Wilhelmina Kinderziekenhuis

Fasting, time for change?

Hannie Megens, anesthesiologist

BAPA – SKA January 2019

Disclosures

- Financial relationships: none.

- Non financial relationships: non-salaried member of the working group of the V&VN (Dutch professional organisation of nurses en caretakers) developing a quality indicator on preoperative fasting in children.

THE TAKE-HOME MESSAGE

Let them drink!

Content

- Why fasting
- International guidelines
- Every day practice
- Drawbacks of fasting
- Gastric emptying
- New developments
- Near future?

Case report - preop

- M patiënt, 11 years, 38 Kilo
- 22 q 11 deletion
- Combined immune deficiency
- Chronic lung disease with recurrent pneumonia
- Many anesthetics

- Kidney dysfunction (Cr 76) unknown case
- Hematoma after kidney biopsy
- Removal of clot in bladder (PCM, oxybutinine)
- Last mael 8 hour ago

I have just
one question for you…

Case report - anesthesia

- IV induction: lidocaine, propofol, sufentanil.
- Placement of LMA
- Aspiration of brown fluid – a lot
- Suxemethonium and intubation
- Suction through endotracheal tube

- Increasing oxygen and pressure needed
- Transfer to Pediatric Intensive Care Unit

Case report

Risk factors

- Emergency
- Pain
- Oxybutynine
- Lithotomy position
- ??

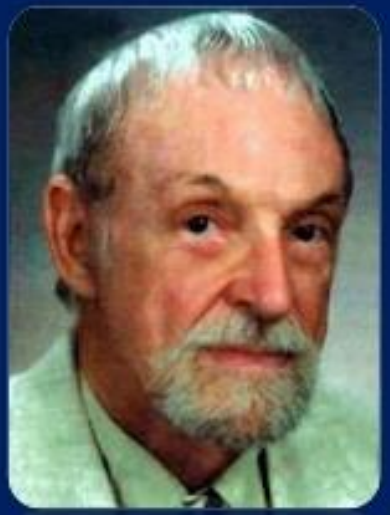
Case report - postop

- 25 days in PICU
- ARDS
- Pleural effusion, drainage
- Pneumonia – pseudomonas
- 20 days on ventilator
- Delirium

- Discharge from hospital 7 weeks after incident
- At home Oxygen 1 liter/min via nasal sprong
- FEV1 29%

Why fasting

Mendelson



Between 1932 and 1945, 66 cases of aspiration occurred during obstetrical anesthesia at New York Hospital.

Mendelson CL The aspiration of stomach contents into the lungs during obstetric anesthesia. Am J Obstet Gynecol 52:191 1946

Why fasting

- Obstetrician
- 1946
- 66 aspiration among 44016 pregnancies (0.15%)
- Aspiration of liquid: astma-like attack, full recovery
- 2 deaths due to airway obstruction by solid food.
- Injecting vomitus in respiratory tract of rabbits.

Mendelson's syndrome

- Chemical pneumonitis or aspiration pneumonitis caused by aspiration of gastric content during general anaesthesia due to abolition of laryngeal reflexes

Mendelson CL. Am J Obstet Gynecol. 1946. The aspiration of stomach contents into the lungs during obstetric anesthesia.

Why fasting

- 1 Rhesus monkey, instillation of acid directly in bronchus
- 25 ml (0.4 ml/kg) of gastric fluid with a pH < 2.5

Roberts RB, Shirley MA. Anesth Analg 1974. Reducing the risk of acid aspiration during cesarean section.

- **Relationship: residual gastric volume and volume instilled into the lungs ?**
- **40 – 80% of fasted healthy patients gastric volumes > 25 ml and pH < 2.5.**

Maltby JR. Best Pract Res Clin Anaesthesiol 2006. Fasting from midnight - the history behind the dogma.

