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Pediatric NPO guidelines

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AN OVERVIEW

- Why develop fasting guidelines?
- What are the current ASA guidelines?
- What studies support these?
- What are the study limitations?
- Postoperative recommendations?

FASTING GUIDELINES TO BALANCE GOALS

- Minimize pulmonary aspiration risk
- Maximize patient/parent satisfaction
- Improve hemodynamic conditions
- Facilitate vascular access
- Maintain plasma glucose levels

PERIOPERATIVE PULMONARY ASPIRATION OF GASTRIC CONTENTS IS A RARE EVENT...

- Overall pediatric incidence: 1-10:10,000



- Olsson GL. Acta Anaesth Scand 1986;30:84
- Tired L. Br J Anaesth 1988;61:263
- Borland LM. J Clinical Anesth 1998;10:95
- Warner MA. Anesthesiology 1999;90:66

... and therefore difficult to study.

- Assuming a 1:3,000 aspiration incidence, a study that compares fasting protocols by measuring differences in actual aspiration case numbers would require a sample size of > 30,000 to achieve significance.

Cook-Sather SD. Anesth Analg 2003;96:965

FACTORS THAT INCREASE ASPIRATION RISK

- Emergency status
- Depressed consciousness level
- Severe gastroesophageal reflux disease
- Ileus/bowel obstruction

- Hemoperitoneum
- Recent meal
- Sepsis/shock

Warner MA. *Anesthesiology* 1999;90:66

PERIOPERATIVE PULMONARY ASPIRATION

- If no signs or symptoms develop within 2 h of aspiration/ anesthesia end, the child is unlikely to have respiratory sequelae
- 5 of the 9 children developing symptoms within 2 h required respiratory support
- No mortality in this series of 24 cases in 63180 general anesthetics at Mayo Clinic

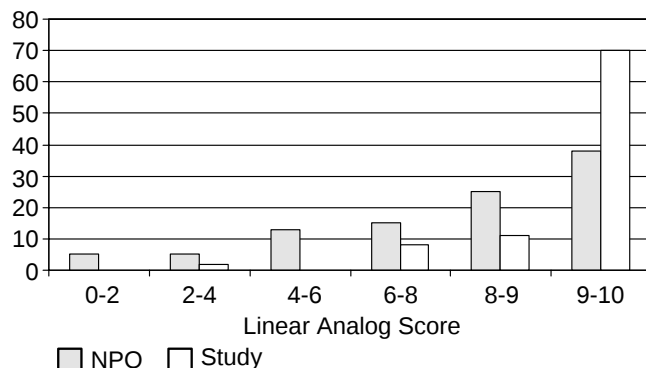
Warner MA. *Anesthesiology* 1999;90:66

FASTING AND PREOPERATIVE BEHAVIOR

	Clear liquid n = 53	NPO n = 68	P-value
Ease of compliance with instructions	9 ± 1.2	7.5 ± 2.5	< 0.001
Child irritability	8.7 ± 1.7	6.6 ± 3	< 0.001
Overall experience	8.6 ± 1.8	7.4 ± 2.6	< 0.01

Schreiner MS. *Anesthesiology* 1990;72:593

SATISFACTION: NPO VERSUS CLEAR LIQUIDS



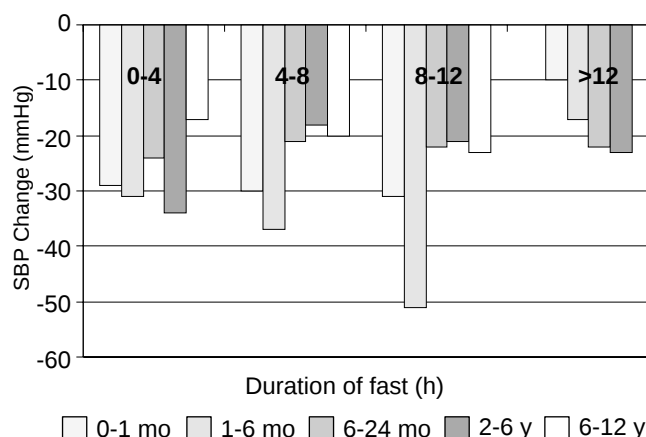
Schreiner MS. *Anesthesiology* 1990;72:593

IMPROVED SATISFACTION...

