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## Preoperative Fasting Practices in Pediatrics

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**Background:** The purpose of this study was to determine current practice patterns for preoperative fasting at major pediatric hospitals.

**Methods:** Fasting guidelines for children at each of the hospitals listed in the second edition of the *Directory of Pediatric Anesthesiology Fellowship Programs* were solicited and analyzed.

**Results:** Fifty-one institutions were surveyed, and 44 responded. In 50%, clear fluids were permitted up to 2 h prior to anesthesia for all children. Breast milk was restricted to 4 h for children younger than 6 months in 61% of hospitals. Institutions were equally divided (39% each) between a 4-h and a 6-h fast for formula in infants younger than 6 months; for infants older than 6 months, 50% of hospitals restricted formula feeding to 6 h. There was no consensus for solid feeding in children younger than 3 yr, but 50% of hospitals agree that solids should be restricted after midnight in children older than 3 yr.

**Conclusions:** There is no uniform fasting practice for children before elective surgery in the United States and Canada. However, there is agreement among most institutions that ingestion of clear fluids 2-3 h prior to general anesthesia is acceptable. Most also accept a 4-h restriction for breast milk and a 6-h restriction for nonhuman formula. There is great diversity among institutions regarding fasting for solids in children, with many restricting intake after midnight. There is little agreement

about whether infant formula should be treated in the same way as solid food or how to categorize breast milk. (Key words: Breast milk; clear fluids; fasting; infant formula; solid food.)

THE American Society of Anesthesiologists (ASA) promulgates practice parameters including standards, guidelines, and other strategies, which are based on review of the relevant scientific literature. In the absence of adequate published information, guidelines are designed to represent a consensus of knowledgeable experts and consultants. Practice parameters for preoperative fasting were proposed by a task force assembled by the ASA.¶ The guidelines that resulted were sent back to the committee for further review in part as a result of concerns that they failed to represent the wide variations in fasting recommendations already in use. This investigation therefore was designed to determine preoperative fasting practices in major pediatric medical centers in the United States and Canada.

### Materials and Methods

One pediatric anesthesiologist from each of the hospitals listed in the second edition of the *Directory of Pediatric Anesthesiology Fellowship Programs* was asked to provide the current guidelines for preoperative fasting at his or her institution.|| This sample was selected specifically to evaluate practices at a geographically diverse group of institutions with a large volume of pediatric patients undergoing anesthesia. In addition to the programs listed, four institutions with fellowship programs that responded too late to be included in the directory were also queried.

To simplify the response process, maximize cooperation among respondents, and eliminate errors in transcription, the individual contacted was asked to send by facsimile transmission a copy of their institutional NPO guidelines to the authors. The anesthesiologists who did not respond to the initial request letter were contacted once by telephone. If a response was still not obtained, a different person at the same institution was contacted. Information from all institutions was compiled and entered into a computerized program by a single individual. Fasting practices for breast milk and infant formula were also evaluated to determine

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§ House of Delegates Manual, Park Ridge, IL, American Society of Anesthesiology 1997.

|| Directory of Pediatric Anesthesia Fellowship Programs, 2nd edition. Richmond, VA, Society for Pediatric Anesthesia, 1996-1997.



## PREOPERATIVE FASTING IN PEDIATRICS

Table 1. NPO Guidelines from Individual Institutions

Fasting Period	Clear Liquids				Breast Milk				Formula				Solids					
	<6 mo	%	≥6 mo	%	<6 mo	%	≥6 mo	%	<6 mo	%	≥6 mo	%	<6 mo	%	6-36 mo	%	>36 mo	%
2 h	28	64	21	48	5	11	3	7	1	4			1	2				
3 h	11	25	15	34	5	11	4	9										
4 h	5	11	8	18	27	61	19	43	11	39	3	11	15	34	1	2		
6 h					5	11	12	27	11	39	14	50	7	16	17	39	10	23
7-8 h					1	2	3	7	3	11	4	14	7	16	6	14	12	27
Midnight					1	2	3	7	2	7	7	25	14	32	20	45	22	50
Total practices	44	100	44	100	44	100	44	100	28	100	28	100	44	100	44	100	44	100

whether these foods were treated as clear liquids, solids, or something in between.