Why fasting

Study	Time period	Study design	Study size	Aspiration (per 10.000)
Murat	2000-2002	Prosective, teaching hospital France	24.165	19 (8)
Walker	2010-2011	Prospective, multicentre UK	118.371	24 (2)
Andersson	2008-2013	Retrospective, University hospital Sweden	10.015	3 (3)
Tan	2000-2013	Retrospective, Singapore	102.425	22 (2)
Eisler	2008-2014	Retrospective, tertiary care pediatric hospital, New York	47.472	20 (5.5)
Habré	2014-2015	Prospective, multicentre Europe	31.127	29 (9.3)

Why fasting

Aspiration the presence of any non-respiratory secretions in the airway as evidenced by laryngoscopy, suctioning, or bronchoscopy.

In a situation where there was suspicion of pulmonary aspiration but no positive aspiration of non-respiratory secretions, new clinical and/or chest X-ray signs consistent with aspiration are accepted as evidence for it

(e.g., new wheeze or crackles in the chest after regurgitation or vomiting incident).

Habré W. The Lancet 2017. Incidence of severe critical events in paediatric anaesthesia (APRICOT): a prospective multicentre observational study in 261 hospitals in Europe.

Why fasting

Outcome

Study	Time period	Study design	Aspiration per 10.000	Postoperative ventilation %
Walker	2010-2011	Prospective, Multicentre UK	2	20.8
Tan	2000-2013	Retrospective, Singapore	2	9.1
Andersson	2008-2013	Retrospective, university hospital Sweden	3	0
Habré	2014-2015	Prospective, multicentre Europe	9.3	0

Why fasting

Risk factors

- Non-elective surgical procedure
- Inadequate anaesthesia
- Abdominal pathology
- Obesity
- Opioid medication
- Neurological disease
- Lithotomy
- Difficult intubation / airway
- Reflux
- Hiatus hernia

Kluger MT. Anesthesia 1999. Aspiration during anaesthesia: a review of 133 cases from the Australian anaesthetic Incident Monitoring Study.

Why fasting

- Gastric content
- Exceed lower oesophageal sphincter barrier pressure
- Regurgitate through the upper oeophageal sphincter
- Loss of protective airway relfexes

- What can we influence …. Gastric content

Mesbah A. BJA Education 2017. Preoperative fasting in children.

Why fasting, summary

To prevent pulmonary aspiration

Rare event

Consequences of fluid aspiration are not catastrophic (?)

No clear relationship: gastric content – volume aspiration

What can be modified: gastric content!

International guidelines

Pre-operative fasting guidelines: un update.

Scandinavian Society of Anaesthesiology and Intensive Care Medicine. Søreide et al, Anaesth Scand 2005.

Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures.

American Society of Anesthesiologists Task Force on Preoperative fasting and the use of pharmocologic agents to reduce the risk of pulmonary aspiration. Anesthesiology 2017.

Richtlijn Anesthesie bij kinderen.

Nederlandse Vereniging voor Anesthesiologie, 2017.

International guidelines

8 – 6 – 4 – 2

International guidelines

- 8 Fried or fatty foods, meat
- 6 Light meal
- 4 Milk
- 2 Clear fluids

I have just
one question for you…

International guidelines

- 6 Light meal, non human-milk, formula (all)
- 4 Breast milk (all)
  - neonates or infants (< 1 year) (ASA)
  - or ≤ 6 months (Scand)
  - also formula (Scand)
- 2 Clear fluids, no alcohol
  - Coffee / tea with 1/5 of total volume milk
- 1 hour 75 ml of water with preoperative oral medication
  - Children > 1 year (Scand)


large coffee
1940
1960
1980
2000
TODAY
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Every day practice

Fasting instructions: Who – What – Clear?

