The Slippery Slope of Fasting Guidelines

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SickKids

Anesthesia
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Disclosures

- None

In Ontario…

Objectives

- Pediatric Anesthesia Consensus Statement
- Background
- Rationale
- Defining the problem
- Suggestions?

A poll…

- Who believes the current fasting guidelines should be changed?
- Clear fluids?
- Solids?

Consensus statement on clear fluids fasting for elective pediatric general anesthesia

Mark Thomas[1] | Christa Morrison[1] | Richard Newton[2] | Ehrenfried Schindler[3]

Pediatric Anesthesia. 2018;28:411–414.

- 1-hour fast for clear fluids recommended, 3mL/kg
- No difference in gastric emptying time vs. 2 hours, no increased aspiration
- Improved patient comfort (less N&V, thirst, hunger, anxiety), compliance
- Avoid prolonged fasting while minimizing aspiration risk

APA

ESPA
European Society for Paediatric Anaesthesiology

ADARPEF

Why fast?

Fasting from midnight e the history behind the dogma

J Roger Maltby* MB, FRCA, FRCPC

Best Practice & Research Clinical Anaesthesiology
Vol. 20, No. 3, pp. 363e 378, 2006

Table 1. Fasting guidelines 1846—1984.

Year	Author	Clear liquid	Food
1847	Robinson[1]	No guideline	No guideline
1847	Snow[2]	No guideline	2—4 hr light meal
1858	Snow[3]	No guideline	2—3 hr light meal; c.5 hr full meal
1881	Lyman[6]	4 hr	4 hr light meal
1883	Lister[5]	2 hr	'No solids in stomach'
1901	Hewitt[7]	Avoid milk	4 hr meal
1914	Gwathmey[8]	3 hr	2—3 hr gruel of barley or rice
1920	Buxton[9]	3 hr tea, beef-tea	7 hr tea, bread boiled in milk, fish
1943	Woodbridge[10]	4 hr grape juice	4 hr cream of wheat, milk
1947	Macintosh and Bannister[11]	3 hr sweet tea, soup	3 hr bread and butter
1947	Lee[12]	No guideline	6 hr
1948	Minnitt and Gillies[13]	3 hr tea, orange juice	3 hr sweetened tea with biscuit
1949	Hunt[14]	2—3 hr	NPO midnight
1951	Guedel[15]	No guideline	No guideline
1955	Eliason et al[16]	4 hr	p.m. surgery: breakfast
1964	Lee and Atkinson[17]	NPO midnight or 6 hr	NPO midnight or 6 hr
1970	Cohen and Dillon[18]	NPO midnight	NPO midnight
1971	Wylie[19]	5 hr	5 hr
1976	Canadian Anaesthetists' Society[20]	5 hr	5 hr
1976	Collins[21]	NPO midnight	p.m. surgery: breakfast
1982	Dripps et al[22]	NPO midnight	NPO midnight

Background

- 1848 – first casualty from aspiration pneumonia recorded
- 1946 – Mendelson syndrome described
- 1974 – "high risk" aspiration if RGV > 25 mL (0.4 mL/kg) and pH < 2.5 (Rhesus monkeys, *Roberts and Shirley*) → dogma of NPO after midnight promoted until 1990s
  - Clear, easy instructions; prevented delays if cancellations
  - No concern for patient comfort/physiology
- Evidence later refuted above assumptions

Pulmonary aspiration

- Aspiration most common cause of anesthetic death in adults
- Pediatrics – higher risk (9.3/10 000), no mortality reported (APRICOT study)
  - smaller stomach, increased gastric pressure, extensive diaphragm breathing, swallowing of air during crying
- Other risk factors: high ASA grade, emergency surgery, gastroesophageal reflux, dysphagia symptoms, gastrointestinal motility disorders, neuromuscular disorders, obesity and diabetes mellitus

Aspiration

- Most often during induction with cough/gag during airway manipulation
- Confirmed with particulate matter/bilious matter in tracheobronchial tree or CXR
- 1:373 emergency, 1:4544 elective
- Majority <3 years old who aspirated had ileus or bowel obstruction

Modern fasting guidelines in children

Scott D. Cook-Sather* MD Ronald S. Litman DO

Best Practice & Research Clinical Anaesthesiology
Vol. 20, No. 3, pp. 471e481, 2006

