Objectives: (1) To determine the frequency and duration of grunting in term and near-term newborns; (2) to determine the peripartum characteristics associated with grunting; and (3) to compare the short-term outcomes of newborns with and without grunting.

Design: Medical record review of all newborns admitted to a well-baby nursery during a 2-month period.

Setting: University well-baby nursery for term infants, with more than 2700 deliveries annually.

Main Outcome Measures: Frequency and duration of grunting, maternal and newborn clinical characteristics, clinical course, and length of stay.

Results: Grunting respirations beginning during the first 4 hours of life were recorded for 81 (17.4%) of 466 newborns. Fifty-five (68%) stopped grunting within 30 minutes of birth, 69 (85%) by 1 hour, and 75 (93%) by 2 hours. More mothers of grunting infants received intrapartum antibiotics than mothers of nongrunters (33% vs 20%; P = .03). More grunting infants than nongrunters received bag and mask resuscitation (15% vs 5%; P = .01). More chest radiographs, blood cell counts, and blood cultures were ordered for grunting infants, and antibiotics were more often given to grunting than nongrunting infants (11.1% vs 4.6%; P = .04). Gruntings’ length of stay exceeded that of nongrunters (72 vs 55 hours; P = .01), but only 3 were transferred to a neonatal intensive care unit.

Conclusions: All grunting infants should be carefully observed, but because nearly all otherwise healthy term or near-term infants will stop grunting and have a benign course, other interventions can be postponed for 1 or 2 hours to give the newborn a chance to stop grunting or show other signs of respiratory illness.


Grunting occurs when a newborn exhales against a partially closed glottis. In 1956, Silverman and Andersen included grunting as part of their 5-part “retraction score,” with 0 indicating no grunting; 1, “expiratory grunt heard with stethoscope only”; and 2, “expiratory grunt heard with naked ear.” Standard pediatric textbooks list grunting as a sign of respiratory distress in newborns, but the peer-reviewed pediatric literature provides no data on how frequently grunting occurs, what characteristics are associated with it, or the outcome for infants who demonstrate grunting in the first hours after birth. The authors had observed that grunting in these first hours appeared to be relatively common in term and near-term newborns and that many such newborns did not progress to significant respiratory illness or distress.

To characterize the frequency and significance of grunting, we designed a study with the following objectives: (1) to determine the frequency and duration of grunting in term and near-term infants admitted to a well-baby nursery; (2) to determine the peripartum characteristics associated with grunting respirations; and (3) to compare the short-term outcomes of grunting newborns with those of newborns without grunting. We hypothesized that grunting would be relatively common, but that most newborns who demonstrated grunting without other signs of disease would have a good outcome.
SUBJECTS AND METHODS

The study was conducted in the well-baby nursery of the University of Utah Health Science Center, Salt Lake City. The nursery provides initial care for all newborns with a gestational age of 34 weeks or more unless complications are anticipated. In 1999, 2723 newborns were admitted to the well-baby nursery.

Medical records of all infants admitted to the nursery between June 23 and August 27, 1999, were reviewed (N=474). No infants were excluded. The period was chosen to accommodate the availability of one of us (G.C.Y.) to collect the data. The standard postpartum procedure at the University of Utah Health Science Center is as follows: After birth and contact with the mother in the delivery or birthing room, the newborn is observed for a 4-hour “transition” period in the nursery before rooming-in with the mother. Vital signs and other relevant observations are recorded in a flow sheet by a nurse assigned for this purpose. This nursing care flow sheet for the first 4 hours of life contains a column for the nurse to indicate whether grunting is present. These nursing records were used as the primary data source for this study. In addition to the presence or absence of grunting, the following information was extracted from the complete medical records of all mothers and infants: birth weight; gestational age; mode of delivery; the presence of maternal fever, prolonged rupture of the membranes, or sustained fetal tachycardia; group B streptococcal culture results; use of intrapartum antibiotics; evidence of meconium at delivery; and the presence of a nuchal cord. One- and 5-minute Apgar scores, the presence of infant tachypnea, and the type of resuscitation, if any, were also noted. Short-term outcomes included transfer to a neonatal intensive care unit (NICU), length of stay, and discharge diagnoses.

Complete data were collected for all infants who demonstrated grunting respirations (n=81) and for the first 197 infants who did not exhibit grunting respirations. This sample of 278 infants served as the primary data set for comparison. The remainder of the nongrunters (n=188) had only outcome data recorded. Data for the grunting and for the initial 197 nongrunting infants were recorded in 30-minute time blocks for the first 4 hours. In addition to grunting, maximum respiratory rate, oxygen saturation, need for supplemental oxygen, laboratory studies performed (capillary blood gas, complete blood count, blood glucose level, or hematocrit), and the initiation of antibiotic treatment were recorded. A χ² analysis was used for categorical variables and t tests for continuous variables. P values greater than .05 were considered to be significant. Statistical analysis was performed with StatView statistical software (Abacus Concepts, Berkeley, Calif). The study was approved by the University of Utah Institutional Review Board for the Health Sciences.