I have just
one question for you…

Every day practice

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Parents' understanding of and compliance with fasting instruction for pediatric day case surgery

Steve Cantellow, Jonathan Lightfoot, Helen Bould & Richard Beringer

Bristol Royal Hospital for Children, University Hospitals Bristol NHS Foundation Trust, Bristol, UK

Table 1 Method by which parents received fasting instructions

	Number of parents (%)
Letter	75 (72%)
Leaflet	21 (20%)
Anesthetist	11 (10%)
Pre operative assessment clinic	9 (9%)
Surgeon	2 (2%)
Internet	2 (2%)
Other	2 (2%)

Every day practice

Table 2 Parents' understanding of the reason to fast

We fast patients to prevent	
Aspiration	9 (9%)
Nausea or vomiting	53 (51%)
Efficacy of anesthesia being altered	13 (12.5%)
Other	18 (17%)

4.9% would allow:

Every day practice

Study	Year of publication	Fasting solids range	Fasting clear range
Engelhardt 2011	2011	12:05 00:45-21:50	7:57 00:05- 20:50
Arun* 2013	2013	11:25	9:25
Buller 2016	2016	10.0	6.3
Cantellow 2012	2012	9.53 - 40	5 0.5 – 24

***Change in surgical schedule is major cause (30%)!**

Arun BG. J Anaesth Clin Pharm 2013. Preoperative fasting in childen: an audit and its implications in a tertiary care hospital.

Every day practice

- 97% written NPO order: noncompliant with ASA guidelines for clear liquids
- NPO from midnight

- Williams C. J Ped Nursing 2014. Pediatric fasting times before surgical and radiologic procedures: benchmarking institutional practices against national standards.

Every day practice

- Children on morning list fast longer than children on afternoon list.

Buller Y. Anawsth Int Care 2016. Prolonged fasting of children before anaesthsia is common in private practice.

- Postoperative NPO time in complex surgery
- The story continues: 30 hours

Brunet-Wood K. J Ped Surg. Surgical fasting guidelines in children: are we putting them into practice.

- Small feedings may actually stimulate the gastrointestinal tract and shorten the period of ileus.

Every day practice

- Kwaliteitswet Zorginstellingen
  (Law on Quality in Health Care Institutions)
- Set of quality indicators

- Pediatric nurses (V&VN)
- Working group
- Unnecessary – long fasting in children
- Improve care by means of a quality indicator

Every day practice

- Quality indicator
- 2020 (?)
- Percentage of children no clear fluids > 2 h (= 120 min)
- Information child and parents
- Agreement on what to do

Every day practice, summary

We don't tell 6 – 4 – 2

We don't explane

We are unable to plan

Patients – parents – nurses - ..

Case report

- M patiënt, 2 year + 3 months old
- Achrondoplasia
- Lunghypoplasia
- Previously admitted gastro-enteritis with hypoglycaemia

- Set up for non invasive ventilation
- Hypertrofia of adenoid and tonsils
- On the emergency list, starting at 12:00

Case report

- Fasting from 6:00 a.m.
- Refused clear fluids
- No intraveneus line

- 21:00 surgery started
- Dronk well after surgery, mostly water
- IV no glucose added
- Next morning …… difficult to wake up
- Glucose level < 1

Case report

- Glucose IV
- Intubation, respiratory insufficiency
- PICU
- Accidental detubation

Drawbacks of fasting

Thristy, hungry, behaviour, oncomfortable

- Brady MC. Cochrane Library 2009. Preoperative fasting for preventing perioperative complications in children (Review).

Hungry or starving 56%

Thirsty 27%

- Engelhardt T. Ped Anesth 2011. Are you hungry? Are you thirsty? – fasting times in elective outpatient pediaric patients.

Drawbacks of fasting

Blood glucose level, ketone body concentration

- (low) normal glucose level
- Ketone bodies ↑
- BE / Anion gap ↓

- Cook-Sather SD. Best Pract Res Clin Anaesth 2006. Modern fasting guidelines in children.
- Dennhardt N. Eur J Anaesth 2015. Impat of preoperative fasting times on blood glucose concentration, ketone bodies and acid-base balance in children younger than 36 months.
- Dennhardt N. Ped Anesth 2016. 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.

Drawbacks of fasting

Hemodynamics in optimized preop fasting

- Incidence of hypotension ↓
- MAP after induction ↑

- Dennhardt N. Ped Anesth 2016. 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.

Drawbacks of fasting

- Insulin resistance ↑ in standard fasting versus Pre Op
  (= lemon flavoured carbohydrate beverage)

Gawecka A. Anaesth Int Ther 2014. Tolerane of, and metabolic effects of, preoperative oral carbohydrate administration in children – a preliminary report.

