

**TITLE:** EVALUATION OF ANESTHETIC RISKS IN PREMATURE INFANTS

**AUTHORS:** Leila G. Welborn, M.D., Nina Ramirez, M.D., Tae Hee Oh, M.D., Urs E. Ruttimann, Ph.D., Thomas Murphy, M.D., Robert Fink, M.D., Phillip Guzzetta, M.D. and Burton S. Epstein, M.D.

**AFFILIATION:** Departments of Anesthesiology, Pulmonary Medicine, Surgery and Child Health and Development, Children's Hospital National Medical Center and the George Washington University School of Medicine, Washington, D.C. 20010.

Premature infants often present respiratory and cardiovascular complications in the perioperative period. Development of objective criteria may help to identify risk factors in the high risk premature infants. We designed a prospective study to: 1. Evaluate apnea, periodic breathing (P.B.), and bradycardia in infants undergoing general anesthesia (G.A.) in the first year of life; 2. Analyze the postoperative responses on these infants.

**Method:** Infants <12 months postnatal age undergoing G.A. for minor surgery were studied. They were divided into two groups: Group I; premature infants (birth weight <2500 gm, gestational age < 37 wks,) and Group II; full term (gestational age >37 wks). Infants with cardiac, neurologic, endocrine or metabolic diseases were excluded. To quantitate the risk of each infant preoperatively, an evaluation chart (Table 1) was used. Any patient who scored 9 or higher was hospitalized and monitored for at least 12 hours prior to surgery. During this time, the patients' heart and respiratory rates were recorded using a pneumogram with a magnetic tape recorder. The recorded data were analyzed for evidence of apnea, P.B. and bradycardia by participating pulmonologists; however, the results were not made available to the anesthesiologist before anesthesia. Patients who scored <9 had surgery performed as outpatients and their pneumograms were recorded only postoperatively. Definitions:

Apnea: Respiratory pause of 3-5 seconds or longer.  
Prolonged Life Threatening Apnea: Respiratory pause of 15 seconds or longer.

Bradycardia: Heart rate slower than:  
100 bpm-for neonates 0-1 month of age for at least 5 secs.  
90 bpm-for infants 1-3 months of age for at least 5 secs.  
80 bpm-for infants 3 months or older for at least 5 secs.

Periodic breathing: Three or more periods of apnea 3-15 secs. separated by < 20 secs of normal respiration. All periods of periodic breathing that met that definition were added together and reported as a percentage of the hours that the pneumogram was recording.

After preoperative assessment, general endotracheal anesthesia was administered using a variety of techniques. Heart sounds, electrocardiogram, heart rate, temperature and respiration were monitored. At the completion of surgery the trachea was extubated in the operating room after the patient was fully awake. On admission to the recovery room the pattern of respiration and heart rate were monitored and recorded; 12 hours for in-patients, and at least 4 hours for out-patients until they met discharge criteria.

**Results:** Forty patients (Group I; 21, Group II; 19) were studied. (Table 2). No patients developed either life threatening apnea or bradycardia in the two groups, even if a history of apnea was present preoperatively. All 8 patients who showed P.B. clinically were in Group I, had a preoperative score >9, and a conceptual age < 44 wks. Two of these patients showed P.B. 4-5 hrs. postoperatively. Despite the absence of a history of preoperative apnea, 4 patients showed P.B. >0.5% on the postoperative tape (Table 3). No patients required prolonged intubation or postoperative mechanical ventilation. There were no

episodes of P.B. in Group II or in those patients in Group I selected for outpatient surgery.

**Conclusion:** None of the patients studied showed apnea or P.B. with bradycardia in the pre- or post-operative period and none required prolonged intubation or artificial ventilation. P.B. without bradycardia however, was found in 8 patients in the postoperative period. In 4 no history of apnea occurred preoperatively, yet the frequency of P.B. detected and the fact that it occurred 4-5 hrs. post-operatively was disturbing. It is likely that with larger percentages of P.B., hypoxemia and bradycardia would occur. As predicted, P.B. was more frequent the more immature the baby. In infants <44 weeks conceptual age, our scoring system has helped identify high risk infants. None of the patients that were selected as outpatients developed P.B. postoperatively. Further studies are planned to validate the scoring system.

Table 1: PREOPERATIVE EVALUATION OF RISK

I. Postnatal age and body weight		Points	
1) age (week)	<4	6	
	4-15	3	
	>15	0	
2) Weight (kg)	<1.8	6	
	1.8 - 2.5	3	
	>2.5	0	
II. Present or Past History of Perinatal Disease			
1) Apneic spells	9	6) Pneumonia	1
2) SIDS among		7) URI	1
siblings	9	8) Anemia (Hct < 30)	1
3) RDS	9	9) Gavage feeding	1
4) BPD	9	10) Seizure	1
5) Sepsis	1	11) Urgent or emergency surgery with any of the above	9

Table 2: PERIOPERATIVE DATA OF STUDY PATIENTS. (n = 40)

	Group I	Group II
Anesthetic Administered (n)	21	19
Mean gestational age (wks)	32	39
Mean conceptual age (wks)	47	52
History of Apnea	11 (52%)	0
Preoperative Score > 9	17 (81%)	0
Periodic Breathing postoperatively	8 (38%)	0

Table 3: INCIDENCE OF POSTOPERATIVE PERIODIC BREATHING ON THE PNEUMOGRAM

	Periodic Breathing 0.5% - 1.6%	Periodic Breathing 0% - 0.1%
Premature infants* < 44 weeks conceptual age	4	8
Premature infants > 44 weeks conceptual age	0	9

\*Woolf G-test: p = 0.05