Emergency Department Visits and Rehospitalizations in Late Preterm Infants

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There is a rising rate of late preterm babies (8.8\% in 2003), up from 7.6\% a decade earlier, and the highest since the government started tracking such births\textsuperscript{[1,2]}. Neonatologists generally recognize that these infants face more problems in the immediate newborn period compared with their full-term counterparts. What is not known completely is how these infants fare after they are discharged from the nursery.

Practitioners outside the nursery are not able to recognize readily the often subtle differences in size and appearance of late preterm infants from more mature infants, and thus, they tend to include them in the same category as full-term infants\textsuperscript{[3]}. This perhaps explains the commonly used phrase near-term infant to describe infants born at 34 to 36 weeks gestational age. Their size and apparent maturity create a false sense of security, delaying the recognition of problems in this vulnerable group.

There is limited literature describing the experience of these late preterm infants after nursery discharge. Wang and colleagues reviewed the clinical outcomes of late preterm infants in the nursery and concluded that these infants had significantly more medical problems at birth, leading to increased hospital costs compared with contemporaneous full-term infants\textsuperscript{[4]}. They recommended that the next steps include closer follow-up of late preterm newborns with particular emphasis on frequency of pediatric visits, hospital readmission, feeding, and growth issues. Shapiro-Mendoza and colleagues studied late preterm birth as a risk factor for neonatal morbidity among singleton newborns discharged early (defined as less than 2 nights’ stay in the
hospital after vaginal delivery) [5]. As compared with full-term infants, late preterm infants discharged early were at greater risk of neonatal morbidity, with a nearly twofold relative risk of being readmitted to a hospital in the neonatal period. Oddie and colleagues also noted that late preterm infants had the highest rate of readmission to hospital in the first month of life after early discharge [6]. Escobar and colleagues found that late preterm babies with short neonatal ICU (NICU) stays had the highest rehospitalization rates among 6054 NICU survivors of all gestational ages [7]. Another study found that rehospitalization rates within 2 weeks of nursery discharge were higher among late preterm infants who never were admitted to the NICU [8].

Several of these studies have found similar reasons for these rehospitalizations. Escobar and colleagues found that the two most common reasons for rehospitalization in the first 2 weeks are jaundice and feeding difficulties [9]. They emphasized the high rate of admission for dehydration in late preterm infants to underscore the need for better education of parents about feeding issues faced by these infants who may appear more mature than they are. Tomashek and colleagues described readmission diagnoses among term and late preterm infants who were discharged early, with jaundice in 27% and 49% and infection in 33% and 29% of term and late preterm infants respectively [6]. A recent review article summarizes other short-term outcomes of 35- to 36-week gestation infants such as mortality and respiratory distress, in addition to rehospitalizations [10].

Although short-term problems during the birth hospitalization and rehospitalization are beginning to be recognized for late preterm infants, there is limited information on how these infants present to medical care and what interventions take place before, and inclusive of, a hospitalization. In a recent issue of *Pediatric Clinics of North America* devoted to pediatric emergencies, newborn emergencies in the first 30 days of were reviewed [11]. Newborns were not subclassified by gestational age, however. To the authors’ knowledge, there are no published data describing outpatient presentation of late preterm infants in the immediate postnatal period. This article reports the experience in the authors’ emergency department (ED) with newborn visits, with particular emphasis on late preterm infants.