Table 1. Grunting Respirations and Maternal Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal temperature &gt;38°C</td>
<td>6/81 (7.4)</td>
<td></td>
</tr>
<tr>
<td>PROM* &gt;18 h</td>
<td>5/81 (6.2)</td>
<td></td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>18/81 (22.2)</td>
<td></td>
</tr>
<tr>
<td>Intrapartum antibiotics</td>
<td>27/81 (33.3)</td>
<td></td>
</tr>
<tr>
<td>Maternal temperature &gt;38°C</td>
<td>12/193 (6.2)</td>
<td>.80</td>
</tr>
<tr>
<td>PROM* &gt;18 h</td>
<td>18/193 (9.3)</td>
<td>.50</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>27/197 (13.7)</td>
<td>.10</td>
</tr>
<tr>
<td>Intrapartum antibiotics</td>
<td>40/196 (20.4)</td>
<td>.03</td>
</tr>
</tbody>
</table>

*PROM indicates prolonged rupture of membranes.

ASSOCIATED MATERNAL CHARACTERISTICS

Maternal characteristics evaluated for possible association with grunting respirations in the newborn are shown in Table 1. Only the rate of intrapartum antibiotic administration was significantly different, with 27 (33%) of the 81 mothers of grunters being treated compared with 40 (20%) of the 196 mothers of nongrunters (P=.03). Of the 27 mothers of grunters who received intrapartum antibiotics, 6 (22%) were treated for presumed chorioamnionitis and 21 (78%) for group B streptococcal prophylaxis. Of the 40 mothers of nongrunting infants who received intrapartum antibiotics, 13 (33%) received antibiotics for presumed chorioamnionitis and 26 (67%) for group B streptococcal prophylaxis (in 1 case the reason was unknown). These proportions are not significantly different (P=.42).

ASSOCIATED INFANT CHARACTERISTICS

Infant characteristics examined for differences between grunters and nongrunters are shown in Table 2. Only the use of bag and mask ventilation during initial resus-
“Other than normal,” x-ray films of 7 (64%) of 11 grunters were read as normal, 1 as showing transient tachypnea of the newborn, 8 were read as showing prematurity vs pneumonia. Of the 10 chest x-ray films obtained in the nongrunting cohort, 4 were read as normal, 3 were read as showing prematurity vs pneumonia. Grunting infants were more likely to have had a respiratory rate greater than 60 breaths/min, have received antibiotics (9/81 [11.1%] vs 9/197 [4.6%]; P = .04). White blood cell counts were all more likely to be ordered for grunting infants than for nongrunting ones. Chest x-ray films, complete blood cell counts, and blood cultures were more frequently ordered for grunting infants compared with nongrunting ones. The grunting cohort was transferred to the NICU because of tachypnea and the physician’s concern about sepsis. Rates of transfer were compared by means of likelihood ratio chi-squared analysis; the P-value was .06. Because of the small numbers of transfers, this finding should be interpreted with caution.

**PHYSICIAN TREATMENT AND SHORT-TERM OUTCOMES**

Table 3 displays differences in treatment and outcomes of the 2 groups of infants. More laboratory tests were ordered for grunting infants than for nongrunting ones. Chest radiographs, complete blood cell counts, and blood cultures were all more likely to be ordered for grunting infants. Grunters were also more likely than nongrunters to have received antibiotics (9/81 [11.1%] vs 9/197 [4.6%]; P = .04). Of the 11 chest x-ray films obtained in the grunting cohort, 4 were read as normal, 3 were read as showing transient tachypnea of the newborn, 2 had abnormal heart shadows, 1 had a small effusion, and 1 was read as showing prematurity vs pneumonia. Of the 10 chest x-ray films obtained in the nongrunting cohort, 8 were read as normal, 1 as showing transient tachypnea of the newborn vs atelectasis, and 1 as showing consolidation. When chest x-ray films were categorized as “normal” or “other than normal,” x-ray films of 7 (64%) of 11 grunters were read as “other than normal” compared with 2 (20%) of 10 nongrunters (P = .04). White blood cell counts between the grunting and nongrunting cohorts did not differ. Three blood cultures in the study were positive, 2 from the grunting cohort. All were considered to be contaminants (2 *Staphylococcus epidermidis* and 1 *Propionibacterium acnes*).

