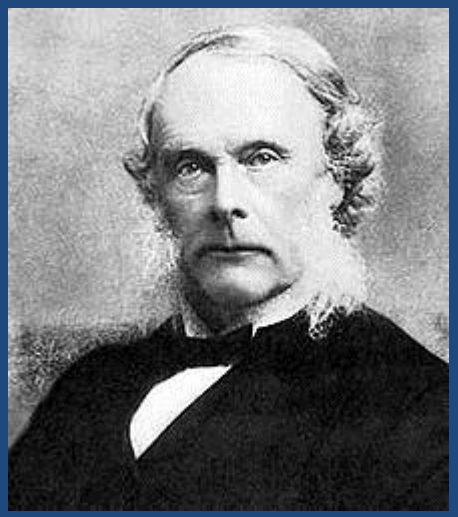
Dr. M. Coppens

Snow 1858

- Chloroform is very apt to cause vomiting, if inhaled while there is a quantity of food in the stomach.
- The sickness is not attended with any danger but it constitutes an unpleasantness and inconvenience wich is desirable to avoid
- The best time for an operation under chloroform is before breakfast or about the time when the patient would be ready for another meal

Sir Joseph Lister 1883

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



Buxton 1920

- Morning surgery: small cup of China tea at 6 AM
- Afternoon surgery: light breakfast of tea, bread boiled to pulp in milk and fish but no meat at 7 AM followed by tea or beef tea at 11 AM

- ….DO NOT EAT OF DRINK ANYTHING AFTER MIDNIGHT

C. Mendelson (1946)

66 cases of pulmonary aspiration in 44.016 pregnancies:

in 45 cases the aspirated material was inspected: 5 solid food – 2 deaths

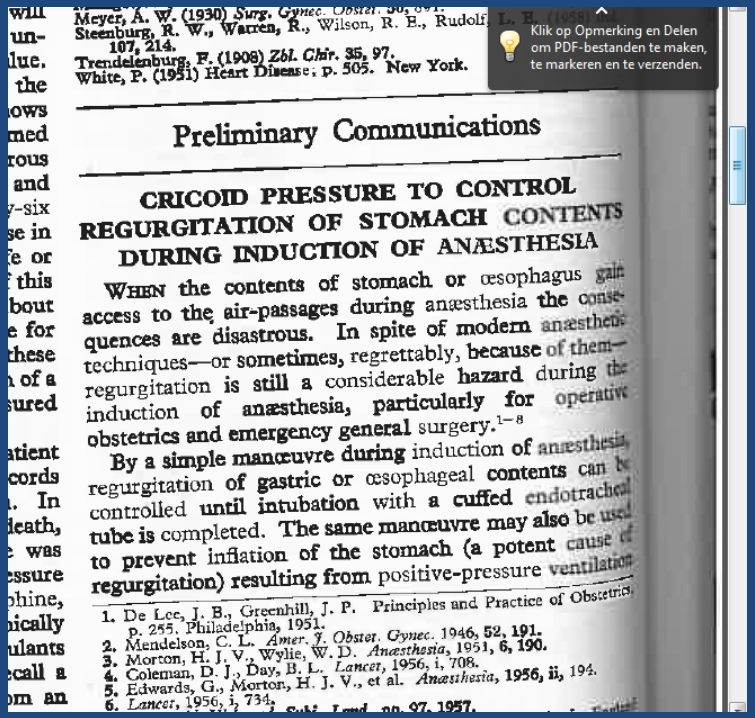
aspiration pneumonitis: no fatalities

Ether inhalation, … administered by
“ an new and inexperienced intern “

- Hydrochloric acid
- Human liquid vomitus; (un-) neutralised

25 ml gastric juice of pH below 2.5
Triple prophylaxis in outpatients

The Lancet, aug 1961



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Steenburg, R. W., Warren, R., Wilson, R. E., Rudolf, L. E. (1953) *Ann. Surg.* 107, 214.
Trendelenburg, F. (1908) *Zbl. Chir.* 35, 97.
White, P. (1951) *Heart Disease*, p. 505. New York.

