medical, social, behavioral, and school performance) and also increased mortality as compared to full-term infants (3-9).

This study was conducted to look at the rate of readmissions in late preterm neonates compared to early term neonates and various determinants of readmission.

### **Method**

This study was conducted as a hospital based prospective observational study from Apr 2020 to Oct 2021 in a tertiary care hospital in western India to study the readmission rate of late-preterm and early-term neonates in the first month of life following normal hospital discharge.

Neonates born in our institution between 34-37week period of gestation and 37-38 week period of gestation (Late Preterm and Early Term) were included in the study. Period of gestation was assessed by careful menstrual history. Neonates requiring NICU admission, with birth weight less than 2 kg, with major congenital malformation or dysmorphism were excluded from the study. Neonates on extensive replacement feeds were also excluded from the study. The ethical clearance for the study was obtained from the institutional ethical committee.

Parents of eligible babies were explained the nature of the study and informed consent was obtained. All the eligible babies included in the study, were thoroughly evaluated and their birth parameters were recorded as per the study proforma. The neonates were discharged once they were on breast feeds, mothers were confident about breast feeding, basic care of newborn and recognizing danger signs. All neonates were examined at follow up visits. Neonates were also followed up telephonically every week. All the babies, who were brought for re-admission, were thoroughly examined and detailed investigations pertaining to individual cases were done. All the newborns were managed as per hospital protocol under supervision of neonatologist or Pediatrician. At the time of discharge, diagnosis was confirmed and readmission details were recorded. All the data were compiled and results were analyzed using appropriate statistical methods.

Sample size calculation- Based on the analysis of hospital records in past 06 months, the re-hospitalization rate for late preterm and early term was approximately 10%. To estimate true incidence with 95% confidence interval and 5% absolute margin of error, the calculated sample size was 140 late-preterm neonates. 170 early-term neonates, born during this period were taken as comparison group for this study.

### **Result:**

A total of 140 late-preterm neonates and 170 early-term neonates were enrolled in the study and followed-up for a period of 1-month post-natal life. The flow of the study is elaborated in table 1. The demographic profiles of mothers and neonates are shown in Table 1.

A large number of Late Preterm and Early Term deliveries were seen in mothers with comorbid conditions like Pregnancy Induced Hypertension (34.2% and 28.8% respectively) and Gestational diabetes mellitus (27.8% and 25.9% respectively). Large number of mothers in Late Preterm group were multigravida (64%). These two factors could have contributed to earlier termination of pregnancy. The incidence of male and female births was similar in both the study groups. The mean birth weight, head circumference, birth length was smaller in

Late Preterm neonates as compared to Early term neonates. We observed a difference in initial feeding practice in the two groups as more number of Late preterm neonates required supplemental feeds compared to early term group. The rates of initial exclusive breast feeding were 29% compared to 43% in Early term group.

There was total 22 (7.1%) admissions among the study population, of which 13 (9.3%) were late preterm neonates and 9 (5.3%) early term neonates shown in Table 2.

The mean duration of hospital stay was higher in Late Preterm group though the result was not significant. Late preterm neonates also had a higher hospital stay after re-hospitalization.

Common cause of readmission was Neonatal hyperbilirubinemia followed by feeding issues, hypernatremic dehydration and late onset sepsis. There was no significant difference in the morbidity pattern between these two groups shown in Table 3.

Mean duration of initial hospital stay during birth period was 3.95 days in readmission group and 5.08 days in no readmission group which was statistically significant shown in Table 4.

There was no significant difference between Readmission and no Readmission group when compared for maternal age or neonatal anthropometric parameters.

### **Discussion**

Readmission of newborns within the first month after hospital discharge is an unwelcome event from the point of view of the parents, care givers and doctors. The American Association of Pediatrics Policy Statement “Hospital Stay for Healthy Term Newborns” suggests that readmission is an indicator of an “inadequate” assessment of a newborn’s readiness for discharge. The assessment is to include, in addition to determining physiologic stability, family preparedness, availability of social support, and access to follow-up care Ref. In our study, rate of readmission was 9.3% for late preterm neonates and 5.3% for early term neonates during the first month following birth discharge. Similar results were shown by Kuznweich et al with readmission rates of 8% and 6.8% for late preterm and early term groups respectively (7). However, some studies in developed nations showed much lesser rates of readmission. Tomashek et al showed re-hospitalization rates were 3.5% for 34- 36 weeks gestational age babies within 28 days of birth (11). Many studies conducted in western countries have shown higher rates of readmission in Late Preterm neonates compared to Term and early term neonates (3-9). Other risk factors for readmission were lower gestational age, smaller length of initial hospital stay, lack of exclusive breast feeding (7,10,11). The hospital discharge policy of our institution focuses on antenatal counselling of mothers, educating mothers regarding breast feeding, recognizing danger signs in neonates and encouraging other family members in supporting mother. Once these criteria are met then only mother-neonate dyad is discharged. Most common cause for readmission in these babies was neonatal hyperbilirubinemia seen in 46 % of late-preterm neonates who were readmitted and 56 % of early-term readmissions. Similar results were shown in studies conducted by various authors like Escobar et al (3,6-9,11,12).