Grunting infants remained in the hospital significantly longer than nongrunters (72 vs 55 hours; P = .01), with a mean difference of 17 hours. Three of the 81 grunting infants were transferred to the NICU. One, an infant of 38 weeks’ gestation who had grunting respirations for 1 hour, continued to evidence respiratory distress after grunting ceased and was transferred to the NICU for presumed meconium aspiration. Another infant of 38 weeks’ gestation grunted for 2 hours and stopped but, because of a continued oxygen requirement, was transferred to the NICU for respiratory distress and possible sepsis. The third infant transferred to the NICU was an infant of 39 weeks’ gestation who grunted continuously for the first 4 hours of life and had persistent tachypnea with an increasing oxygen requirement. One infant from the non-grunting cohort was transferred to the NICU because of tachypnea and the physician’s concern about sepsis. Rates of transfer were compared by means of likelihood ratio chi-squared analysis; the P-value was .06. Because of the small numbers of transfers, this finding should be interpreted with caution.

**COMMENT**

There is limited information regarding grunting respirations in the pediatric literature. To understand the physiologic significance of grunting respirations, Knelson et al. studied the effects of grunting respirations in dogs with and without pneumonia. The subjects received mechanical ventilation, and an end-inspiratory pause was used to simulate grunting respirations. The authors found that grunting produced a mean increase in PaO2 and a mean decrease in PaCO2. These effects were found to be less pronounced when the subjects had pneumonia. Others have reported that grunting respirations improve oxygenation and ventilation. Yao and colleagues described the respiratory frequency, pattern, and occurrence of grunting respirations in 57 healthy term infants from birth through the first hours of life. In their study, infants in whom clamping of the umbilical cord was delayed were more likely to demonstrate grunting respirations; they specu-
lated that grunting respirations served as a compensatory mechanism to achieve respiratory adaptation in the face of an overdistended circulatory system. Harrison and colleagues studied 22 infants with hyaline membrane disease. Observing PaO2 values while the infants and colleagues studied 22 infants with hyaline membrane disease. Observing PaO2 values while the infants and while intubated (a means of preventing grunting respirations), they found that arterial oxygen tension fell during intubation. They concluded that grunting respirations were a protective form of breathing resulting in improved alveolar ventilation.

Although grunting respirations are most often associated with respiratory disease, they may occur in other types of illness. Several authors have reported that grunting in older infants and children can be an indication of severe disease. Poole et al found that 28 (55%) of 51 patients between the ages of 1 month and 18 years presenting to an emergency department with grunting respirations had a respiratory or cardiac condition, while 45% had another cause for their grunting respirations. These other causes were most often illnesses that were accompanied by high fever or appeared to cause pain.

These studies support an association of grunting with serious illness in older infants but may not be applicable to newborns with grunting respirations. The idea for our study arose from a question posed during a morbidity and mortality conference where the death of a term newborn nursery infant who had several hours of documented grunting respirations was being discussed. The question, “How long should a general pediatrician in a well-baby nursery observe a newborn term or near-term infant with grunting respirations before intervening?” was vigorously debated but not resolved. Although this study does not provide a direct answer to this question, it provides some insight into the frequency and natural course of grunting respirations in term infants admitted to a well-baby nursery.

We hypothesized that grunting respirations would be relatively common in this population, and we found that 17% of infants in the well-baby nursery demonstrated grunting respirations at some point during their first 4 hours of life. The onset in 78 (96%) of the 81 was within the first 30 minutes of life.

The second hypothesis was that most infants who grunted would have a good outcome. We found that 69% of the infants stopped grunting within 30 minutes of birth, 85% by 1 hour, and 93% by 2 hours. Although more laboratory tests were ordered for grunting infants, more grunting infants received antibiotics, and they remained in the hospital longer, only 3 were believed by their physicians to be ill enough to require transfer to the NICU. Two did well, but 1 of these infants developed persistent fetal circulation and had a prolonged NICU course.

Our study has some important limitations. First, data collection was retrospective and based on the assessments and charting accuracy of the nursing staff. Many nurses were working in the nursery, and they may have varied in their categorization or charting of grunting or other symptoms. We believe, however, that if grunting was not recorded, it would be more likely to have been

in infants in whom grunting was brief and who had a good outcome; thus, our study could have underestimated the incidence of grunting while overestimating the number of adverse outcomes. Second, adverse outcomes in this population of term and near-term infants were very infrequent; thus, our study does not have sufficient power to make reliable determinations of sensitivity, specificity, or predictive values regarding grunting and its association with serious illness.

Despite these limitations, we believe that our study can help inform decision making in a well-baby nursery when an infant is noted to exhibit grunting during transition. Careful observation of grunting infants, particularly for other evidence of respiratory problems, is warranted, but other interventions can be postponed for 1 or 2 hours to give the grunting a chance to resolve. If grunting persists, or the child’s condition deteriorates during this period, further investigations for treatable causes of grunting, eg, sepsis, should be undertaken.

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REFERENCES