

Significance of Grunting Respirations in Infants Admitted to a Well-Baby Nursery

Gentry C. Yost, MD; Paul C. Young, MD; Karen F. Buchi, MD

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%; $P = .04$). Grunters' 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.

Arch Pediatr Adolesc Med. 2001;155:372-375

GRUNTING OCCURS when a newborn exhales against a partially closed glottis. In 1956, Silverman and Andersen¹ 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 textbooks²⁻⁵ 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.

RESULTS

INCIDENCE AND DURATION OF GRUNTING RESPIRATIONS

Grunting respirations beginning at some time during the first 4 hours of life were recorded for 81 (17.4%) of the 466 newborns. The duration of grunting is shown in the **Figure**. The onset of grunting occurred during the first of the 8 time blocks for all but 3 of the infants, 1 who began grunting at the end of the second 30-minute period (about 1 hour of age) and

From the Departments of Pediatrics, University of California, Fresno (Dr Yost), and University of Utah, Salt Lake City (Drs Young and Buchi).

SUBJECTS AND METHODS

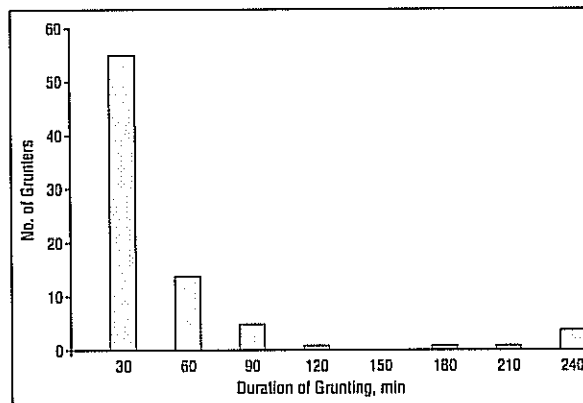
The study was conducted in the well-baby nursery of the University of Utah Health Science Center, Salt Lake City. The nursery provides initial care for all newborns with a gestational age of 34 weeks or more unless complications are anticipated. In 1999, 2723 newborns were admitted to the well-baby nursery.

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 nongrunting newborns (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 cell count, blood glucose level, or hematocrit), and the initiation of antibiotic treatment were recorded.

A χ^2 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.

2 in whom grunting was first noted at 2 hours of life. Of the 78 infants who began grunting during the first 30 minutes, 54 (69%) stopped during this first time block. Another 14 (18%) stopped during the second 30-minute pe-



Duration of grunting.

Table 1. Grunting Respirations and Maternal Characteristics

	No. (%)		<i>P</i>
	Grunters	Nongrunters	
Maternal temperature $>38^{\circ}\text{C}$	6/81 (7.4)	12/193 (6.2)	.80
PROM* >18 h	5/81 (6.2)	18/193 (9.3)	.50
Cesarean delivery	18/81 (22.2)	27/197 (13.7)	.10
Intrapartum antibiotics	27/81 (33.3)	40/196 (20.4)	.03

*PROM indicates prolonged rupture of membranes.

riod. Five infants had grunting that lasted 90 minutes. Four of these 5 had begun grunting during the 0- to 30-minute period. The fifth began grunting at 1 hour of age and continued into the sixth 30-minute interval. One infant who began grunting during the first 30 minutes of life continued for the next 120 minutes before stopping. Six infants had grunting that lasted 3 hours or more; 5 of these began in the first 30 minutes of life, while the sixth began at about 2 hours of age.

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-

	Grunters	Nongrunters	P
Mean birth weight, g	3241	3152	.20
Mean gestational age, wk	38.5	38.7	.30
Meconium present, No. (%)	21/81 (26)	37/196 (19)	.20
Nuchal cord present, No. (%)	21/81 (26)	43/192 (22)	.50
Respiratory rate >60/min,* No. (%)	15/81 (19)	23/197 (12)	.20
Bag and mask use, No. (%)	12/81 (15)	10/195 (5)	.01

*Any respiratory rate greater than 60/min recorded in first 4 hours after birth.

	Grunters	Nongrunters	P
Chest x-ray film obtained, No. (%)	11/81 (13.6)	10/196 (5.1)	.02
Complete blood cell count obtained, No. (%)	28/81 (34.6)	41/196 (20.9)	.02
Blood culture obtained, No. (%)	23/81 (28.4)	30/197 (15.2)	.02
Antibiotics given after birth, No. (%)	9/81 (11.1)	9/197 (4.6)	.04
Mean length of stay, h	72	55	.01
NICU* transfer, No. (%)	3/81 (3.7)	1/197 (0.5)	.06

*NICU indicates neonatal intensive care unit.

citation was significantly associated with grunting respirations.

