Safe discharge of the late preterm infant

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Late preterm infants are infants who are premature, but often mature enough to be managed in settings and with treatment plans appropriate for term newborns. They are arbitrarily defined as infants born at gestational ages of 34, 35 and 36 weeks. Late preterm infants have more problems with adaptation than term infants, and may require neonatal intensive care and prolonged admission. However, those who do not may, appropriately, be triaged to mother-baby care in a low-risk nursery setting. Special attention must be offered to the late preterm infant in ensuring adequate thermal homeostasis and the establishment of successful feeding before discharge. In particular, care must be taken to ensure that these babies do not experience severe late hyperbilirubinemia, which characteristically occurs in the breastfeeding late preterm infant at four to five days of age and is not always predictable by routine bilirubin screening before 48 h of age. Discharge of a late preterm infant places particular demands on the community; accessible facilities for retesting, re-evaluation and readmission must be made available by the discharging institution.

Key Words: Discharge; Hyperbilirubinemia; Hypoglycemia; Late preterm

Late preterm infants are infants who are premature (ie, they are born at a gestational age [GA] of less than 37 weeks), but who are often mature enough to be managed in settings and with treatment plans appropriate for term newborns. These babies are often cared for in mother-baby units, rather than special or intensive care nurseries. Avoidance of mother-baby separation allows family centred care with mother-infant nursing. Early discharge, if safe, may encourage infant feeding, parental confidence and stability of the family unit. The late preterm infant is particularly responsive to the benefits but vulnerable to the risks of the mother-baby environment and of early discharge home. The purpose of the present statement is to identify practices that ensure safe discharge.

LEVELS OF EVIDENCE

These recommendations address a broad spectrum of neonatal care and are generally drawn from level IIa or level III levels of evidence (1). Each recommendation represents a consensus-derived position drawn from several sources of evidence. We believe that these recommendations have been assembled from the best evidence available, consistent with the definition of evidence-based practice (2). There are many

Le congé sécuritaire du nourrisson peu prématuré

Les nourrissons peu prématurés sont des nourrissons prématurés, mais souvent assez matures pour être pris en charge dans des milieux et à l'aide de régimes thérapeutiques conçus pour les nouveau-nés à terme. On les définit arbitrairement comme des nourrissons nés à 34, 35 ou 36 semaines d'âge gestationnel. Les nourrissons peu prématurés ont plus de problèmes d'adaptation que les nourrissons à terme et peuvent avoir besoin de soins intensifs néonataux et d'une hospitalisation prolongée. Cependant, ceux qui n'en ont pas besoin peuvent, de manière tout à fait pertinente, être envoyés en soins mère-enfant dans une pouponnière à faible risque. Chez le nourrisson peu prématuré, il faut accorder une attention particulière à l'homéostasie thermique pertinente et à la mise en place d'une alimentation satisfaisante avant le congé. Notamment, il faut s'assurer que ces bébés ne font pas d'hyperbilirubinémie tardive grave, qui se produit habituellement chez le bébé peu prématuré allaité de quatre ou cinq jours de vie et qui n'est pas toujours prévisible par le dépistage systématique de la bilirubine avant 48 heures de vie. Le congé d'un nourrisson peu prématuré s'associe à des exigences particulières dans la collectivité. L'établissement qui accorde le congé doit prévoir des installations accessibles pour reprendre des tests de dépistage, procéder à une réévaluation et une réhospitalisation.

opportunities to improve on the evidence bearing on decisions ensuring the safe discharge of the late preterm infant.

DEFINITION AND FREQUENCY OF LATE PRETERM

Extensive reviews (3-6) addressing current epidemiology, care and outcomes of late preterm infants are available. Late preterm infants are those born at a GA of 34, 35 and 36 completed weeks (or from 238 to 258 days, inclusively). (In Canada, where GA is defined according to the WHO [7], this definition is interpreted as including babies born from 238 to 258 days, inclusively. In the United States, the clinical definition of GA differs from this definition by one day [6].) In 2006, 5.9% of live born infants in Canada were late preterm (8). In 1994, multiple pregnancies accounted for 2.1% of all Canadian live births, but 14% of late preterm live births (9,10); the incidence of late preterm delivery and the contribution of multiple pregnancy appear to be increasing (9). These data are similar to those reported in the United States (5,11,12) and internationally (13). Increases in multiple births, obstetric intervention and improved accuracy of measurement of GA have contributed to a rise in the incidence of late preterm delivery (5,9,12).