- Insulin resistance ↓ preop oral carbohydrates

Nygren J. CO Anesth 2015. Preoperative oral carbohydrate therapy.

Drawbacks of fasting, summary

Thirst, oncomfortable, negative behaviour

Glucose / ketone bodies

Instability at induction … (IV placement?)

Insulin resistance

Gastric emptying

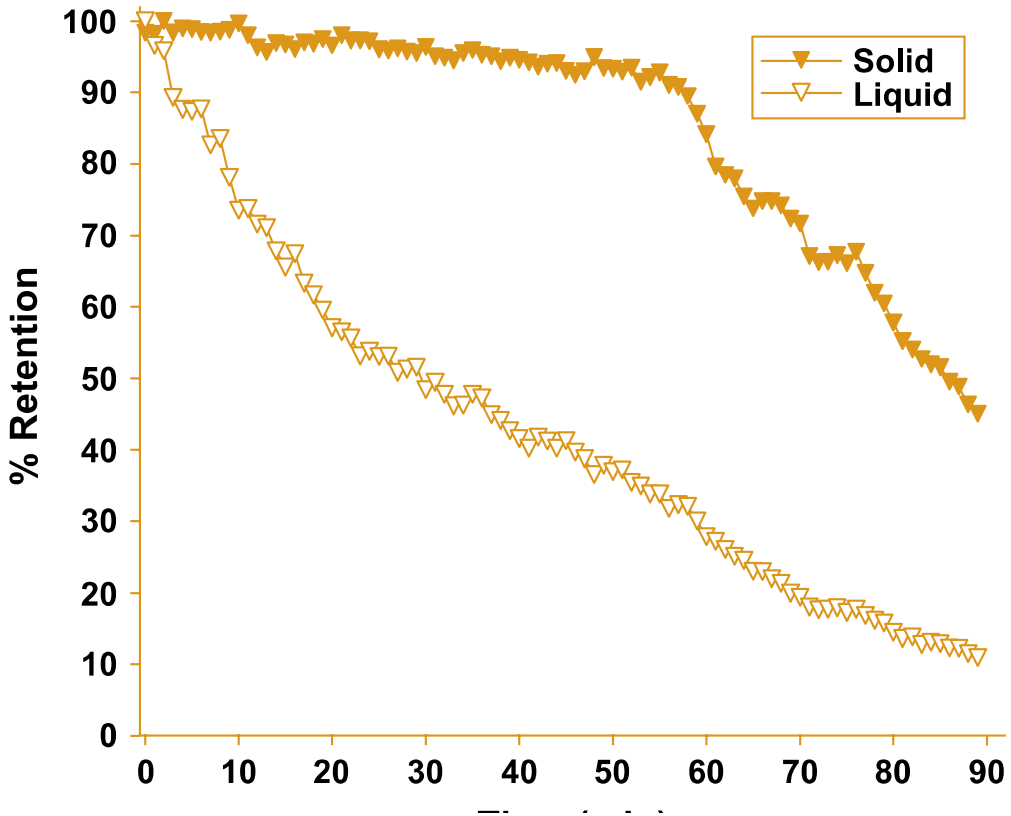
	Factors increasing emptying	Factors decreasing emptying
Physiological factors	Large gastric volume	Large duodenal volume
	Liquid gastric contents	High-calorie chyme
	Solids <2 mm	Acidic chyme
		Hypo-/hyper-osmolar chyme
		Fatty and amino acid-rich chyme
		Hot and cold chyme
	Parasympathetic stimulation	Sympathetic stimulation
	Secretion of motilin and gastrin	Secretion of cholecystokinin, secretin, somatostatin, vasoactive intestinal peptide, and gastric inhibitory peptide
	Sitting position (for non-caloric liquids)	Left lateral position (for non-caloric liquids)
Pharmacological factors	Anticholinergics	Antimuscarinics
	Metoclopramide	Opioids
	Domperidone	
	Erythromycin	
Patient factors	Hyperthyroidism	Pain
		Anxiety and stress
		Trauma
		Pregnancy
		Alcohol ingestion
		Hypothyroidism
		Diabetes
		Pyloric stenosis
		Intestinal obstruction
		Vagotomy

Mesbah A. BJA Education 2017. Preoperative fasting in children.