## Results

Fifty-one programs were surveyed, 47 in the United States and 4 in Canada. Forty-four institutions (86%) responded. Ingestion of clear fluids by children younger than 6 months was permitted up to 2 h prior to the induction of anesthesia in 64% of institutions. Ingestion of clear liquids by children 6 months or older was permitted up to 2 h before anesthesia in 48% of institutions (table 1). Only one institution restricted the volume of ingested fluid to 8 ounces; all other institutions permitted ad libitum ingestion of clear fluids. The guidelines at some institutions indicated specific fluids that were acceptable, whereas at other institutions no description was provided (table 2). Ingestion of breast milk was restricted to 4 h before anesthesia for all age groups in most institutions. Breast milk was restricted by the same criteria as clear fluids in 23%, as formula in 7%, and as solid food in 34% of institutions (table 2). Institutions were equally divided between a 4-h and 6-h fast for formula (39% for each) in children younger than 6 months; a 6-h fast for formula was appropriate for children older than 6 months in 50% of institutions. Formula was considered equivalent to a solid in 43% of institutions (table 2). Respondents were divided between a 6-h fast for solid food and fasting after midnight in the 6- to 36-month-old patient population; one half of all institutions agree that solids should be restricted after midnight in children older than 3 yr (table 1).

There is less agreement about breast milk feeding. Some institutions (36%) consider the composition of breast milk to be equivalent to that of a clear fluid, others (34%) equivalent to a solid, and the remaining institutions consider it "something else." This is likely due to the paucity of data examining absorption of breast milk in healthy infants. Most institutions (77%) consider at least a 4-h fast for breast

milk to be sufficient; only 23% allowed breast milk to be ingested less than 4 h before induction. There has been little investigation of gastric emptying after formula feeding in patients having surgery.<sup>1</sup> Forty-three percent of institutions consider formula to be similar in composition to a solid food, 36% do not specify a category for formula, and 20% consider it to be neither a clear fluid or a solid. In children younger than 6 months, an equal number (39% each) of institutions permit formula 4-6 h before anesthesia, and only one institution restricted formula to less than 4 h before anesthesia. There is very little agreement regarding the timing of solid food feedings. Institutions are almost equally divided between a 4-h restriction (34%) and a restriction after midnight (32%) for solids in children younger than 6 months, suggesting that there is no clear information regarding gastric emptying time beyond the 4-h mark. In children between 6 months and 3 yr, there is almost equal division between a 6-h fast and a fast after midnight.

## Discussion

The ASA recommends practice guidelines based on current literature, expert opinions and clinical practice data. Preoperative fasting guidelines recently proposed by a ASA task force were referred back to committee for

Table 2. Liquid Feedings

How is breast milk treated?	Description of "clear fluids"
As a clear liquid: 23%	Water
Between a clear liquid and formula: 36%	Glucose water
As a formula: 7%	Pedialyte
As a solid: 34%	Apple juice
How is formula treated?*	Plain Jello
As a solid: 43%	Nonpulp popsicles
Between a clear liquid and solid: 20%	White grape juice
Not specified: 36%	Tea without milk
	Black coffee
	Hawaiian Punch
	Gator Aid
	Kool Aid

\* Total is 99% due to rounding.



further refinement. This shows not only the current controversy surrounding this subject but also the absence of uniformity regarding fasting practices.