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Preliminary Communications

CRICOID PRESSURE TO CONTROL REGURGITATION OF STOMACH CONTENTS DURING INDUCTION OF ANÆSTHESIA

WHEN the contents of stomach or œsophagus gain access to the air-passages during anæsthesia the consequences are disastrous. In spite of modern anæsthetic techniques—or sometimes, regrettably, because of them—regurgitation is still a considerable hazard during the induction of anæsthesia, particularly for operative obstetrics and emergency general surgery.[1–8]

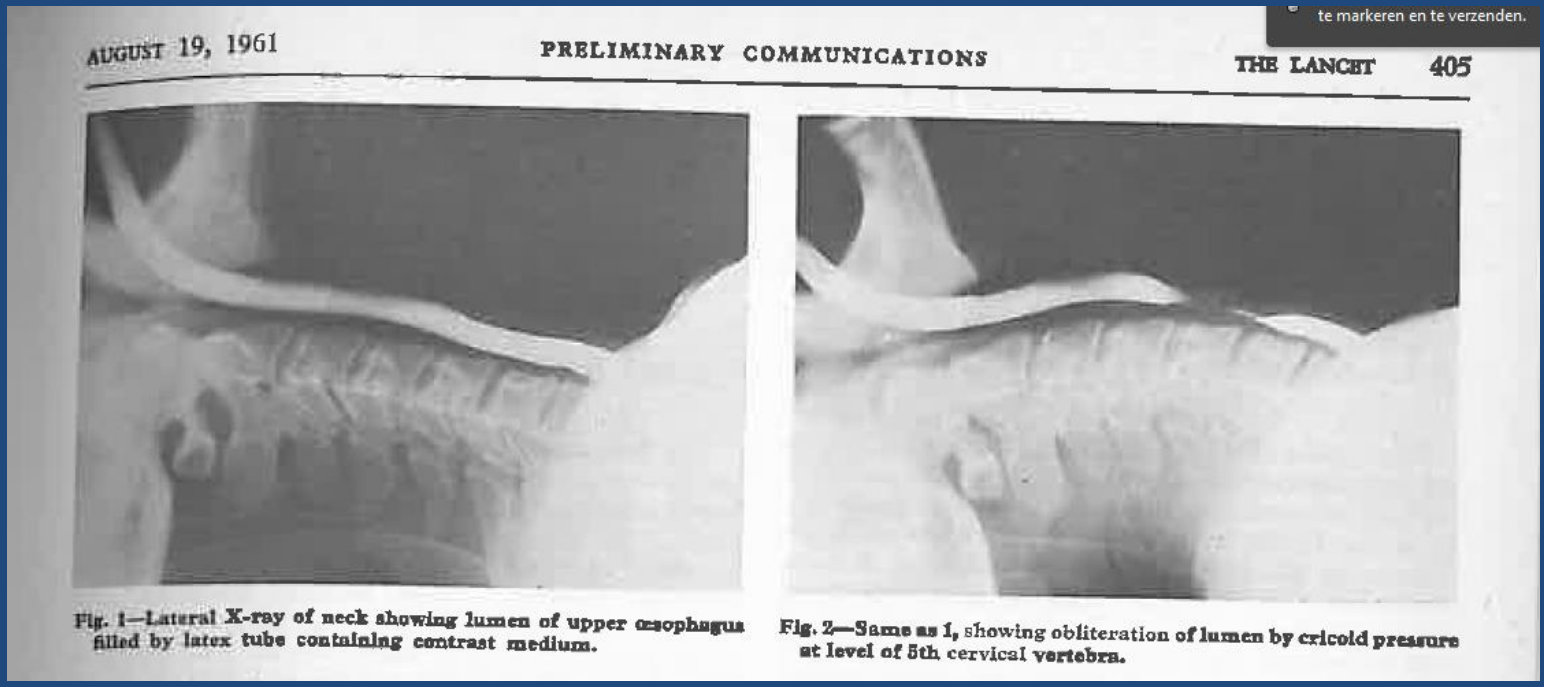
By a simple manœuvre during induction of anæsthesia, regurgitation of gastric or œsophageal contents can be controlled until intubation with a cuffed endotracheal tube is completed. The same manœuvre may also be used to prevent inflation of the stomach (a potent cause of regurgitation) resulting from positive-pressure ventilation