### Newborn visits to the emergency department: a comparison of term and late preterm infants

Medical care for the neonate after nursery discharge occurs in two main settings: the primary care office and the ED. The authors reviewed their experience of visits to the ED by newborns in their first 31 days of life, over a 1-year period from July 1, 2005, to June 30, 2006. The authors’ institution consists of two free-standing tertiary care pediatric hospitals in a large metropolitan area. The EDs saw 122,585 pediatric patients during this 1-year period, of which 3059 (2.5%) were newborns between 0 and 31 days of age. In 1011 infants, gestational age was not documented; this lack of
documentation is concerning given that these patients were newborns presenting to the ED, and their gestational age could have affected their management. Additionally, the hospital electronic medical record has predefined gestational age groups in the birth history template that sometimes are used. The two age groups of note are 32 to 35 weeks and 36 to 42 weeks. Eight patients were noted as being in the 32- to 35-week age group, and 440 were in the 36- to 42-week age group. Some late preterm infants may have been included in these groups, and therefore their preterm status not recognized. Four patients left before being seen by a physician. Of the 1596 patients who had a specific gestational age documented, 764 were documented as full-term while 516 had a gestational age noted as being 37, 38, 39, 40, 41, or 42 weeks, for a total of 1280 (80.2%) documented term births. Twenty five (1.6%) were preterm (under 34 weeks gestational age); 282 (17.7%) were late preterm (34 to 36 weeks gestational age), and 9 (0.6%) were post-term (at least 43 weeks gestational age). The relatively low number of preterm infants seen in the ED in the authors’ data set is probably a function of their inclusion criteria for analysis (age 0 to 31 days) and the fact that many preterm infants would remain hospitalized in the nursery or NICU during this age range. The proportion of visits by late preterm infants to the authors’ ED (17.7%) is double the reported 8.8% rate of late preterm births nationally [2]. This may be a reflection of the institution’s status as a tertiary care pediatric ED or a result of higher frequency of medical concerns in this subset of newborns. To better understand the unique issues related to late preterm infants, the authors compared the 1280 term infants seen in the ED to 282 late preterm infants.

**Age at presentation**

The age of the infant at presentation was available for every patient. Fig. 1 shows visits by age of patient divided into 0 to 7 days, 8 to 14 days, 15 to 21 days, 22 to 28 days, and 29 days or more in term newborns compared with late preterm infants. Patients were divided evenly between the four age ranges except the age group 29 days or more, which included only 4 days (29 to 31 days of age). More term infants presented to the ED in the second week of life, whereas more late preterm infants presented in the fourth week of life (Fig. 1A). Fig. 1B depicts the age at presentation to the ED of late preterm infants; no noticeable patterns emerge, except that more late preterm infants presented in the 22- to 28-day age range (fourth week of life).

**Presenting complaint**

The chief complaint of the patient at the time of presentation was recorded by the triage nurse for every visit. This included problems voiced by the parents and tentative diagnoses made by referring physicians. The
top five complaints for term and late preterm infants accounted for most patient visits and were the same in each group: difficulty breathing/stopped breathing, fever, jaundice, vomiting, crying.

**Acuity of presentation**

Based on the presenting complaint and a quick assessment, patients arriving at the ED are assigned a triage category that denotes the acuity of their condition. This helps in prioritization of patients for immediate medical attention. Newborns in general are considered to be a higher priority than older patients with a similar presentation. Acuity is divided into four categories: critical, emergent, urgent, and nonurgent. Fig. 2 shows that most newborns presented in the emergent or urgent categories, in comparable ratios between term and late preterm infants. Although a higher proportion of late preterm infants presented in critical condition compared with term

Fig. 1. (A) Age distribution of term (N = 1280) and late preterm (N = 282) infants at presentation to ED. (B) Age distribution of late preterm infants at presentation to ED. A significant number of infants presented at greater than or equal to 2 weeks of age, reflecting ongoing issues in this population.
infants, the total number of newborns in critical condition was less than 1% (10 of 1562).

**Gestational age at presentation**

Term infants presented in the entire range from 37 weeks through 42 weeks, with many being noted simply as being “full term”. Of the late preterm infants, 26.2% were 34 weeks gestational age, and 21.6% were 35 weeks. More than half, 52.1%, were 36 weeks (Fig. 3). This larger number of infants in the more mature late preterm category is surprising. Escobar and colleagues found that 34- to 36-week gestation infants who were never in the NICU were much more likely to be rehospitalized than other infant groups (including preterm infants) [8]. In view of that finding, one possible reason for the disproportionate number of infants of 36 weeks gestation presenting to the ED might be that these infants had short nursery stays, more like term infants, while those infants of 34 and 35 weeks gestation required longer stays in the nursery or NICU. So, despite an uneventful perinatal
course and discharge from the nursery, 36-week infants develop problems at home, prompting caregivers to seek medical attention. This trend underscores the need for critical evaluation of nursery discharge practices for late preterm infants.