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TABLE 1
Weight and components of body composition of late preterm infants compared with term infants

Gestational age, weeks	Mean birth weight (16), g	% of cohort of birth weight <2500 g (16)	Body fat, % (17)	Brain weight, % of term (18,19)
34	2319	67	7.5	67
35	2565	44	8.1	72
36	2809	24	8.7	80
40	3563	0.8	11.2	100

Adapted from references 16 to 19

Late prematurity is recognized as a period when the risks of prematurity are sufficiently low to allow spontaneous labour to proceed or, when continued pregnancy threatens the health of the mother or fetus, permit obstetric intervention with little risk or even benefit to the newborn. In one large American centre, 80% of late preterm births were attributable to premature labour and 20% to obstetric intervention (3). Clinical trials of adequate size to test the outcomes of obstetric decisions at this GA are, however, lacking (5).

MORTALITY AND MORBIDITY OF LATE PRETERM INFANTS

Mortality and morbidity in late preterm infants increase rapidly as GA decreases (3,14,15). In 1992 to 1994, infant mortality in late preterm singleton infants in Canada was 13.3/1000 live births, 4.5 times higher than that of term singletons (3.0/1000 live births) (14). RRs for deaths of late preterm compared with term infants were 3.3 for asphyxia, 5.0 for infection and 1.9 for sudden infant death syndrome (SIDS), accounting for 4.9%, 6.1% and 3.8% of cause-specific deaths, respectively.

The late preterm infant may appear outwardly mature; body weight often exceeds 2500 g, which still defines the upper limit of low birth weight (7). This weight, however, is one-third below that of a healthy full-term newborn, and reflects major differences in body composition and brain weight (Table 1 [16-19]). The late preterm may present with inadequate thermoregulation (20), immature and weak suck and swallow patterns (21), incomplete adaptation of certain enzyme systems (20,22) and poor immunological and respiratory defense systems (23).

Several studies (3,24,25) have identified significant rates of morbidity related to prematurity in these infants (Table 2), with increases as the GA falls from 39 to 34 weeks (3,26). The particular increase in morbidity and mortality at 34 weeks compared with 35 weeks is apparent. In a large population-based study (24) in Massachusetts (USA) from 1998 to 2003, 22% of late preterm infants experienced life-threatening neonatal morbidity, seven times higher than term infants (3%).

The relative immaturity of the late preterm infant is reflected in longer term outcomes. Rates of cerebral palsy are three times higher, and rates of developmental delay or mental retardation are modestly increased (HR 1.25) when compared with term infants in a large retrospective cohort

TABLE 2
Neonatal morbidity in late preterm live births and at 37 and 39 weeks' gestational age

	Gestational age, weeks				
	34	35	36	37	39
Group, n	3498	6571	11,702	26,504	84,747
Ventilator-dependant respiratory distress	3.3	1.7	0.8	0.5	0.3
Transient tachypnea	2.4	1.6	1.1	0.7	0.4
Intraventricular hemorrhage (all grades)	0.5	0.22	0.07	0.03	0.01
Worked up for sepsis	31	22	15	12	12
Culture-proven sepsis	0.5	0.4	0.2	0.2	0.1
Phototherapy	6.1	3.5	2.0	1.6	1.0
Necrotizing enterocolitis	0.09	0.02	0.01	0.01	0.0
Apgar score ≤ 3 at 5 min	0.1	0.2	0.9	0.08	0.06
Intubation in the delivery room	1.4	0.8	0.6	0.6	0.6
One or more of the above	34	24	17	14	14

Data presented as percentages, unless otherwise indicated. Adapted from reference 3

study (27) at early follow-up (predominantly younger than two years of age). Early school-age outcomes of late preterm infants, excluding those with acute perinatal morbidity, have also shown modestly increased risks of developmental delay and special needs attributable to shorter GA (28).