	Group T	Group L
Infant		
Irritability	2.4 ± 2.8	1.8 ± 2.3
Hunger	3.9 ± 3.4	3.4 ± 3.1
Parent		
Satisfaction	2.3 ± 2.6	1.3 ± 1.8

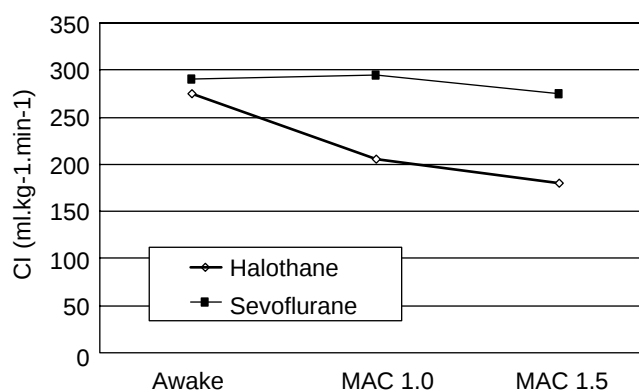
Cook-Sather SD. *Anesth Analg* 2003;96:965

PREOPERATIVE FAST DURATION AND BLOOD PRESSURE RESPONSE TO HALOTHANE IN INFANTS



Friesen RH. *Anesth Analg* 2002;95:1572

CARDIAC INDEX IN INFANTS: SEVOFLURANE VERSUS HALOTHANE



Wodey E. *Anesthesiology* 1997;87:795

MAINTENANCE OF PLASMA GLUCOSE LEVELS

- Prolonged fasts may result in hypoglycemia
- Thomas DKM. *Br J Anaesth* 1974;46:66
- Bush GH. *Paed Anaesth* 1996;6:415
- Clear liquids at shorter fasting intervals help maintain plasma glucose levels
- Maekawa N. *Acta Anaesth Scand* 1993;38:783
- Wellborn LG. *Paed Anaesth* 1993;3:167



GASTRIC FLUID VOLUME DETERMINANTS

- Salivary secretions 1 ml/kg/h
- Gastric secretions 0.6 ml/kg/h
- Ingested volume and time
- Characteristics of contents
 - solid versus liquid
 - protein > carbohydrates > lipids
- Motility changes
 - Trauma, ileus, bowel obstruction, sepsis, reflux
 - Medication related

Splinter WM. *Anesth Analg* 1999;89:80

QuickTime™ and a Photo - JPEG decompressor are needed to see this picture

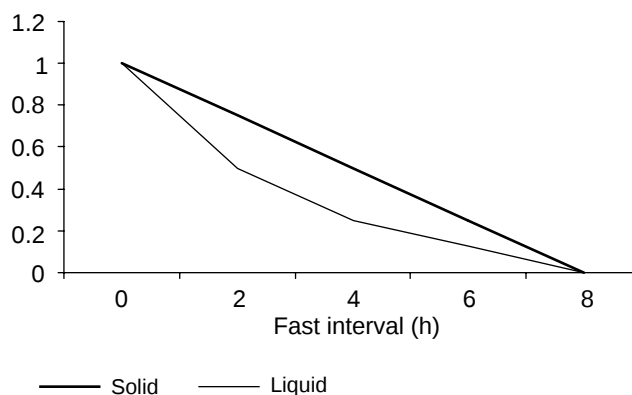
ASA FASTING RECOMMENDATIONS

Ingested material	Minimum fast (hr)
Clear liquids	2
Breast milk	4
Infant formula	6
Non-human milk	6
Light meal	6
Other meal	> 8