**Mode of delivery**

The mode of delivery was documented as vaginal or normal for 715 term infants and 93 late preterm infants and as caesarean section for 275 term and 60 late preterm infants. For 290 term infants and 129 late preterm infants, the mode of delivery was not documented. Fig. 4 depicts the mode of delivery in term infants as compared with late preterm infants. Of note, as compared with 27.8% of term patients presenting to the ED delivered by caesarean section, 39.2% of late preterm infants had a caesarean section delivery. This higher rate of caesarean delivery in late preterm infants presenting to the ED may reflect a failure of smooth neonatal transition in these infants, or may be reflective of the recent increase in elective deliveries, and a concomitant rise in iatrogenic prematurity [12].

**Range of diagnoses**

The range of diagnoses noted at disposition from the ED is shown in Table 1. The authors grouped related diagnoses by system (eg, gastrointestinal [GI], respiratory, or neurologic) or common newborn conditions (eg, fever, apnea/apparent life-threatening event [ALTE], jaundice, feeding problems, or crying/fussiness). The six most commonly noted diagnoses accounted for most (over 75%) infants and were the same for term and late preterm infants.
preterm infants (GI, respiratory, fever, jaundice, infectious, feeding problems). Comparable to previous studies, the authors also found jaundice, infectious issues, feeding problems, and apnea/ALTE in a higher proportion of late preterm infants, as compared with term infants [4,13,14]. Additionally, although not a very common presentation, more late preterm infants were found to have hypothermia than term infants (2.5% versus 0.2%). Fever was a common presentation for both groups; however, it was seen much less frequently in late preterm infants (term 13.8% versus late preterm 6.8%) (Fig. 5). This finding supports the observation that the ability to mount a febrile response may be regulated developmentally.

### Outcomes of the emergency department visit

Of the 1276 term infants and 279 late preterm infants evaluated in the ED, 521 of 1276 (40.8%) term infants were hospitalized, compared with 103 of 279 (36.9%) late preterm infants (Fig. 6). Four term and three late preterm infants left before being seen by a physician. There are several points worthy of note concerning these admission rates. First, the authors’ institution is a tertiary care pediatric facility with an 11.4% overall rate of admission from the ED, which may reflect a higher patient acuity in general. Second, while these admission rates appear higher than those previously reported for late preterm infants, previous studies reported population-based data [7,9,10]. Finally, these rates of hospitalization are comparable between term and late preterm infants. At first glance, this appears contradictory to
previously published higher rates of rehospitalization for late preterm infants \([5,7,10,15,16]\). Given, however, that late preterm infants presented to the authors’ ED at twice the rate (17.7%) of late preterm births in the United States (8.8%), the absolute number of late preterm infant hospitalization is compatible with previously published readmission rates. Among admitted patients, the rate of disposition to the ICU or operating room in late preterm infants (12/103) was almost twice that of term infants (32/521) (11.7% versus 6.1%).

**Late preterm infant: problems persist after discharge from nursery**

Detailed medical record review was performed for all 279 late preterm infants. Various interventions, both diagnostic and therapeutic, were
performed in the ED. One hundred thirty of 279 (46.6%) infants had laboratory evaluation (ie, complete blood count [CBC], electrolytes, bilirubin level, blood culture, or other tests). Urinalysis was performed in 60 (21.5%) infants, and lumbar puncture was performed in 44 (15.8%) infants. Radiologic imaging (chest radiograph, abdominal radiograph, CT, ultrasound and echocardiogram, fluoroscopy, or other images) was obtained in 82 (29.4%) infants. Some patients had more than one imaging study during a single visit.

Fifty four of 279 (19.4%) infants received a bolus of intravenous fluids, and 40 (14.3%) received antibiotics/antivirals. Five infants received critical care, including two who required intubation. Subspecialty consultation was requested for 27 (9.7%) infants, primarily for cardiac and surgical services.