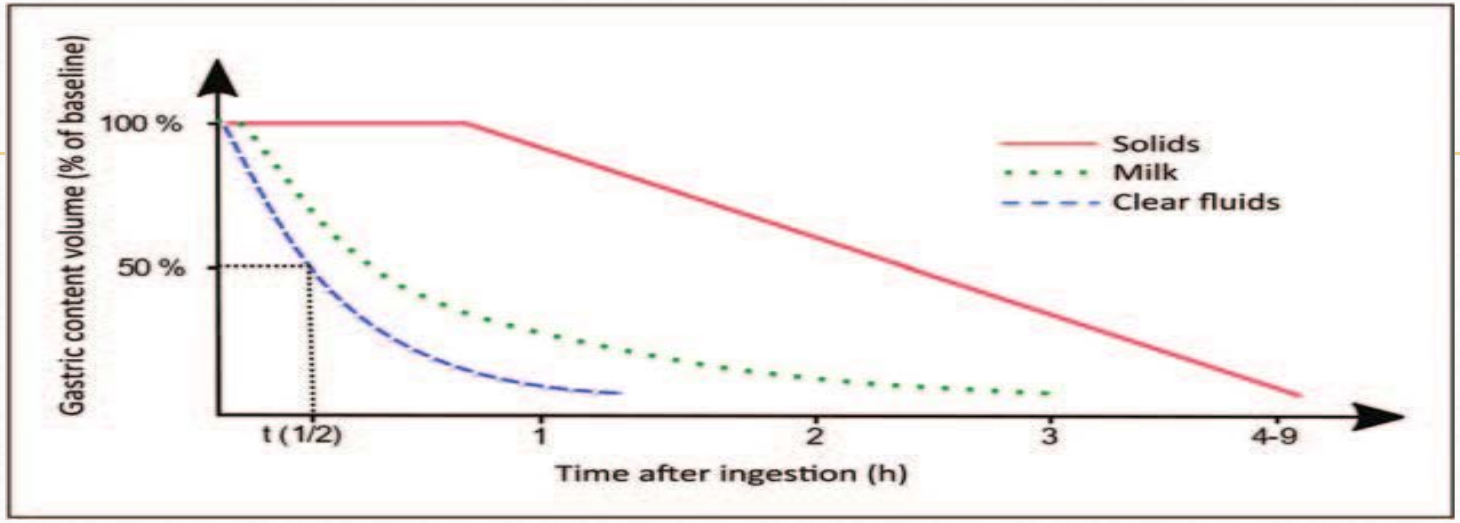
Physiology of gastric emptying

- Liquids – first order kinetics (exponential)
- Solids – lag phase (up to 60 min) followed by zero order kinetics (constant)
- Milk – separates into liquid and solid components
- Lipids empty particularly slowly
- Quality, quantity, timing, patient factors → GFV
- No differences found in gastric emptying time based on age

Preoperative fasting guidelines in pediatric anesthesia: are we ready for a change?

Hanna Andersson[a], *Achim Schmitz*[b], *and Peter Frykholm*[a]

Curr Opin Anesthesiol 2018, 31:000–000



Other factors…

• Pain/fear/stress • Medications – opioids, anesthetics	• Inadequate anaesthesia • Inappropriate use of supraglottic airways • Poor preoperative evaluation

Current ASA/CAS guidelines (1999)

- 2 hours – clear fluids
- 4 hours – breast milk
- 6 hours – formula/non-human milk/light meal
- 8 hours – solids/fatty meal

Evidence

- GFV used as surrogate for aspiration risk (patient undergoing emergency surgery have much higher risk of aspiration) – imperfect

- Baseline – saliva 1 mL/kg/h, gastric secretions 0.6 mL/kg/h
- Ingestion induces production of gastric juices

Clear fluids

- No difference in pH and gastric volumes for children permitted clear fluids up until 2 hours pre-op
- Children permitted fluids were less thirsty and hungry, better behaved and more comfortable than those who fasted
- Volume of fluid no impact

Preoperative fasting for preventing perioperative complications in children (Review)

Brady MC, Kinn S, Ness V, O'Rourke K, Randhawa N, Stuart P

Cochrane Database of Systematic Reviews 2009, Issue 4. Art. No.: CD005285.

Breast Milk

- Emptied faster than casein-predominant formula
- High lipid content
- Mean gastric emptying time ~ 2.43 h (2 – 2.75 h)
- Some institutions using 3 hours

Formula/Non-human milk

- Whey-predominant > casein-predominant > cow's milk
- Properties vary considerably between different formulas
- ++ individual differences
- 6 hours generally safe

Solids

- Complete emptying between 4-9 hours, and beyond
- Few randomized trials, equivocal differences between 4 or 6 hours for “light” meal, ++ variability
- 6 hours consensus for light meals
- 8 hours consensus for fatty meals

Why change?