1. De Lee, J. B., Greenhill, J. P. Principles and Practice of Obstetrics p. 255. Philadelphia, 1951.
2. Mendelson, C. L. *Amer. J. Obstet. Gynec.* 1946, **52**, 191.
3. Morton, H. J. V., Wylie, W. D. *Anæsthesia*, 1951, **6**, 190.
4. Coleman, D. J., Day, B. L. *Lancet*, 1956, i, 708.
5. Edwards, G., Morton, H. J. V., et al. *Anæsthesia*, 1956, **ii**, 194.
6. *Lancet*, 1956, i, 734.

The manoevre may be used to prevent inflation of the stomach resulting from positive pressure ventilation apllied through a facepiece or by mouth-to-mouth

Cricoid pressure

- Sellick 1961:
- Cadaver study
- 26 patients: no regurgitation
- Sellick’s maneuver was born !



AUGUST 19, 1961 PRELIMINARY COMMUNICATIONS THE LANCET 405

Fig. 1—Lateral X-ray of neck showing lumen of upper œsophagus filled by latex tube containing contrast medium.

Fig. 2—Same as 1, showing obliteration of lumen by cricoid pressure at level of 5th cervical vertebra.

Soft latex tube distended with contrast medium to 100 cm H_2O

Rapid sequence induction and intubation:

80 succesful cases

1. Start IV infusion
2. Check equipment
3. Insert large-bore nasogastric tube (remove ?)
4. Clean mouth and pharynx of foreign material
5. Denitrogenate the lungs: Oxygen administration
6. Place patient in semisitting, V-position
7. Apply ECG / precordial stethoscope

Introduction of sux in 1951
Description of cricoid pressure - Sellick
First publication RSII in 1970 – Peter SAFAR

Rapid sequence induction and intubation:

80 succesful cases

8. Inject d-tubocurarine; this may produce slight weakness but most patients do not notice
9. Rapid injection of predetermined dose of thiopental (150 mg/70 kg):

   stuporous/comatose: thiopental is omitted

   critically ill and consciuous: scopolamine alone/cyclopropane/halothane
10. Tilt the patient head backward, cricoied pressure
11. Inject succinylcholine (100mg/70 kg)

12. Allow respiration to cease spontaneously:Apnea is essential, partial paralysis would result in straining and regurgitation, Avoidance of positive pressure ventilation
13. Application of cricoid pressure: quick laryngoscopy, rapid intubation
14. Release cricoid pressure
15. Insert gastric tube

A fifteen step method of induction and intubation for avoiding aspiration of gastric contents, which has been succesfully in 80 patients over a 2 year period.

Induction agent

- Rapidly inject a precalculated dose of induction drug, immediately followed by NMBD = rapid sequence
- Risk: awareness vs hemodynamic compromise
- Titration to loss of consciousness: longer induction time ?