Warner MA. *Anesthesiology* 1999;90:896

Splinter WM. *Anesth Analg* 1999;89:80

GASTRIC VOLUME VERSUS TIME



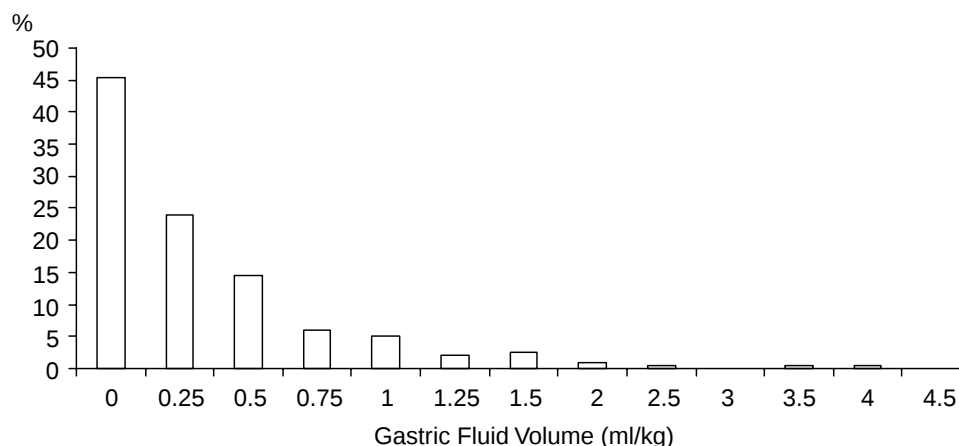
GASTRIC FLUID VOLUME

- Surrogate end point for aspiration risk(s)
 - Gastric fluid must be regurgitated and cause damage
 - No absolute volume indicative of risk
 - pH and particulates also at issue
 - Retrograde passage of intestinal contents
- Methodology for determination
 - Blind aspiration
 - Marker dilution
 - Ultrasonography
 - Endoscopy
- Patient population considerations
 - Healthy subjects and non-normal distribution
 - Concurrent disorders and illnesses



CLEAR FLUID INGESTION BY CHILDREN

Reference	n	Fluid (ml/kg)	Fast (h)	GFV (ml/kg)
Splinter 1989	80	3	3	0.24 ± 0.31
Sandhar 1989	88	5	2-3	0.25
Splinter 1990	93	6, 10	3	0.66 ± 0.79, 0.71 ± 0.77
Splinter 1990	121	Unlimited	3	0.34 ± 0.28
Splinter & Schaefer 1990	228	Unlimited	2, 2.5, 3	0.33 ± 0.49
Schreiner 1990	121	Unlimited	2	0.44 ± 0.51

GASTRIC FLUID VOLUME FREQUENCY DISTRIBUTION IN FASTED HEALTHY CHILDRENCook-Sather SD. *Can J Anaesth* 1997;44:168**GASTRIC VOLUME AND PH IN INFANTS FED CLEAR LIQUIDS AND BREAST MILK PRIOR TO SURGERY**

	Clear liquids n = 46	Breast milk n = 24	P value
Volume (mL/kg)			
Mean	0.3 ± 0.9	0.7 ± 1.1	NS
0	36 (78%)	16 (67%)	NS
> 0.4	8 (17%)	8 (33%)	NS
≥ 1	3 (7%)	7 (29%)	0.03
pH			
Mean	2.1 ± 1.4	2.6 ± 1	NS
≤ 2.5	9/10 (90%)	4/8 (50%)	NS

Litman RS. *Anesth Analg* 1994;79:482**RECOMMENDATIONS FOR INFANTS < 1 YEAR OF AGE: CLEARS AND BREAST MILK**

- 2 h for clear liquids
- ≥ 3 h for breast milk

Litman RS. *Anesth Analg* 1994;79:482**GASTRIC EMPTYING IN INFANTS AT 2 H**

Meal	% emptied
Human milk	82 ± 11
Whey-hydrosylated formula	84 ± 21
Whey-predominant formula	74 ± 19
Casein-predominant formula	61 ± 17
Cow's milk	45 ± 19