TRIAGE AT BIRTH

The late preterm infant must be identified at birth by careful evaluation of the GA, preferably using data from early obstetric ultrasound. Late preterm infants are at risk for poor thermal, metabolic and cardiovascular adaptation, and may be admitted to special care units for short periods of evaluative monitoring. Infants of 34 weeks' GA are likely to require 24 h of evaluation for respiratory stability. Infants who develop complications require admission to the neonatal intensive care unit, and their stay may be prolonged past the preterm period.

Late preterm infants who are stable enough to be admitted to level 1 nurseries require close attention to the thermal environment including room temperature, clothing, bedding and exposure. Special expertise from staff trained in lactation support is required to support breastfeeding, especially for first-time mothers. Many mothers who have delivered in late prematurity are recovering from caesarean section or from complications of pregnancy, and may be receiving medication for pain or coexisting medical conditions. Discharge cannot be considered until feeding has been evaluated as successful by an expert, and the mother is confident in her ability to continue feeding.

Mothers who are unable to or opt not to breastfeed require special consideration and support. They are frequently the sickest or may have pressing, competing demands at home, and deserve expert guidance on choice and preparation of infant formula.

Late preterm infants are far more likely to be readmitted following discharge than term infants (21). Paradoxically, babies of 36 weeks' GA seem to be more at risk for readmission than babies of 34 and 35 weeks' GA – this may be

explained by more frequently delayed discharge of infants of shorter GA due to problems in transition (15).

Recommendations

- All infants at birth must have a carefully documented assessment of GA.
- Infants identified as late preterm should be carefully observed for successful adaptation. Evaluation should include core temperature, blood glucose at 2 h and vital signs.
- Provision should be made for short-term observation of late preterm infants for cardiorespiratory stability and ability to feed before triage to either a low-risk or an intermediate/high-risk nursery.
- Infants should be wrapped, and core temperatures measured and documented. Bathing should await the establishment of a core body temperature of at least 36.5°C.
- Early feeding should be attempted.

POSTDISCHARGE PROBLEMS OF THE LATE PRETERM

In addition to the general problems of the newborn, late preterm infants are particularly at risk for readmission with hyperbilirubinemia, feeding problems, apnea or acute life-threatening events, suspected sepsis, respiratory problems and hypothermia (4).

HYPERBILIRUBINEMIA

Late preterm infants are over-represented among infants with extreme hyperbilirubinemia (29). Bilirubin levels in late preterm infants peak later (at seven rather than at five days), stay elevated for longer and reach higher mean values (207 $\mu\text{mol/L}$ versus 190 $\mu\text{mol/L}$) (30) compared with term infants. The late preterm infant is probably at risk of kernicterus at lower levels of bilirubin than the term infant (31). In the only existing collection of infants with kernicterus, the American Pilot Kernicterus Registry (1992 to 2003), 24% were late preterm (31,32). The incidence of kernicterus in western countries is approximately four per million births (33,34).

Extreme hyperbilirubinemia (serum bilirubin levels of higher than 428 $\mu\text{mol/L}$) has been used as a surrogate for kernicterus risk (31). In an American study (35) of 51,387 newborns of at least 2000 g birth weight and 36 weeks' GA, 73 newborns or 1.4/1000 newborns exceeded this threshold. The risk of extreme hyperbilirubinemia doubles for every week of GA shorter than 40 weeks (35).

Exclusive breastfeeding increases the risk of extreme hyperbilirubinemia by a factor of approximately six; almost all the infants in the kernicterus registry and with extreme hyperbilirubinemia were breastfed (33,35). This very strong association exists particularly in the late preterm infant and is attributed, in part, to dehydration and poor weight gain due to poor feeding. With reduced enteral feeding, the enterohepatic circulation of bilirubin is greatly increased.

High levels of bilirubin may be predicted in infants from a screening nomogram (36) reproduced in guidelines for the management of hyperbilirubinemia (37,38). The Canadian Paediatric Society advocates universal screening (ie, measurement of hour-specific serum or transcutaneous bilirubin levels before 72 h). Late preterm infants who score in or above the low-intermediate zone must be re-evaluated within 24 h to 48 h. The median age at which infants with extreme hyperbilirubinemia were reported to have reached or exceeded 428 $\mu\text{mol/L}$ was 4.5 days; these were not necessarily associated with early rapid rises in bilirubin levels (33,35). Observation of a late preterm infant identified as being in a risk zone must, therefore, be extended throughout the first week of life.