- **Newer** evidence
- Aspiration is **rare**
- **Minimal** morbidity, no mortality associated
- Prolonged fasting can be **harmful**

Clear fluids

- Short half life – 10-26 min
- Volume-dependent - 7 mL/kg – higher residuals than 3mL/kg at 1 hour (back to baseline), but median gastric emptying half life < 30 min even for 7 mL/kg

Preoperative fasting in children: review of existing guidelines and recent developments

P. Frykholm[1,*], E. Schindler[2], R. Sümpelmann[3], R. Walker[4] and M. Weiss[5]

British Journal of Anaesthesia, 120 (3): 469–474 (2018)

Effect of different quantities of a sugared clear fluid on gastric emptying and residual volume in children: a crossover study using magnetic resonance imaging

A. Schmitz[1*], C. J. Kellenberger[2], N. Lochbuehler[2], M. Fruehauf[1], R. Klaghofer[3], H. Fruehauf[4] and M. Weiss

British Journal of Anaesthesia **108** (4): 644–7 (2012)

Nonhuman milk

- Recent radionuclide studies showing 300 ml of cow's milk takes less than 4 h to pass through the stomach
- 4 hour rule in Sweden since 2000, also Scandanavian guidelines

Preoperative fasting guidelines in pediatric anesthesia: are we ready for a change?

Hanna Andersson[a], *Achim Schmitz*[b], *and Peter Frykholm*[a]

Curr Opin Anesthesiol 2018, 31:000–000

Fasting times and gastric contents volume in children undergoing deep propofol sedation – an assessment using magnetic resonance imaging

Achim Schmitz[1], Christian J. Kellenberger[2], Diego Neuhaus[1], Elke Schroeter[1], Dubravka Deanovic
Friederike Prüfer[2], Martina Studhalter[2], Lieselore Völlmer[2] & Markus Weiss[1]

Pediatric Anesthesia ISSN 1155-5645

- 4 hour fasting time for light meal for patients undergoing GA with SV implemented in some institutions (eg. University Children's Hospital, Zurich, Switzerland)
- No correlation between gastric volume and fasting times!