Gastric emptying

- Scintigraphy using radiolabelled meals
- Magnetic Resonance Imaging
- Endoscopy
- Ultrasound
- Paracetamol absorption test
- Wireless motility capsules
-
-

Gastric emptying



Liquid emptying begins instantly, solid emptying begins after the lag phase
Hellström PM. Best Pract Res Clin Anaesthes. 2006. The physiology of gastric emptying.

Gastric emptying

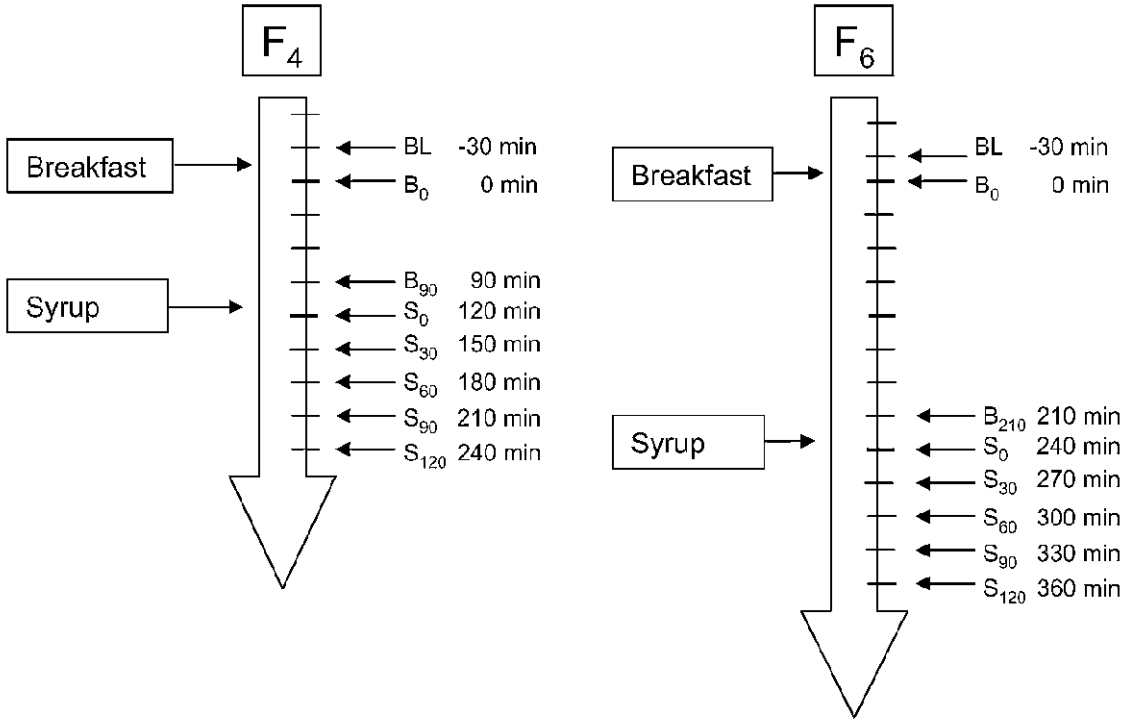
MRI

- 18 healty volunteers (aged 9 years)
- Breakfast (cereal flakes and milk) 4 of 6 h
- Clear liquids 2 h
- Half hourly MRI
- No anesthesia

Schmitz A. Acta Anaesth Scand 2012. Residual gastric contents volume does not differ following 4 or 6 h fasting after a light breakfast – a magnetic resonance imaging investigation in healthy non-anaesthetised school-age children.