Controversies : succinylcholine

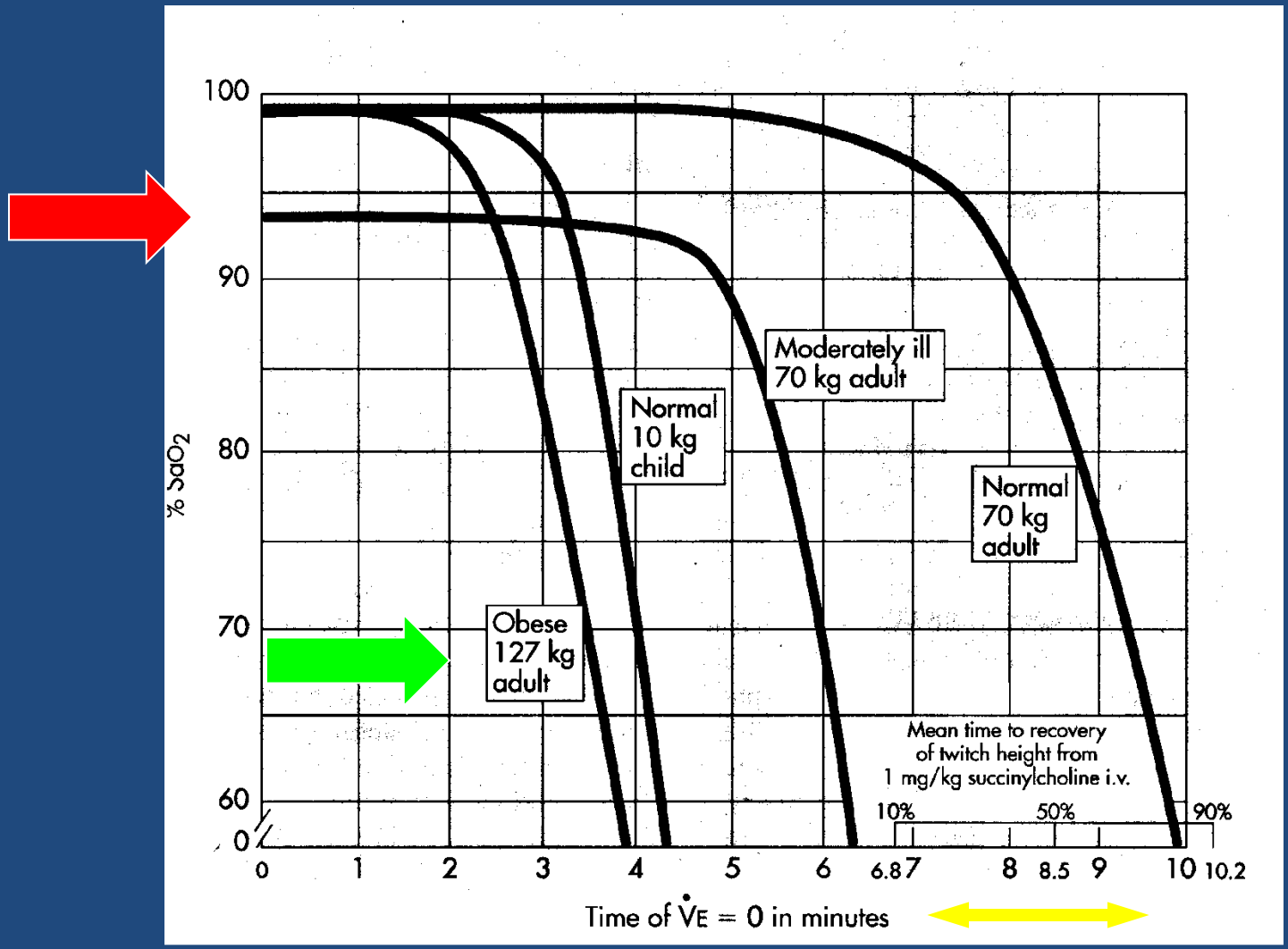
- Wat is an adequate dose ?
  - 1 mg/kg = 'gold standard' – no pretreatment
  - 1.5 mg/kg – with pretreatment
  - Clinically acceptable IC : 0.6 mg/kg
- Pretreatment with curare ?
  - 1/10 dose reduces the side effects of sux (0.03 mg/kg or 2 mg/70 kg roc)
  - 3 min before sux
  - But difficult breathing, weakness, …
- Excellent intubating conditions achievable after 60 seconds ?
- Dose adjustments for the pregnant patient ?

El-Orbany, Anesth Analg, 2010

precurarisation

- D-tubocurarine
- 3 min before sux
- 1/10 of the ED95
- Rocuronium: 0.03 mg/kg (2mg/70 kg)
- Pharyngeal muscle weakness
- Higher dose of sux whith precurarisation (2mg/kg)