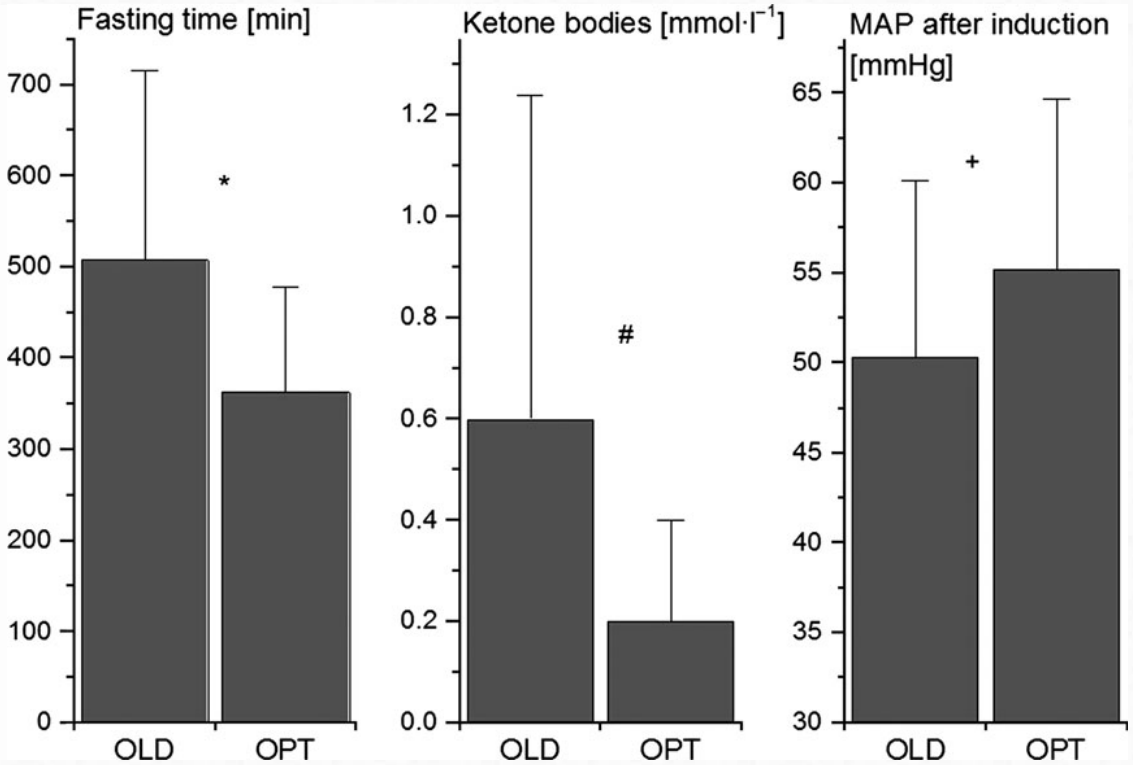
Prolonged fasting

- Dehydration, catabolism and insulin resistance

Optimized preoperative fasting times decrease ketone body concentration and stabilize mean arterial blood pressure during induction of anesthesia in children younger than 36 months: a prospective observational cohort study

Nils Dennhardt[1], Christiane Beck[1], Dirk Huber[1], Bjoern Sander[1], Martin Boehne[2], Dietmar Boethig[3], Andreas Leffler[1] & Robert Sümpelmann[1]

Pediatric Anesthesia ISSN 1155-5645



Physiological parameters

- Lower frequency of low normal glucose (< 3.5), hypoglycemia (<2.8) or increased ketone body concentrations (>0.6) in optimized fasting group
- No demonstrated significant differences in glucose, lactate, bicarbonate, anion gap levels (8 vs. 6.5 h)

Hemodynamics

- In infants, changes in SAP and MAP with halothane induction were significantly greater with prolonged fasting (8-12 h) vs. standard (0-4 h)

Duration of Preoperative Fast Correlates with Arterial Blood Pressure Response to Halothane in Infants

Robert H. Friesen, MD, Jonathan L. Wurl, MD, and Richard M. Friesen

Anesth Analg 2002;95:1572–6

However…

- No pediatric data to suggest increased incidence of hypotension with sevoflurane induction
- No data exists re: ease of IV cannulation
- Fluid abstinence times did not correlate with change in SBP/MAP in children undergoing MRI under deep sedation

Modern fasting guidelines in children
Scott D. Cook-Sather Ronald S. Litman

Best Practice & Research Clinical Anaesthesiology
Vol. 20, No. 3, pp. 471e 481, 2006

The Potential Consequences of Fluid Fasting Time on Hypotension During Pediatric Sedation While Using Propofol

J Clin Anesth Pain Med
Volume 1 • Issue 3 • 011

Ramin Nazari[1*], Sharon Calaman[2], Ajit Mammen[2], Bruce Bernstein[2], Vean Tan[2], Maria Bergel[2], Carlos A. Carmona[2] and Shonola Da-Silva[2]

Discomfort

- Majority of children reported being hungry/thirsty when arriving for surgery
- Median fasting times - > 12 h for solids, > 8 h for fluids despite written instructions

Are you hungry? Are you thirsty? – fasting times in elective outpatient pediatric patients

Thomas Engelhardt[1], Graham Wilson[1], Lesley Horne[1], Markus Weiss[2] & Achim Schmitz[2]

Pediatric Anesthesia ISSN 1155-5645

What is the problem?

- *Appropriate* fasting vs. *prolonged* fasting
- Children fasting for periods longer than necessary – poor adherence to guidelines

Table 1. Reported fasting times in children when applying the 6–4–2 regimen

Reference	Fasting time clear fluids mean/median ± SD (range)	Fasting time breast milk	Fasting time solids mean/median (range)
Engelhardt *et al.* [5]	8 (0–21)		12 (1–22)
Schmitz *et al.* [6]	5.5 (1.1–15.5)		6.7 (4–20.2)
Cantellow *et al.* [7]	5 (0.5–24)		9.5 (3–40)
Arun *et al.* [8]	4 (2–8.3)		9 (4.8–13.5)
Dolgun *et al.* [9▪]	10.5	6.27	
Newton *et al.* [10▪▪]	6.3 ± 4.5		

Introducing the 6-4-0 fasting regimen and the incidence of prolonged preoperative fasting in children

Hanna Andersson[1] | Per M. Hellström[2] | Peter Frykholm[1]

Pediatric Anesthesia. 2018;28:46–52.

Liberal fluid fasting—impact on gastric pH and residual volume in healthy children undergoing general anaesthesia for elective surgery

A.R. Schmidt, K.P. Buehler, Ch Both, R. Wiener, R. Klaghofer, M. Hersberger, M. Weiss, A. Schmitz, BJA 2018

- No differences in residual volumes or pH
- Mean fluid fasting time decreased **from 4 → 1 hour**, decreased incidence of prolonged fasting(1)
- Liberal group – **mean fasting 48 min** vs**. 234 min** standard group (2)
- No statistical difference in aspiration rates

1 vs. 2 hour CF fast?

