Chapter 33 – Care of the Late Preterm Infant

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Had he been alive today, Patrick Bouvier Kennedy would have been hailed as a triumph of neonatal care—after all, he was the son of the former United States President, John F. Kennedy and former First Lady Jacqueline B. Kennedy. Born prematurely at 34 weeks gestation, he would have been aptly labeled as a late preterm neonate; however, based on his birth weight (2.1 kg) and gestational age, few would have predicted the outcome he had then, were he born in 2009. But then, in 1963, little was available to the clinician for the management of hyaline membrane disease—no routine use of neonatal ventilators, no device to provide airway positive pressure, no surfactant, and no antenatal steroids. He died two days after his birth; the New York Times obituary said that “the battle for the Kennedy baby was lost because medical science has not advanced far enough.”

(Jain and Carton, 2009)

With more than 4 million live births per year (Martin et al, 2007), the United States has one of the highest birth rates among industrialized countries; it also has the stigma of having a disproportionately high prematurity rate. Decades of efforts to reduce preterm births have not affected this formidable problem. In recent years the problem has been highlighted by the rise in births between 34 and 36 weeks’ gestation, a group referred to as late preterm infants (Figure 33-1). Late preterm infants have a checkered history, having been passed off as nothing more than “near term” infants, yet being feared as the “quick to spiral down group” when they develop respiratory distress syndrome or other complications. As the number of late preterm infants has grown, so has the awareness of their unique set of problems, such as delayed neonatal transition, wet lung syndrome, hypothermia, hypoglycemia, and hyperbilirubinemia (Figure 33-2). Although not unique to this population, these complications have sufficient differences in their manifestations and management, prompting the editors to add an entirely new chapter to this textbook devoted to the health issues of late preterm infants. In Chapter 14, the obstetric issues and epidemiology related to prematurity are addressed. This chapter focuses on the special considerations applicable to the clinical course and management of late preterm infants.

There has been a shift in the distribution of births away from term and post term and toward earlier gestational ages (Davidoff et al, 2006). This shift has resulted in a disproportionately high rate of premature births with estimates of up to 12.7% of live births being premature (Martin et al, 2007)—defined as <37 completed weeks’ gestation or <260 days, counting from the first day of the last menstrual period (Raju, 2006). Within this group of premature babies, up to 75% are classified as late preterm infants (Adamkin, 2009). Although the reasons for such a high number of late preterm births are multifactorial, higher rates of induced deliveries, cesarean births, and efforts to reduce stillbirths may have contributed to the increase.

Late preterm babies currently account for up to one third of all neonatal intensive care unit (NICU) admissions in the United States (Angus et al, 2001), adding strain to the overburdened system of health care delivery, particularly in community hospitals and rural areas. These admissions range from short stays, for problems such as transient tachypnea of the newborn (TTNB), to more complicated or extended NICU stays for problems such as persistent pulmonary hypertension of the newborn (PPHN). With the average NICU stay costing up to $3500 per day, the economic impact of caring for the late preterm baby can be significant. For example, in 1996 the State of California alone could have saved $49.9 million in health care costs by preventing non–medically indicated deliveries between 34 and 37 weeks’ gestation (Gilbert et al, 2003). In addition to the expense of the initial hospitalization, the cost of caring for a late preterm baby can also be compounded by the increased incidence of hospital readmissions and the long-term care issues related to persistent problems. The effects of the increasing number of late preterm births create a societal burden in lost productivity, as parents take extended leave from work to be with their fragile newborns. More importantly, there may be lasting effects with neurodevelopmental delays extending into early school age. Because a significant proportion of brain growth occurs during the last 6 weeks of gestation (Adams-Chapman, 2006), late preterm infants are vulnerable to neuronal injury and disruption of normal brain development. Whereas more longitudinal studies are needed, preliminary studies show that late preterm infants are more likely to have a diagnosis of developmental delay within the first 3 years of life, require special needs preschool resources, and have more problems with school readiness (Morse et al, 2009).

Given their large numbers, the overall socioeconomic effects of the late preterm births can be significant. Strategies are required that can reduce the preventable fraction of late preterm births and work toward...
reducing the morbidity in others, when continuation of the pregnancy is deemed harmful to the fetus or the mother. This chapter explores the pathophysiology of the major morbidities that affect late preterm infants and discusses the unique challenges faced by clinicians in the management of these conditions.

**Definition**

Late preterm birth is an accepted term used for infants born between 34 and $36\frac{1}{7}$ weeks’ gestation (see Figure 33-1) (Raju et al, 2006). This group of infants was initially referred to as near term, but the misleading implication of maturity has prompted the name change to late preterm (Box 33-1). This notion is further validated by recent studies showing that term infants born at 37 to 38 weeks’ gestation have higher morbidity and mortality than those born at 39 weeks’ gestation (Hansen et al, 2008; Madar et al, 1999; McIntire and Leveno, 2008; Shapiro-Mendoza et al, 2008); this has prompted the use of early term to describe births at 37 to 38 weeks’ gestation.

**BOX 33-1**

<table>
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<tr>
<th>Characteristics of Late Preterm Infants</th>
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<tr>
<td>• Late preterm infants—defined as born at 34 to $36\frac{1}{7}$ weeks’ gestation</td>
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<tr>
<td>• Physiologically immature with limited compensatory responses to extrauterine environment compared to</td>
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FIGURE 33-1 Definitions of late preterm and early term.  
(Adapted from Engle WA, Kominiarek MA: Late preterm infants, early term infants, and timing of elective deliveries, Clin Perinatol 35:325-341, 2008.)

FIGURE 33-2 Graph of clinical outcomes in near-term (35 to 36 weeks) and full-term infants as percentage of patients studied.  
The term late preterm and the gestational age limits were established by a panel of experts convened by the National Institutes of Health and the National Institute of Child Health and Human Development in 2005. While developing these criteria, the group considered many factors, including the obstetric guidelines that consider 34 weeks to be a maturational milestone. Beyond 34 weeks' gestation, surfactant is generally considered to be adequate and antenatal steroids are not offered to mothers with anticipated delivery (Raju et al, 2006). Unlike the smaller, more typical premature infant, late preterm infants appear mature because of their larger size, but have a higher incidence of transient tachypnea of the newborn (McIntire and Leveno, 2008; Wang et al, 2004), respiratory distress syndrome (RDS) (Clark, 2005; Wang et al, 2004), PPHN (Roth-Kleiner et al, 2003), respiratory failure, prolonged physiological jaundice, late neonatal sepsis (Raju, 2006), thermoregulation issues, hypoglycemia, feeding difficulties (Dudell and Jain, 2006; Escobar et al, 2006; Fuchs and Wapner, 2006), and risk of injury to the developing brain, which can lead to neurodevelopmental problems. These problems account for a substantially higher number of NICU admissions (see Figures 33-2 and 33-3).

Term infants
- Greater risk than term infants for mortality and morbidities such as:
  - Temperature instability
  - Hypoglycemia
  - Respiratory distress
  - Apnea
  - Jaundice
  - Feeding difficulties
  - Dehydration
  - Suspected sepsis


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FIGURE 33-3 Distribution of neonatal intensive care unit (NICU) admissions by gestational age, highlighting the contribution made by late preterm and early preterm infants. Data were obtained from a large consortium of NICUs under a common management. (Adapted from Clark RH: The epidemiology of respiratory failure in neonates born at an estimated gestational age of 34 weeks or more, J Perinatol 25:251-257, 2005.)