Time to hemoglobin desaturation



Sux 1 mg/kg
Roc 0.6 mg/kg

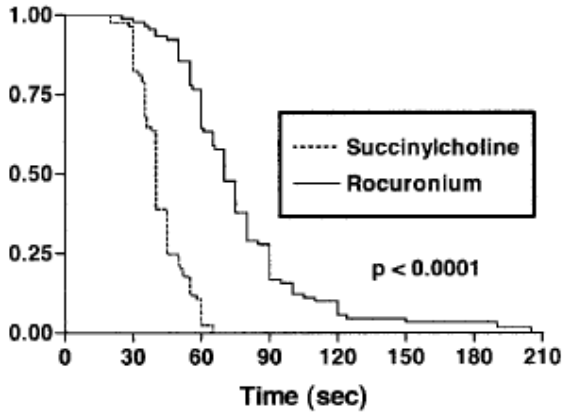


Figure 1. Kaplan-Meyer curve of the probability of the disappearance of a visible motor response to a continuous single-twitch stimulation of the ulnar nerve after injection of succinylcholine or rocuronium. Time 0 denotes the injection of the neuromuscular blocking drug. Curves differ significantly ($P = < 0.0001$; logrank test).

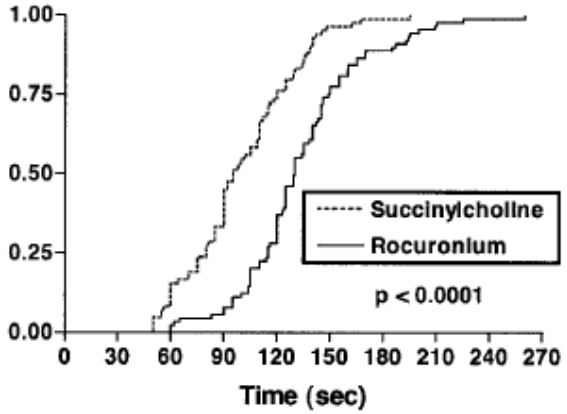


Figure 2. Kaplan-Meyer curve of the probability of the completion of the endotracheal intubation sequence including succinylcholine or rocuronium as the neuromuscular blocking drug. Time 0 denotes the beginning of the injection of the induction drug propofol. The endotracheal intubation sequence was defined to be completed upon the first appearance of end-tidal carbon dioxide after intubation. Curves differ significantly ($P < 0.0001$; logrank test).

Controversies

Good intubating conditions

propofol	2.5 mg/kg
rocuronium	0.6 mg/kg

Satisfactory in 90%

propofol: 61 sec

thiopentone: 101 sec

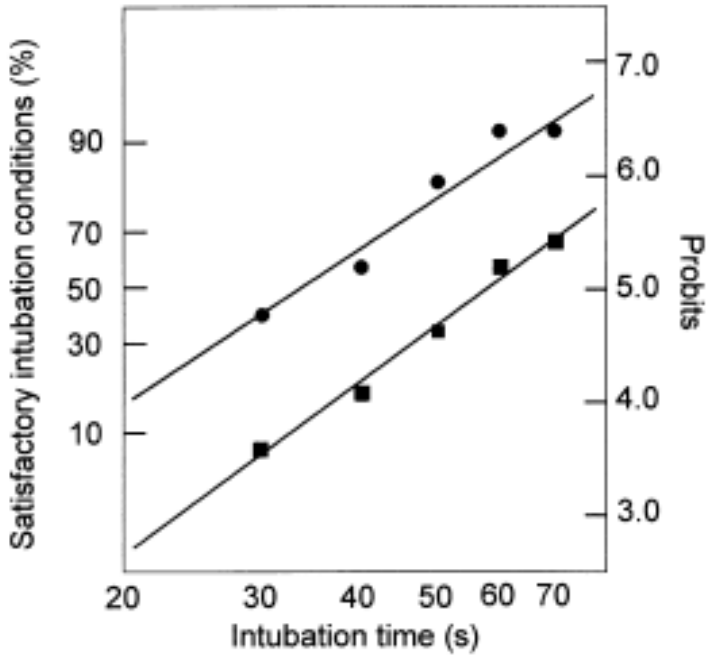


Figure 2 Log time–probit response curves for rocuronium 0.6 mg.kg^{-1} after rapid sequence induction of anaesthesia with either propofol 2.5 mg.kg^{-1} or thiopentone 5 mg.kg^{-1}: ● propofol; ■ thiopentone.

Dobson Anaesthesia 1999

Manual ventilation ?