- No differences in gastric volume and pH between 1 vs. 2 hour clear fluid fast (randomized)
- *However*, no demonstrated physiological (lactate, base excess or glucose) or behavioural (hunger, thirst, induction/recovery quality, N&V) differences either between the two groups

Gastric pH and residual volume after 1 *vs* 2 h fasting time for clear fluids in children†

A. R. Schmidt[1]*, P. Buehler[1], L. Seglias[1], T. Stark[1], B. Brotschi[1], T. Renner[1], C. Sabandal[1], R. Klaghofer[2], M. Weiss[1] and A. Schmitz[1]

British Journal of Anaesthesia 114 (3): 477–82 (2015)

Fasting times and gastric contents volume in children undergoing deep propofol sedation – an assessment using magnetic resonance imaging

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- Even with liberal fasting regimen, fasting times often exceeded
- Clear fluids – 1.1 to 15.5 (5.5) h
- Non-clear fluids/solids 4.0 to 20.2 (6.7) h

Inappropriate fluids

- Carbohydrate-rich clear fluids vs. water/juice/coffee/tea

Preoperative Carbohydrate Loading

- Improved comfort
- Reduced N/V
- Hypothesized to reduced insulin resistance, patient catabolism → improved perioperative glucose control and muscle preservation
- Small reduction in length of stay

Preoperative carbohydrate treatment for enhancing recovery after elective surgery (Review)

Smith MD, McCall J, Plank L, Herbison GP, Soop M, Nygren J

Cochrane Library

Cochrane Database of Systematic Reviews

Randomised controlled trial comparing preoperative carbohydrate loading with standard fasting in paediatric anaesthesia

B.A. Tudor-Drobjewski, P. Marhofer BJA 2018

- 120 children for gastroscopy randomized to standard fast vs. carbohydrate beverage (PreOp; Nutricia, Erlangen, Germany)
- Carbohydrate group – significantly less gastric content, less postoperative nausea, lower incidence of discomfort

Evidence

- Guidelines for ELECTIVE, healthy patients
- Not powered to detect difference in aspiration as event so rare (would need 200 000 patients in each arm of an RCT)

Why *not* change?

- Good safety record
- Lipid-containing liquids/solids – morbidity can be high!
- ++ Inter-individual difference – even 6-4-2 might not guarantee empty stomach, much less decreased fasting times
- If current guidelines optimized, minimal differences in patient comfort, physiological parameters
- Flexibility in scheduling

Parental compliance

- Poor at baseline
- Need continuous and in-time reinforcement

Cultural change

- Surgeons
- Nurses
- Anesthetists

Solutions/suggestions

- *Optimizing* the current guidelines
- Re-introducing an old and familiar concept

An optimized fasting protocol

Pediatric Anesthesia ISSN 1155-5645

- Parents given instructions on 6-4-2 protocol
- Parents/nurses encouraged to feed the children up to the latest possible time according to the written instructions;
- All not scheduled for the first timeslot automatically allowed to drink clear fluids up to morning;

An optimized fasting protocol cont'ed

Pediatric Anesthesia ISSN 1155-5645

- Anesthetists encouraged to call the wards/homes early in the morning and later on to give new fasting orders in case of a change of schedule or in the event of delay
- Sign to remind the anesthetists to follow these instructions in ORs
- Ward nurses and surgeons were educated about the importance of short fasting times to improve children's comfort and metabolic stability

Other suggestions?

- Wake children in the middle of the night to feed/drink if they SSTN
- Consider the type of fluid administered (water vs. juice vs. carbohydrate-rich)

Thank you

Which of the following does ***not*** contribute to increased incidence of pulmonary aspiration in pediatric patients?

- Age
- Emergency procedure
- GI dysmotility
- Diaphragmatic breathing

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Aspiration events most likely occur…

- During induction
- During intubation
- Intraoperatively with painful stimulus without a secure airway
- During extubation

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- During intubation
- Intraoperatively with painful stimulus without a secure airway
- During extubation

Which of the following is ***true*** with regards to gastric emptying*?*

- Elimination of fluids follows zero-order kinetics
- Elimination of solids follows first-order kinetics
- Radionuclide method is the gold standard in the study of gastric emptying
- A 2 hour fasting interval for fluids guarantees an empty stomach

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