Gastric emptying

MRI



- Clear liquids gone within 1 h (T1/2 30 min)
  - Also Okabe. BJA 2015. Liquid gastric emptying.
- Regardless of breakfast at 4 or 6 h prior

Gastric emptying

Endoscopy

- 120 children
- Clear fluids water / tea or Pre-Op 5 ml per kg
- Endoscopy under anesthesia
- Stomach contents aspirated for volume & pH

- **Volume of gastric content lower in Pre Op children**
- Less postop nausea in Pre Op children

Tudor-Drobjewski BA. BJA 2018. Randomised controlled trial comparing preoperative carbohydrate loading with standard fasting in paediatric anaesthesia.

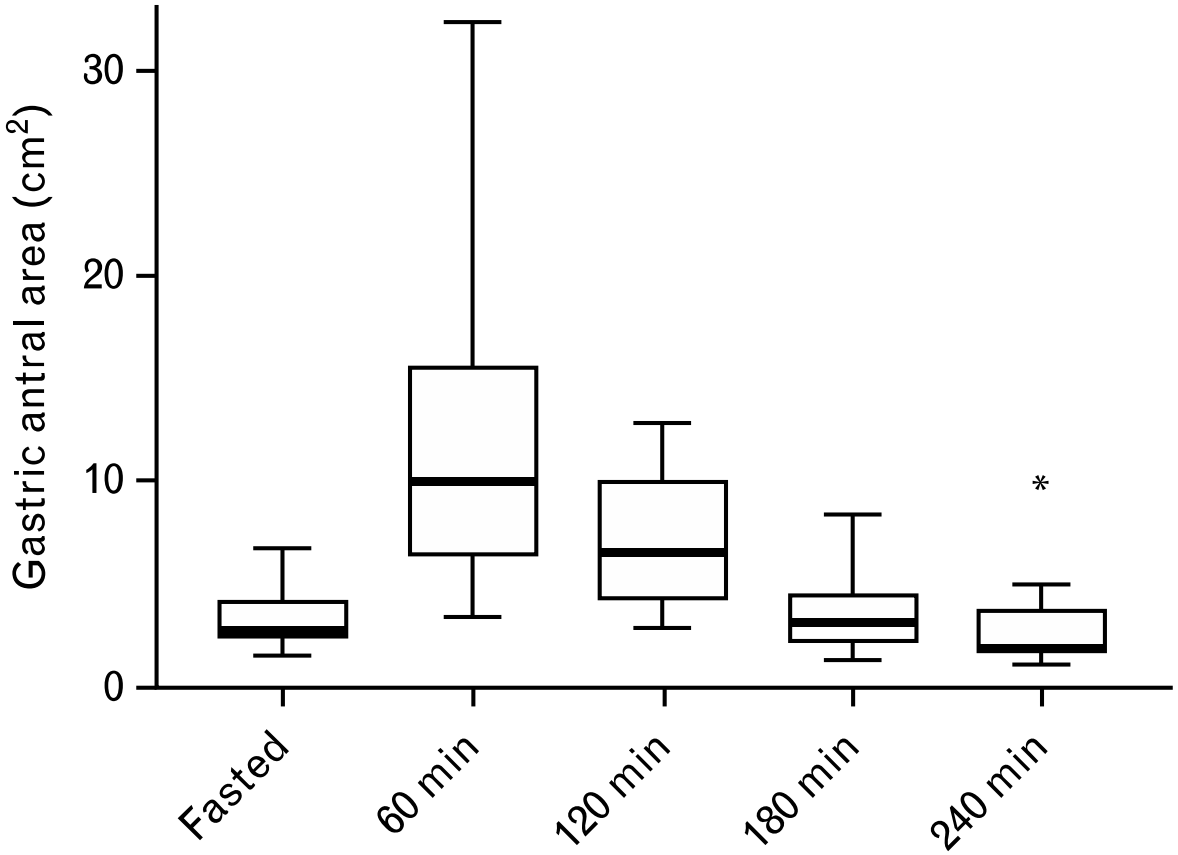
Gastric emptying

Ultrasound

- Preoperative bedside test
- Right lateral decubital (RLD)
- Gastric cross-sectional area (CSA)
- CSA in RLD correlates well with MRI volume (Schmitz)

- Schmitz A. Ped Anesth 2016. Gastric ultrasound as a preoperative bedside test for residual gastric contents volume in children.