Phototherapy is extremely effective in reducing hyperbilirubinemia and avoiding exchange transfusion. Phototherapy and exchange transfusion should be initiated at lower bilirubin thresholds than those used for term infants (38). Rehydration and the re-establishment of adequate breastfeeding are important contributors to therapy.

Recommendations

- Late preterm infants must have an assessment of their serum bilirubin levels within 48 h of birth, and be evaluated using current guidelines for detection, management and prevention of hyperbilirubinemia for late preterm newborn infants (38).
- Late preterm infants should be assessed for feeding, weight gain and jaundice repeatedly in the first 10 days of life until consistent weight gain without jaundice has been established.

FEEDING DIFFICULTIES AND GROWTH

Feeding difficulty is the major cause of delayed discharge of the late preterm infant (25) and a major cause of readmission (39). Coordination of suck and swallow is immature in late preterm infants (40), resulting in longer feeding times and shorter interfeeding intervals. In breastfeeding infants, the effect of poor latching and sucking may be responsible for delayed or impaired lactation and, therefore, malnutrition and dehydration (25,41), particularly in older, first-time mothers or following caesarean birth (39). Smaller babies may require more frequent feeding and may not be able to adapt to nighttime spacing early; in twins, three-hourly feeding schedules may occupy more than one-half of the waking hours available to the mother.

Feeding may be assessed by careful observation of feeds and infant satiety and satisfaction, by timing of feeds and by signs of adequate intake such as weight change and urine output. These clinical signs are difficult to interpret in the first few days of life. Babies of 34 and 35 weeks' GA may benefit from a protein- and mineral-enriched postdischarge formula to accelerate growth; those receiving breast milk may be given expressed breast milk with an added fortifier. Although increased rates of weight gain may be achieved, there is currently no evidence to suggest that supplements are beneficial in the long term.

Recommendations

- Twenty-four hours of successful feeding of late preterm infants must be established before discharge home.
- First-time mothers, in particular, require careful supervision and, when infants are leaving from an intensive care environment, should have a rooming-in experience.
- Individual feedings should not exceed 20 min in length.
- Feeding and preparation for feeding should not take more than 6 h of the day at discharge.
- Discharge plans must take into account the health, parenting and feeding skills of the mother and the availability of support in the home.
- Early weight loss should not exceed 10% of body weight.

APNEA AND SIDS

The incidence of apnea of prematurity falls with increasing brain maturation from 30 to 37 weeks' GA. Although the incidence of apnea in late preterm infants is higher than in term infants (25,42), it is unusual and rarely a cause for readmission. Apnea of prematurity, a diagnosis of exclusion, is more common at a GA of 34 weeks than at a later GA; some centres recommend a 12 h to 24 h period of cardiorespiratory monitoring to exclude the condition in infants of less than 36 weeks' GA. If apnea is identified, an apnea-free interval of eight days is required to achieve safe discharge (43). Discharge on caffeine therapy is not recommended. Other forms of apnea require treatment of the specific cause; prompt removal of the cause may avoid further prolonged monitoring.

Apnea after discharge is also more common in late preterm infants, as is SIDS (42). However, SIDS is not a prolongation of apnea of prematurity and typically occurs many weeks after term. The avoidance of SIDS requires close attention to existing recommendations for all infants (44).

Recommendations

- Late preterm infants of 34 weeks' GA may be considered for a period of cardiorespiratory monitoring in a neonatal intensive care unit before transfer to a low-risk nursery.
- Infants who manifest apnea require a diagnostic evaluation. If apnea of prematurity is diagnosed, infants should receive cardiorespiratory monitoring in a neonatal intensive care unit until they have achieved eight days of freedom from apnea (43).
- Special care should be exercised to ensure that guidelines for the prevention of SIDS are followed in late preterm infants (44).