In a 1990 editorial, Charles Coté called for further investigation of the "sacred caveat of preoperative fasting," which marked the beginning of a reappraisal of fasting guidelines for children during the perioperative period.<sup>2</sup> Some children fast for more than 18 h before anesthesia because of parental reluctance to awaken children during sleep to offer clear fluids.<sup>3</sup> Besides possibly decreasing patient irritability and increasing parent satisfaction, the incidence of severe hypotension during anesthetic induction secondary to hypovolemia in fasting children and hypoglycemia may be reduced with liberalization of preoperative fluid intake.<sup>4</sup> Fear of pulmonary aspiration of gastric contents also leads to failure to liberalize NPO guidelines, although perioperative aspiration is infrequent in children.<sup>5</sup> The incidence of anesthesia-related pulmonary aspiration in a university-affiliated pediatric hospital has been shown to be 0.01%.<sup>6</sup> A fast of 2 h for clear fluids does not increase either gastric acidity or volume, which might predispose children to and increase the incidence of pulmonary aspiration.<sup>7-10</sup> In our evaluation of current practices, we found that the majority of pediatric anesthesiologists agree with this.

In conclusion, this study shows the variation in fasting patterns and the difficulty in developing practice guidelines. It is far easier to simplify guidelines by making all patients NPO after midnight. This is not the optimal or safest practice for pediatric anesthesia, nor is it the accepted practice of the majority of clinicians. The question posed to the pediatric anesthesia community is "Can reasonable guidelines be developed that could be agreed on by the majority of practitioners?" Our results indicate that a "2-4-6-8 rule" represents the majority of institutions that provide anesthesia for children in North America. This restricts clear fluids for 2 h, breast milk for 4 h, formula for 6 h, and solid food for 8 h before induction of anesthesia. In elective surgical procedures, acceptance of this as a guideline deserves further discussion by the anesthesia community and would serve to simplify the current confusing and arbitrary policies that exist in different institutions.

## Appendix

### Participating Institutions

Alberta Children's Hospital (Calgary, Alberta); Arkansas Children's Hospital (Little Rock, AR); Babies and Children's Hospital (New York, NY); British Columbia's Children Hospital (Vancouver, British Columbia); Chil-

dren's Hospital, Boston (Boston, MA); Children's Hospital of Buffalo (Buffalo, NY); Children's Hospital, Denver (Denver, CO); Children's Hospital, Los Angeles (Los Angeles, CA); Children's Hospital of Philadelphia (Philadelphia, PA); Children's Hospital of Pittsburgh (Pittsburgh, PA); Children's Hospital and Medical Center (Seattle, WA); Children's Hospital Medical Center (Cincinnati, OH); Children's Medical Center (Augusta, GA); Children's Memorial Hospital (Chicago, IL); Children's National Medical Center (Washington, DC); Columbus Children's Hospital (Columbus, OH); Cook Children's Medical Center (Fort Worth, TX); C.S. Mott Children's Hospital (Ann Arbor, MI); Duke University Medical Center (Durham, NC); Dupont Hospital for Children (Wilmington, DE); Hasbro Children's Hospital (Providence, RI); Hermann Hospital (Houston, TX); Hospital for Sick Children Hospital (Toronto, Canada); Johns Hopkins Hospital (Baltimore, MD); Kosair Children's Hospital (Louisville, KY); LeBonheur Children's Medical Center (Memphis, TN); Loma Linda University Children's Hospital (Loma Linda, CA); Lucile Packard Children's Hospital at Stanford (Stanford, CA); Massachusetts General Hospital (Boston, MA); Nemours Children's Clinic (Jacksonville, FL); New England Medical Center (Boston, MA); Riley Hospital for Children (Indianapolis, IN); St. Christopher's Hospital for Children (Philadelphia, PA); St. Louis Children's Hospital (St. Louis, MO); St. Mary's Hospital (Rochester, MN); Strong Memorial Hospital (Rochester, NY); SUNY at Brooklyn Health Sciences Center (New York, NY); Texas Children's Hospital (Houston, TX); UCSF Medical Center (San Francisco, CA); University of Missouri (Columbia, MO); University of Illinois College of Medicine (Chicago, IL); University of Maryland Medical Center (Baltimore, MD); Vanderbilt Children's Hospital (Nashville, TN); Yale-New Haven Children's Hospital (New Haven, CT)

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