We found that babies who were readmitted had the initial stay in hospital, that was shorter for readmission group (mean=3.95, SD-1.09) as compared to no readmission group (mean=5.08 SD- 1.28) and this result was statistically significant. The similar findings were reported by authors like Kuznewich et al in their studies (7,10,12). It is possible that the longer initial stay was used for additional counseling regarding lactation or other interventions that lessened the risk of a readmission. The significance of higher initial

newborn stay associated with lesser rates of readmission may indicate that extra time may have provided the care providers for assessment of feeding problems that these neonates face or a better knowledge of neonatal jaundice as observed during longer stay. Hence better counselling was provided to mothers which lessened the rate of readmission later. Our finding that the 2 most common reasons for readmission were jaundice and feeding problems may have implications for prevention because these 2 conditions frequently occur together and are both potentially amenable to interventions that could prevent the need for hospitalization. More focus on cost effective interventions such as more intensive lactation support and universal bilirubin screening as required and pre discharge assessment of jaundice can substantially reduce the rates of readmission and hence financial burden on health services. Assuming that future studies also suggest similar cost-effective interventions; resulting in reduction in re-hospitalizations, newer hospital discharge policies can be framed which emphasize more on these basic interventions.

We also found that late preterm neonates were associated with longer initial hospital stay as compared to the early term neonates. There was a significance difference between the length of initial stay in the two groups 5.17 days for late preterm group and 4.80 days for early term group p value=0.011. They also had higher hospital stay during readmission also although the difference was not statistically significant. This signifies their developmental immaturity compared to term neonates despite their more mature appearance.

### Conclusion

Late preterm babies are vulnerable group of population as highlighted by their high rates of readmission. Jaundice and feeding problems were the most common diagnoses associated with readmission, and most of these occurred within first month of discharge. These findings suggest that when considering readiness for discharge of a newborn, one should carefully assess whether the infant is at risk for feeding problems and jaundice. The importance of maternal education regarding importance of breast feeding and pre discharged assessment of jaundice are two cost effective measures which can significantly lower the readmissions in these vulnerable neonates. We propose that ANC counselling, Lactation counselling and Pre discharge serum bilirubin measurement and can significantly lower rates of re hospitalization and in the long term will prove cost effective strategies.

### Results

**Table- 1 Demographic profile of mothers and late preterm and early term neonates**

| Characteristics                | Neonates                 |                        |
|--------------------------------|--------------------------|------------------------|
|                                | Late-preterm (n=140) (%) | Early-term (n=170) (%) |
| Demographic profile of mothers |                          |                        |
| Maternal Age (years)           | 25.68± 3.756             | 25.29±4.187            |
| Multigravida                   | 90(64)                   | 83(49)                 |
| Primigravida                   | 50(36)                   | 87(51)                 |
| Gestational diabetes mellitus  | 39(27.8)                 | 44(25.9)               |

|  |             |             |
|--|-------------|-------------|
| Pregnancy induced hypertension         | 48(34.2)    | 49(28.8)    |
| Febrile illness/ rash                  | 10(7.1)     | 14(8.2)     |
| Demographic profile of neonates        |             |             |
| Male                                   | 69 (49.2)   | 84(49.4)    |
| Female                                 | 71(50.8)    | 86(50.6)    |
| Birth weight Mean/ SD                  | 2.36± 0.22  | 2.58± 0.29  |
| Head Circumference (OFC) (cm)Mean / SD | 33.14± 1.50 | 33.27± 1.28 |
| Length (cm) Mean/ SD                   | 46.15±1.95  | 47.34± 1.71 |
| Initial feed - Breast Milk             | 41(29)      | 73(43)      |
| Initial feed - Mix Feeds               | 99(71)      | 97(57)      |

**Table-2 Comparison of hospital readmission statistics**

| Characteristics  | Neonates                 |                        | p-value |
|--|--------------------------|------------------------|---------|
|  | Late-preterm (n=140) (%) | Early-term (n=170) (%) |         |
| Readmission  | 13(9.3)                  | 9(5.3)                 |         |
| Mean duration of initial stay (Days)                   | 5.17                     | 4.80                   | 0.011   |
| Mean age at re-admission (Days)                        | 9.846                    | 8                      | 0.119   |
| Mean length of hospital stay during readmission (Days) | 7.15                     | 5                      | 0.119   |