Billeaud C. *Eur J Clin Nutr* 1990;44:577**MEASUREMENT OF GASTRIC EMPTYING OF BREAST MILK BY ULTRASOUND**

	GET (h) Mean	SD	Range
Glucose	1.53	0.25	1.00-1.75
Low-fat milk (3%)	2.32	0.31	1.75-2.75
Breast milk	2.43	0.27	2.00-2.75

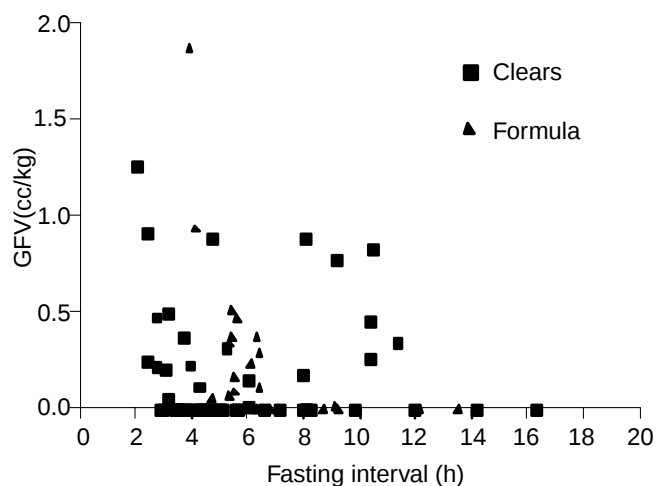
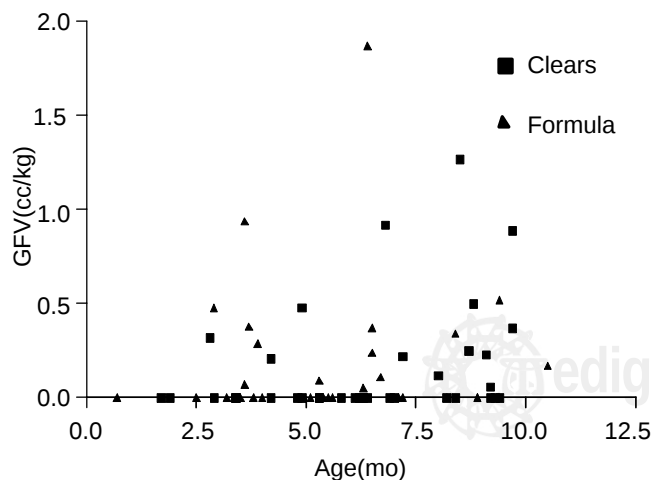
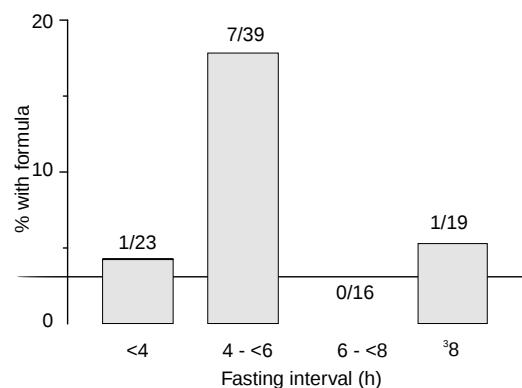
Sethi AK. *Anaesthesia* 1999;54:51**NPO CONTROVERSY AT PEDIATRIC CENTERS**

Fast (h)	Breast milk (%)		Formula (%)	
	< 6 mo	≥ 6 mo	< 6 mo	≥ 6 mo
2	11	7	4	
3	11	9		
4	61	43	39	11
6	11	27	39	50
7-8	2	7	11	14
MN	2	7	7	25