Gastric emptying



Mean gastric emptying time < 4 h after breakfast (Beck)

Beck CE. Eur J Anaesth 2018. Ultrasound assessment of gastric emptying time after a standardised light breakfast in healty children. A prospective observational study.

Gastric emptying

Ultrasound

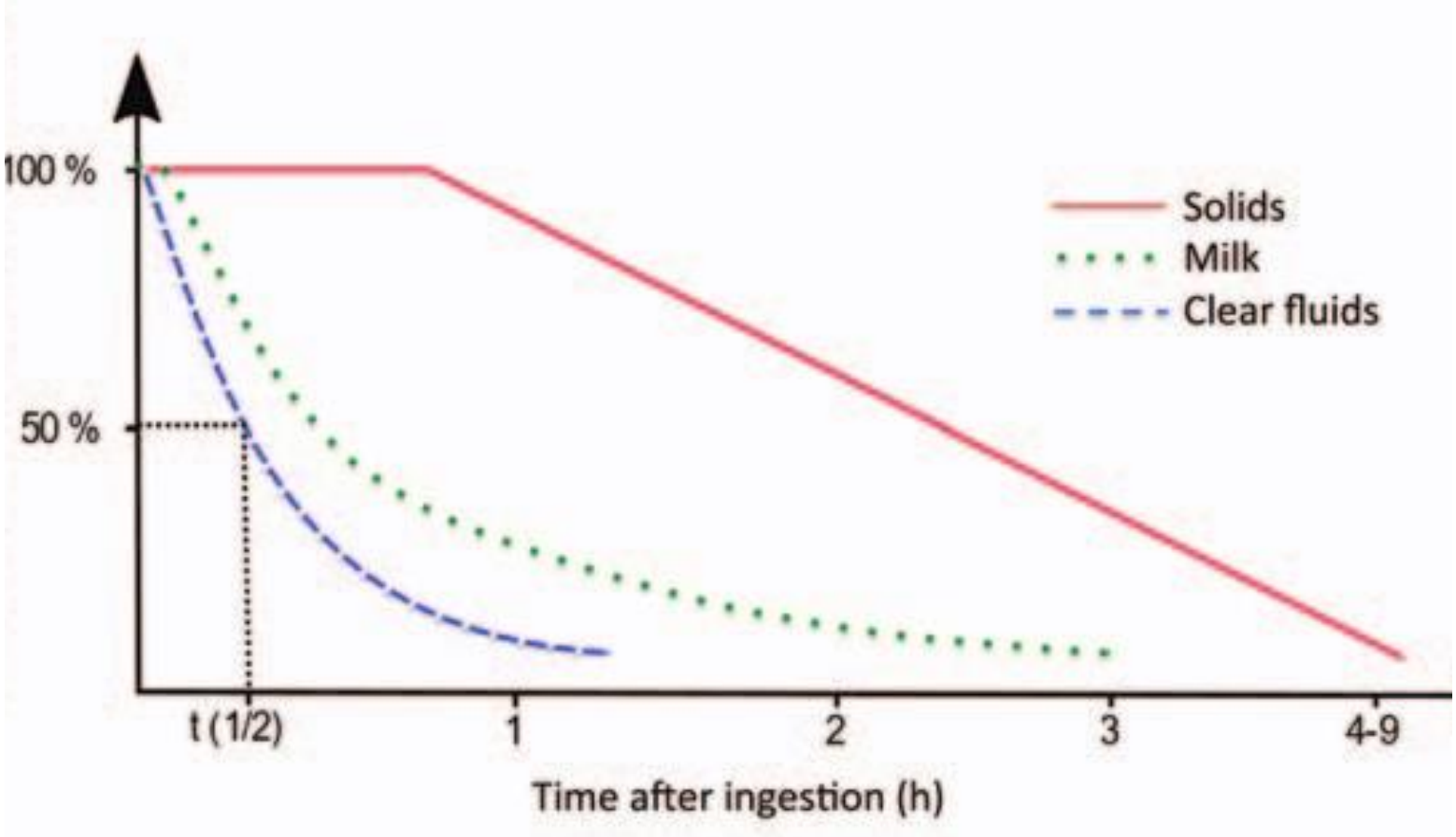
Gastric emptying time < 4 h after breakfast.