**Table-3: Neonatal morbidity in Readmission group**

|   | Diagnosis                   | No of neonates |            |
|---|-----------------------------|----------------|------------|
|   |                             | Late-preterm   | Early-term |
| 1 | Neonatal hyperbilirubinemia | 7(54%)         | 5(36%)     |
| 2 | Feeding issues              | 3(23%)         | 5(36%)     |
| 3 | Hypernatremic dehydration   | 1(8%)          | 4(29%)     |
| 4 | Late onset neonatal sepsis  | 2(15%)         | 0          |

**Table - 4: Comparison between readmission and no readmission group**

| Characteristics      | Readmission | N   | Mean   | SD     | p-value |
|----------------------|-------------|-----|--------|--------|---------|
| Maternal age (Years) | Yes         | 22  | 26.05  | 3.982  | 0.485   |
|                      | No          | 288 | 25.42  | 4.001  |         |
| Maternal Hemoglobin  | Yes         | 22  | 10.691 | 1.0374 | 0.137   |

|                                 |     |     |        |        |         |
|---------------------------------|-----|-----|--------|--------|---------|
| (gm/dl)                         | No  | 288 | 11.046 | 1.1434 |         |
| Birth Weight (Kg)               | Yes | 22  | 2.43   | 0.36   | 0.514   |
|                                 | No  | 288 | 2.48   | 0.28   |         |
| Head Circumference (Cm)         | Yes | 22  | 33.41  | 1.56   | 0.544   |
|                                 | No  | 288 | 33.20  | 1.37   |         |
| Length (Cm)                     | Yes | 22  | 46.86  | 2.44   | 0.904   |
|                                 | No  | 288 | 46.80  | 1.87   |         |
| Duration of initial stay (Days) | Yes | 22  | 3.95   | 1.09   | < 0.001 |
|                                 | No  | 288 | 5.08   | 1.28   |         |

### Reference

1. Estimates generated by the UN Inter-agency Group for Child Mortality Estimation (UN IGME) in 2019 Downloaded from <http://data.unicef.org>
2. Vogel, J.P., Chawanpaiboon, S., Watananirun, K. et al. Global, regional and national levels and trends of preterm birth rates for 1990 to 2014: protocol for development of World Health Organization estimates. *Reprod Health* 13, 76 (2016).
3. Gouyon, Jb & Vintejoux, Amélie & Sagot, Paul & Burguet, Antoine & Quantin, Catherine & Ferdynus, Cyril. (2010). Neonatal outcome associated with singleton birth at 34–41 weeks of gestation. *International journal of epidemiology*. 39. 769-76.
4. Gabriel J. Escobar, MD; Steven Joffe, MD, MPH; Marla N. Gardner, BA; Mary Anne Armstrong, MA; Bruce F. Folck; and Diane M. Carpenter, MPH. Rehospitalization in the First Two Weeks After Discharge from the Neonatal Intensive Care Unit. *Pediatrics* July 1999, 104 (1) e2;
5. Gabriel J. Escobar, MD, Reese H. Clark, MD, and John D. Greene, MA. Short-term Outcomes of Infants Born at 35- and 36-Weeks Gestation: We Need to Ask More Questions. *Semin Perinatol* 2006 Feb;30(1):28-33.
6. Martens PJ, Derksen S, Gupta S. Predictors of hospital readmission of Manitoba newborns within six weeks postbirth discharge: a population-based study. *Pediatrics*. 2004;114(3):708- 713. doi:10.1542/peds.2003-0714-L
7. Kuzniewicz MW, Parker SJ, Schnake-Mahl A, Escobar GJ. Hospital readmissions and emergency department visits in moderate preterm, late preterm, and early term infants. *Clin Perinatol*. 2013;40(4):753- 775.
8. Mclaurin, Kimmie & Hall, Caroline & Jackson, E & Owens, Oksana & Mahadevia, Parthiv. (2009). Persistence of Morbidity and Cost Differences Between Late-Preterm and Term Infants During the First Year of Life. *Pediatrics*. 123. 653-9.
9. Natarajan G, Shankaran S. Short- and Long-Term Outcomes of Moderate and Late Preterm Infants. *Am J Perinatol*. 2016;33(3):305- 317. doi:10.1055/s-0035-1571150
10. Farhat R, Rajab M. Length of postnatal hospital stay in healthy newborns and re-hospitalization following early discharge. *N Am J Med Sci*. 2011;3(3):146- 151.
11. Tomashek KM, Shapiro-Mendoza CK, Weiss J, et al. Early discharge among late preterm and term newborns and risk of neonatal morbidity. *Semin Perinatol*. 2006;30(2):61-68.

12. Gupta P, Malhotra S, Singh DK, Dua T. Length of postnatal stay in healthy newborns and re-hospitalization following their early discharge. *Indian J Pediatr.* 2006;73(10):897-900.