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 cardiac 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 nongrunting 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 χ^2 analysis; the P value was .06. Because of the small numbers of transfers, this finding should be interpreted with caution.

SHORT-TERM VS PROLONGED GRUNTING

We compared the peripartum characteristics of the 75 short-term grunters (those whose grunting resolved within 120 minutes; in 95% it resolved within 30 minutes) with those of the 6 infants with prolonged grunting (those who continued to grunt for 3 hours or more). Prolonged grunters were more likely to have had a respiratory rate greater than 60 breaths/min during the first 4 hours after delivery (4/6 [67%] compared with 11/75 [15%]; $P<.01$) and were more likely to be transferred to the NICU (1/6 [17%] compared with 2/75 [3%]; $P<.01$). There were no differences between short- and long-term grunters with respect to birth weight, gestational age, cesarean delivery, maternal fever, prolonged rupture of membranes, administration of intrapartum antibiotics, presence of meconium or nuchal cord, or need for bag and mask resuscitation. With only 6 infants in the long-term grunting group, there is insufficient power to be confident that no differences between the 2 groups of infants would be found if the number of infants with prolonged grunting had been larger.

COMMENT

There is limited information regarding grunting respirations in the pediatric literature. To understand the physiologic significance of grunting respirations, Knelson et al⁶ 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 PaO_2 and a mean decrease in PaCO_2 . 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 colleagues⁷ 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 colleagues⁸ studied 22 infants with hyaline membrane disease. Observing PaO₂ values while the infants grunted 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.⁹⁻¹² Poole et al¹³ 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.

Accepted for publication November 17, 2000.

Presented as a poster at the Pediatric Academic Societies and American Academy of Pediatrics joint meeting, Boston, Mass, May 14, 2000.

Corresponding author and reprints: Karen F. Buchi, MD, Department of Pediatrics, University of Utah, 50 N Medical Dr, Salt Lake City, UT 84132 (e-mail: karen.buchi@hsc.utah.edu).

REFERENCES

1. Silverman WA, Andersen DH. A controlled clinical trial of effects of water mist on obstructive respiratory signs, death rate and necropsy findings among premature infants. *Pediatrics*. 1956;17:1-10.
2. Tooley W. Acute respiratory distress syndromes in the newborn: hyaline membrane disease. In: Rudolph AM, Hoffman JIE, Rudolph CD, eds. *Rudolph's Pediatrics*. 7th ed. Stamford, Conn: Appleton & Lange; 1996:1598-1605.
3. Gundy JH. The pediatric physical examination. In: Hoekelman RA, Adam HM, Nelson NM, Weltzman ML, Wilson MH, eds. *Primary Pediatric Care*. 4th ed. St Louis, Mo: Mosby-Year Book Inc; 2001:67-109.
4. Carlo WA. Assessment of pulmonary function. In: Fanaroff AA, Martin RJ, eds. *Neonatal-Perinatal Medicine: Diseases of the Fetus and Infant*. 6th ed. St Louis, Mo: Mosby-Year Book Inc; 1997:1009-1018.
5. Taeusch HW, Sniderman S. Initial examination: history and physical examination of the newborn. In: Taeusch HW, Ballard RA, eds. *Avery's Diseases of the Newborn*. 7th ed. Philadelphia, Pa: WB Saunders Co; 1998:334-353.
6. Knelson JH, Howatt WF, DeMuth GR. The physiologic significance of grunting respirations. *Pediatrics*. 1969;44:393-400.
7. Yao AC, Lind J, Vuorenkoski MA. Expiratory grunting in the late clamped normal neonate. *Pediatrics*. 1971;48:865-870.
8. Harrison VC, Heese HV, Klein M. The significance of grunting in hyaline membrane disease. *Pediatrics*. 1968;41:549-559.
9. Morley CJ, Thornton AJ, Cole TJ, Fowler MA, Hewson PH. Symptoms and signs in infants younger than 6 months of age correlated with the severity of their illness. *Pediatrics*. 1991;88:1119-1124.
10. Hawson PH, Humphries SM, Robertson DM, McNamara JM, Robinson MJ. Markers of serious illness in infants under 6 months old presenting to a children's hospital. *AJDC*. 1990;65:750-756.
11. Spooner V, Barker J, Tullock S, et al. Clinical signs and risk factors associated with pneumonia in children admitted to Goroka Hospital, Papua New Guinea. *J Trop Pediatr*. 1989;35:295-300.
12. Banya WAS, O'Dampsey TJD, McArdle T, Lloyd-Evans N, Greenwood BM. Predictors for a positive blood culture in African children with pneumonia. *Pediatr Infect Dis J*. 1996;15:292-297.
13. Poole SR, Chethan M, Anderson M. Grunting respirations in infants and children. *Pediatr Emerg Care*. 1995;11:158-161.