SEPSIS

Preterm infants are at more risk of sepsis at birth, and this susceptibility extends beyond discharge. Case mortality for

group B streptococcal disease is considerably higher in late preterm than in term infants for both early and late forms of infection (45). Some infants will have been born following intervention for maternal chorioamnionitis, and most will be born before maternal group B streptococcal colonization status has been determined. Late preterm infants born to mothers of unknown status should be treated in accordance with current guidelines (46). Those less than 36 weeks' GA are considered at risk of infection, and in the absence of known maternal status and intrapartum antibiotic prophylaxis require a complete blood count and 24 h of four-hourly observations. Susceptibility to postnatal viral infection is also high (47), and post-discharge contact with infected people must be avoided for the first year of life, particularly in the highly susceptible winter months.

Recommendations

- Late preterm infants of less than 36 weeks' GA should be considered at risk of infection and managed according to current guidelines for prevention of group B streptococcal infection (46).
- Exposure to people with active upper respiratory tract infections or other viral infections should be avoided.
- The benefits and techniques of hand washing in the prevention of infection should be taught on discharge.

HYPOGLYCEMIA AND TEMPERATURE CONTROL

These problems are usually immediate and should not ordinarily persist until discharge. It is not clear to what degree, if any, the late preterm is at additional risk for hypoglycemia; a pathological range for blood glucose, distinct from the normal, for term babies has not been determined. Increased routine screening of the late preterm greatly contributes to reported hypoglycemia. Until more is known, it would be prudent to test these babies according to guidelines for the preterm infant (48).

The large weight to surface area and reduced capacity for thermogenesis of smaller babies make temperature instability a common problem for the late preterm (16). Home environments should be reviewed for their ability to provide a suitable thermal environment (approximately 18°C) for a lightly dressed infant sleeping in a cot; parents should, however, be discouraged from overheating infants. Attempting to substitute heavy clothing in an unstable thermal environment impairs infant thermal homeostasis and increases risk of SIDS (49).

Recommendations

- Late preterm infants should have been demonstrated to be euglycemic before discharge.
- The home environment must be adequately warm to support the infant's thermal environment without recourse to excessive clothing or bedding.

HEALTH SERVICES AND THE DISCHARGE ENVIRONMENT

Unlike other hospital inpatients, mothers and infants are experiencing a welcome, highly personal life event, albeit with health risks for both. Birth has multiple cultural interpretations, and health care facilities must be able to respond to individual and family needs and circumstances with respect to inpatient support, discharge practices, follow-up and readmission. Flexible care routines and variety of options are important components of family centred maternal care.

Discharge home is an important event for families, and responsibilities and costs are transferred from institutions to the community and to parents. Early safe discharge of the mother and the infant is the goal of mother-infant care. Separate discharge of mothers and infants usually occurs because of prolonged infant stay attributable to problems of adaptation, coupled with competing demands on the mother, usually for care of young siblings at home. Separation of mother and infant or early unsafe discharge should not be provoked by institutional pressures for discharge of mothers. When well postnatal mothers no longer need inpatient services for themselves, appropriate alternative accommodation must be provided to prevent separation.

Readmission has been identified as a marker of poor discharge decision making, and this may sometimes be the case in babies with poor feeding or jaundice. However, severe jaundice being of later onset in late preterm infants may only be manifest after discharge. Readmission of an infant

may be an institutional inconvenience, but need not be a family disaster. Discharge should not be perceived as a fixed and irreversible event; institutions should develop more permeable frameworks for infants leaving and reentering the hospital nurseries, using strategies such as day passes, courtesy care rooms, and on-site nursery evaluation and testing for discharged infants.

A variety of models of postpartum follow-up of mothers and infants are developing in different regions of Canada. Diminishing the distinction between institutional and community care may be an effective strategy for securing the safety of the early discharged late preterm infant.

Recommendations

- Mother and infant separation at discharge should be avoided through the provision of flexible accommodation arrangements for parents.
- A follow-up appointment within 48 h of discharge should be arranged with a community-based health care provider before the infant is discharged home.

Infant discharge should be flexible and reversible; provisions should be made to incorporate accessible community services into nurseries.

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