Ferrari LR. *Anesthesiology* 1999;90:978

LIBERALIZED FORMULA FAST FOR INFANTS

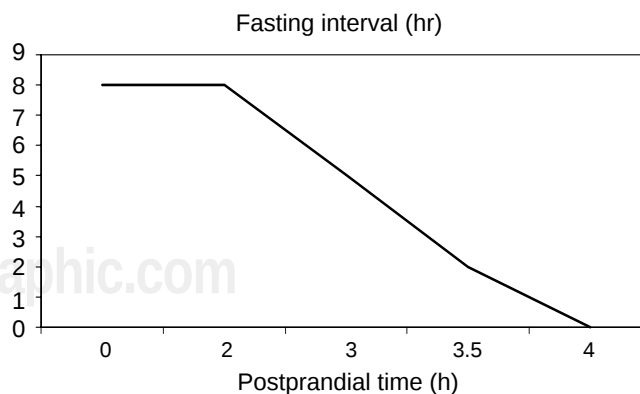
	Group T	Group L
GFV (ml/kg)	0.16 ± 0.30	0.19 ± 0.38
pH	2.9 ± 1.3	2.5 ± 0.5

Cook-Sather SD. *Anesth Analg* 2003;96:965**INFANT GASTRIC FLUID VOLUME
VERSUS FASTING INTERVAL**Cook-Sather SD. *Anesth Analg* 2003;96:965**GASTRIC FLUID VOLUME AND INFANT AGE**Cook-Sather SD. *Anesth Analg* 2003;96:965**RESIDUAL FORMULA IN GASTRIC FLUID**Cook-Sather SD. *Anesth Analg* 2003;96:965**HEALTHY INFANT FORMULA FASTING**

- Minimum of 4 h if ≤ 6 months old
- Minimum of 6 h if > 6 months old
- No additives such as milk or rice cereal
- If significant medical problems such as severe GERD, 8 hr may be appropriate

Cook-Sather SD. *Anesth Analg* 2003;96:965**SOLIDS**

- Particulate matter cleared slowly
 - Meakin G. *Br J Anaesth* 1987;59:678
- Light "theatre" breakfast
 - Soreide E. *Acta Scand Anaesth* 1996;40:549
 - Fasting S. *Acta Scand Anaesth* 1998;42:1188

LIGHT HOSPITAL BREAKFASTSoreide E. *Acta Anaesth Scand* 1996;40:549

GUM

- Adult studies suggest minimal to no change in GFV
 - Dubin SA. *Can J Anaesth* 1994;41:603
 - Soreide E. *Anesth Analg* 1995;80:985
- No pediatric studies, but gum chewing may be an indication of other fasting protocol violations...

GFV AND DISEASE STATES

- Pyloric stenosis: average 10 fold GFV increase despite NGT
 - Cook-Sather SD. *Can J Anaesth* 1997;44:278
- Trauma: GFV increases with severity of injury
 - Olsson GL. *Acta Anaesth Scand* 1982;26:417
 - Schurizek BA. *Acta Anaesth Scand* 1986;30:404
- Children with gastrointestinal symptoms for upper endoscopy: 6 (<6 mo)-8 h fast sufficient
 - Schwartz DA. *Anesth Analg* 1998;87:757
- Obesity: no increase in GFV
 - Harter RL. *Anesth Analg* 1998;86:147



SHOULD CHILDREN DRINK BEFORE DISCHARGE FROM AMBULATORY SURGERY?

	Mandatory drinkers	Elective drinkers	p-value
Drank in DSU, n (%)	442 (95)	441 (78)	
Duration ± SD (min)			
PACU	70 ± 24	68 ± 20	0.11
DSU	101 ± 58	84 ± 40	< 0.001
Vomiting (%)			
PACU	6	6	0.99
DSU	23	14	< 0.001
Home	27	26	0.72
Total	39	32	0.04

Schreiner MS. *Anesthesiology* 1992;76:528

PONV AND THE GASTROINTESTINAL SYSTEM

- Perioperative gastric emptying not a predictor of early PONV
 - Wattwil M. *Anesth Analg* 2002;95:476
- Prokinetics such as Cisapride may worsen PONV
 - Cook-Sather SD. *Anesth Analg* 2002;94:50



“While it is desirable that there should be no solid matter in the stomach when chloroform is administered, it will be found very salutatory to give a cup of tea or beef-tea about 2 hours previously.”

Lord Lister, 1889