- Gastric insufflation !
- Time enough after preoxygenation

- Gentle mask ventilation is acceptable to some experienced practitioners
- <15 cm H_2O: no gastric insuf (no CP)
- <45 cm H2O: no gastric insuf with CP

Currently some experts strongly recommend the routine use of PPV

- Traditionally no opioid during induction
  - Slower onset times
  - Respiratory depressant effect during preoxyg
- Now fast acting opioids

Manual ventilation

- Avoidance of PPV before intubation
- Gentle bag-mask ventilation: < 15 mmHg

Adequate depth of anesthesia

Premature application of CP: retching and vomiting
Lowering of LES when pressure is applied

- All reasonable steps should be taken to empty the stomach and oesophagus before anesthesia is induced
- First choice IV but, … in the seriously ill inhalational induction may be preferred
- 23 high risk cases: no problems !!

Cricoid pressure

Table 1 Application of cricoid pressure and incidence of regurgitation and death among patients receiving endotracheal general anaesthesia

	Cricoid pressure applied	Cricoid pressure not applied	Total
All patients having general anaesthesia	2985 (61%)	1906 (39%)	4891
Regurgitation at induction n (% of above)	24 (0.8%)	6 (0.3%)	30
Intra-operative regurgitation	2	4	6
Regurgitation or vomiting at extubation or in recovery	52	51	103
Total regurgitating	78	61	139
Maternal death associated with regurgitation	9	2	11
Maternal death from all causes	57	20	77

Data are n (%).

139 ptn regurgitated
Only 30 at induction
More regurgitation with cricoid pressure

Fenton, Reynolds IJOA 2009

Table 2 Methods of general anaesthesia, use of cricoid pressure and occurrence of regurgitation

Method of anaesthesia	Mothers (% of all general anaesthetics)	Cricoid applied (% of all type of anaesthesia)	Regurgitating during induction, cricoid applied	Regurgitating during induction, no cricoid applied	Regurgitation or vomiting at any other time, all mothers	Total regurgitating
Halothane with tracheal intubation	3124 (64%)	1832 (59%)	9 (0.5%)	4 (0.3%)	68 (2.2%)	81 (2.6%)
Ether with tracheal intubation	1629 (33%)	1057 (65%)	9 (0.85%)	1 (0.2%)	39 (2.4%)	49 (3%)
Ketamine with tracheal intubation	138 (2.8%)	96 (70%)	6 (6.2%)	1 (2%)	2 (1.5%)	9 (6.5%)
Total	4891	2985	24	6	109	139

Data are n (%)

Cricoid pressure: preoperative complications

Table 3 Episodes of regurgitation and deaths with and without cricoid pressure among 751 mothers with pre-operative medical complications (mainly advanced HIV, pneumonia and anaemia) and moderate or severe haemorrhagic shock receiving general anaesthesia

Time	Cricoid pressure applied		Cricoid pressure not applied		Total	
	Regurgitation	Death	Regurgitation	Death	Regurgitation	Death
On induction	15 (3.2%)	8 (1.7%)	2 (0.7%)	0	17 (2.3%)	8 (1.1%)
At other times	10 (2%)	1 (0.2%)	12 (4.2%)	2 (0.7%)	22 (2.9%)	3 (0.4%)
Total regurgitating	25 (5.4%)	9 (1.9%)	14 (4.9%)	2 (0.7%)	39 (5.2%)	11 (1.5%)
Death not associated with regurgitation		39 (8.4%)		12 (4.2%)		51 (6.8%)
Total	463	48 (10.4%)	288	14 (4.9%)	751	62 (8.3%)

Data are numbers regurgitating (% of all patients in treatment group).