Readmissions of late preterm infants from the emergency department

One hundred three of 279 (36.9%) late preterm infants seen in the ED in the first month of life required readmission to the hospital. These infants accounted for a total of 589 hospital days. The average length of stay was 5.7 days; most stayed for 3 days. There were various admitting diagnoses, of which the top six were apnea/ALTE (18), hyperbilirubinemia (17), neonatal fever/suspected sepsis (13), respiratory problems (7), and hypothermia (6). Almost all patients who were admitted required additional interventions during their hospitalization; only four were admitted for simple observation. These interventions included intravenous antibiotics and antivirals, imaging studies, intravenous fluids, additional laboratory evaluation, and subspecialty consultation.

The top six diagnoses accounted for most (about 75%) of late preterm patients admitted from the ED. The final diagnoses for these hospital admissions are noted in Table 2. Many infants admitted for apnea/ALTE and feeding problems were given a final diagnosis of gastroesophageal reflux disease (GERD). Three of the six infants with hypothermia had sepsis as the final diagnosis.

Table 2

<table>
<thead>
<tr>
<th>Emergency department diagnosis</th>
<th>Final diagnosis</th>
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<tbody>
<tr>
<td>Apnea/ALTE (18)</td>
<td>GERD (11), bronchiolitis (3), sepsis (2), neurological (1), pertussis (1)</td>
</tr>
<tr>
<td>Hyperbilirubinemia (17)</td>
<td>Hyperbilirubinemia (17)</td>
</tr>
<tr>
<td>Fever (16)</td>
<td>Sepsis (2), UTI (1), meningitis (1), flu (1), rotavirus (1), URI (1), fever (9)</td>
</tr>
<tr>
<td>Respiratory (13)</td>
<td>Bronchiolitis (10), GERD (2), fever (1)</td>
</tr>
<tr>
<td>Feeding problems (7)</td>
<td>GERD (2), diarrhea (2), FTT (1), feeding problem (2)</td>
</tr>
<tr>
<td>Hypothermia (6)</td>
<td>Sepsis (3), hyperbilirubinemia (2), feeding problems (1)</td>
</tr>
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*Abbreviations:* GERD, gastroesophageal reflux disease; URI, upper respiratory infection; UTI, urinary tract infection.
Twelve of the 103 late preterm infants who were hospitalized were admitted to the ICU, accounting for a total of 107 ICU days. One infant with staphylococcal pneumonia and empyema had a 36-day ICU stay.

Summary

This was a comprehensive review of the experience of late preterm infants as compared with term infants in a large pediatric ED, including rehospitalizations. The 17.7% rate of late preterm visits, as compared with the overall 8.8% rate of late preterm deliveries in the United States, might indicate increased parental concern or increased morbidity in this population. Although infants in both groups had similar complaints and diagnoses, the authors found a higher frequency of presentation for jaundice, infectious issues, feeding problems, and apnea/ALTE in late preterm infants. This is in concordance with similar findings in other studies within and outside the nursery. The authors found that over half of late preterm infants presenting to the ED were born at 36 weeks of gestation. This unexpected finding warrants further study of the early postnatal course and nursery discharge practices for these infants. The rate of caesarean section delivery in late preterm infants in the authors’ data warrants further study of decisions regarding timing and mode of delivery. Finally, although rehospitalization rates were comparable among term and late preterm infants presenting to the ED, late preterm infants were more likely to be seen in the ED, thus accounting for an overall higher hospitalization rate for this population.

There are several initiatives underway to increase general awareness of the risks and problems faced by late preterm infants within the nursery. These initiatives need to extend beyond the nursery to outpatient providers and parents. Emphasis should be placed on feeding issues, jaundice, GERD, and temperature regulation, in addition to the common concerns of respiratory problems. Early follow-up with a pediatrician after discharge from the birthing unit may be helpful. More studies on short-term outcomes of late preterm infants compared with term infants may help delineate their morbidity and define guidelines for their care after nursery discharge.

References