- Sümpelmann AE. Ped Anesth 2017. Ultrasound assessment of gastric emptying after breakfast in healthy preschool children.

No difference in pH / volume fasting 1 or 2 h clear fluids.

- Schmidt. BJA 2015. Gastric pH and residual volume

Gastric emptying



Solid: lag phase followed by linear manner
Cow milk: intitial fast phase followed by linear manner
Liquids:first order kinetics half-life of 10 – 26 min
Andersson H. CO-anesth 2018. Preoperative fasting guidelines in pediatric anesthesia: are we ready for a change?

Gastric emptying, summary

Is influenced by many factors

Can be measured in various ways

Breakfast safe – 4 h

Clear fluids gone very fast

Ad glucose to speed up the process

New developments

New developments

New developments

- Hanna Andersson & Prof Frykholm
- Restrospective
- 10.015 children
- Elective surgery
- Intake of clear fluids untill called

- Aspiration 3 in 10.000
- No intensive care or ventilation support

New developments

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Low incidence of pulmonary aspiration in children allowed intake of clear fluids until called to the operating suite

Hanna Andersson, Björn Zarén & Peter Frykholm

Department of Surgical Sciences, Anesthesia and Intensive Care, Uppsala University Hospital, Uppsala, Sweden

What is already known

- Today most departments apply the 6-4-2 fasting regime. Previous studies have shown incidence of pulmonary aspiration in pediatric anesthesia to be 1–10 in 10 000.

What this article adds

- With a regimen allowing free clear fluids until called to the operating suite the incidence of pulmonary aspiration was 3 in 10 000.

Implications for translation

- Shortened fasting times may improve the perioperative experience for parents and children and reduce dehydration and hypoglycemia.

New developments

Meanwhile at the Wilhelmina Children's Hospital

"We tend to favour more traditional anaesthetic techniques here."

New developments

- Poster (2014) and publication (2015)
- Questions for the investigators
- PICO by resident
- Staff meeting

- Nurses on board
- Pediatricians on board
- Surgeons

New developments

Meanwhile at the Wilhelmina Children's Hospital

March 2016

6 – 4 – 0

10 ml per kg per hour

Max 100 ml per hour

Clear liquids or rocket waterice

Wilhelmina Kinderziekenhuis

Beatrix Kinderziekenhuis
Universitair Medisch Centrum Groningen

Erasmus MC

Sophia Kinderziekenhuis

vóór kinderen tégen kanker
Prinses MÁXIMA
centrum voor kinderoncologie

Amalia kinderziekenhuis
Radboudumc

Statement ESPA

April 30, 2018

Based on the current convincing evidence base, unless there is a clear contraindication, it is safe and recommended for all children able to take clear fluids, to be ***allowed and encouraged*** *to have them* ***up to 1 hour*** *before elective general anesthesia.*

Thomas M. Ped Anesth 2018. Consensus statement on clear fluids fasting for elective pediatric general anesthesia.

Statement SKA

January 10th, 2019

- Solids / milk: Guideline Anesthesie in Children, NVA
- Clear fluids: 6 – 4 – 0
- Short turnover time: 6 – 4 – 1
- Clear fluids are water, water with sugar, tea, appeljuice, syrup or waterice. Volume: about 3 ml per hour, preference glucose containing drinks!!

Near future?

Quality indicator fasting in children

Multicentre trail drink untill called for anesthesia

- Prof Frykhom, Uppsala University, Sweden
- Sufficient power
- Establish non inferiority – just as save
- Andersson H. CO Anesth 2018. Preoperative fasting guidelines in pediatric anesthesia: are we ready for a change?

Breakfast 4 h prior to anesthesia?

Let them drink sweet
OR