vs 2.4% if no preop complications

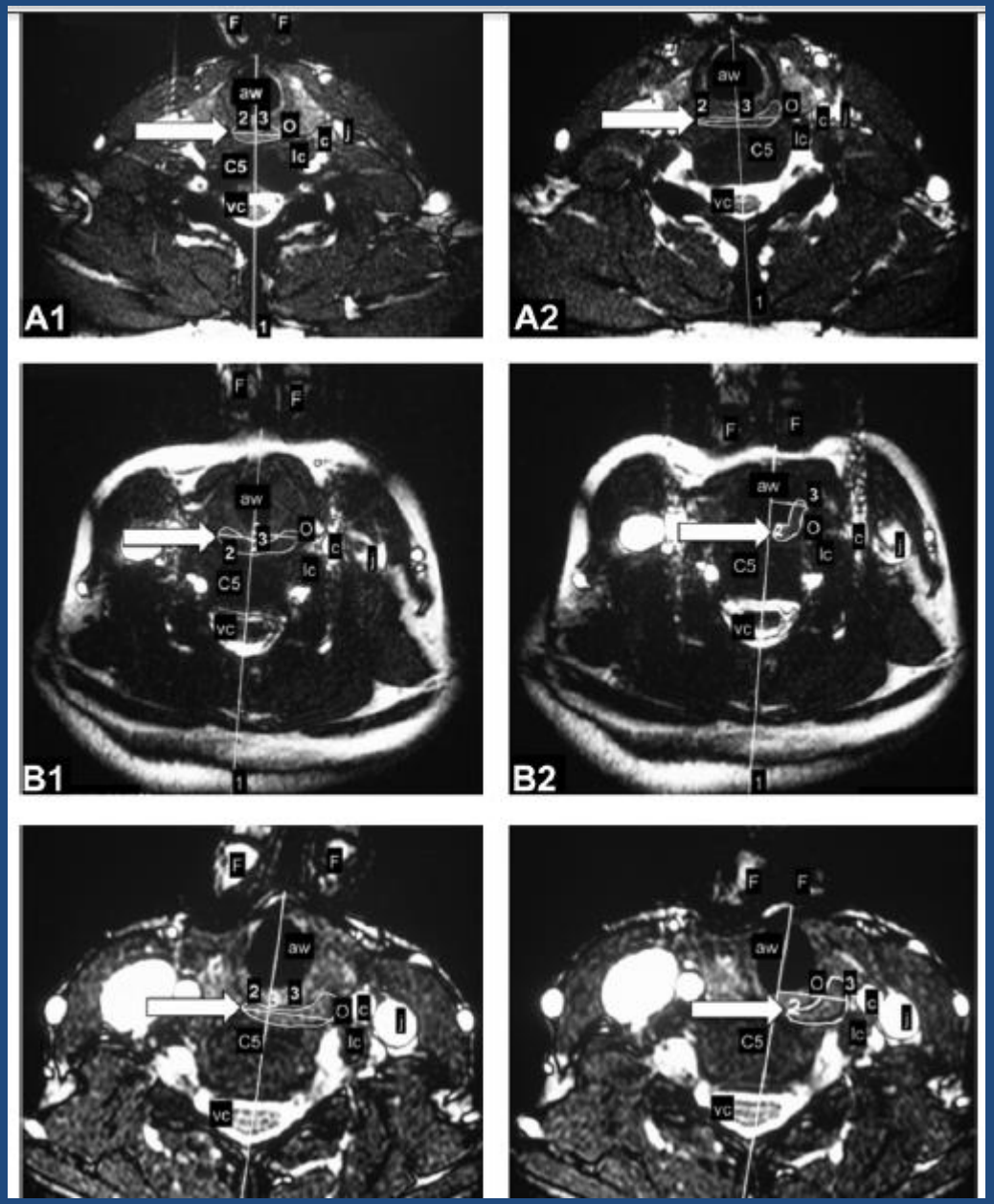
Table 4 Significant risk factors for regurgitation and maternal death among those receiving endotracheal anaesthesia

	Odds ratio (95% CI)		
	Regurgitation on induction	Regurgitation at any time	Maternal death (any cause)
Cricoid pressure applied	2.60 (1.05 to 6.47)	0.80 (0.57 to 1.13)	1.88 (1.10 to 3.20)
Untrained anaesthetist	4.35 (1.98 to 9.54)	1.90 (1.24 to 2.91)	2.36 (1.29 to 4.34)
Preoperative complications	5.63 (2.48 to 12.7)	2.11 (1.40 to 3.17)	20.9 (11.5 to 37.9)
Regurgitation at any time			3.80 (1.81 to 7.98)

no death in regurgitation without preop complications

Cricoid pressure

- No evidence for a protective effect of cricoid Pressure
- Preoperative gastric emptying may be more effective to prevent aspiration
  - Fasting
  - Pharmacologic
  - Gastric tube

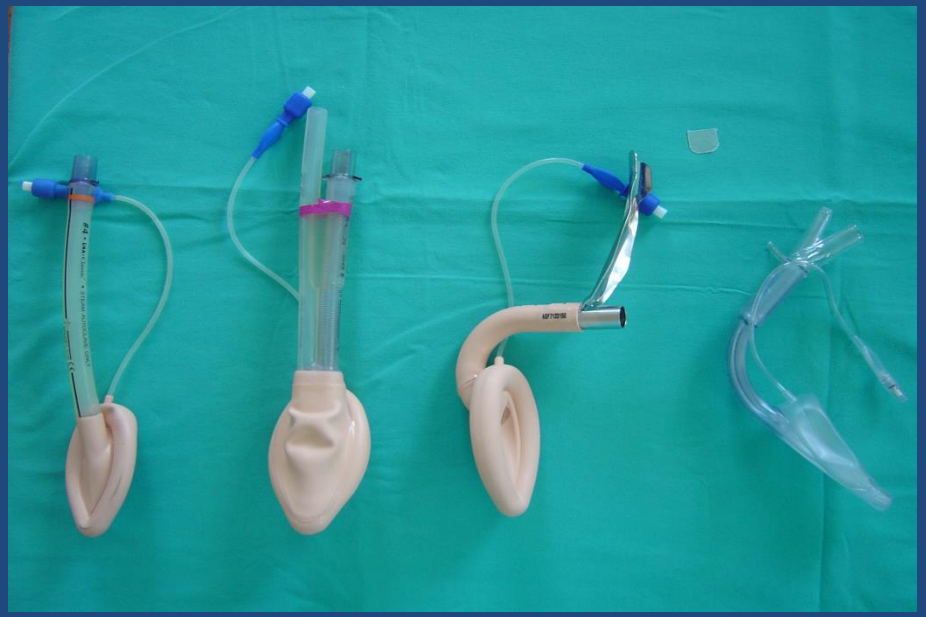


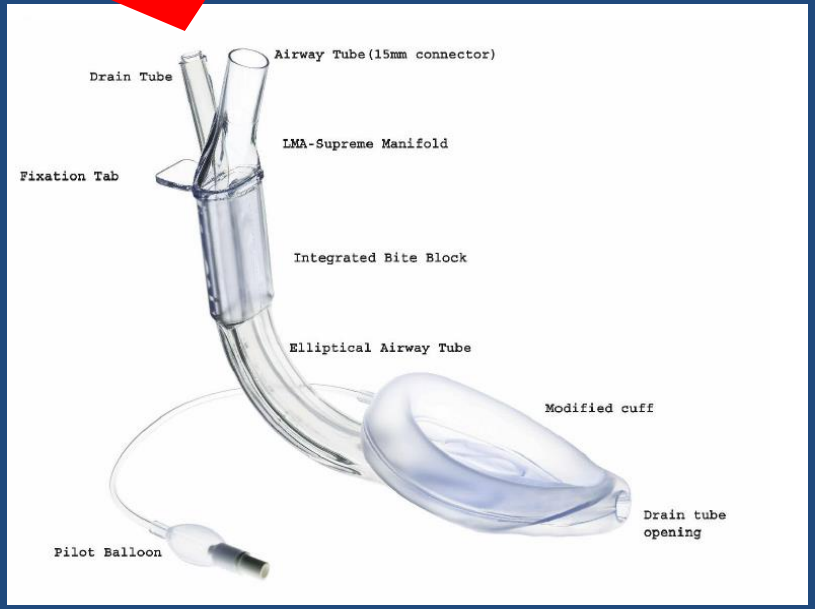
Evidence that airway patency prolongs time to desaturation even when apneu

Laryngeal mask

- LMA effective and probably safe in selected healty patients for elective CS, Can J Anesth, 2001 Han, Brimacombe
- The use of ProSeal laryngeal mask airway in caesarean section-experience in 3000 cases, Halaseh Anaesth Int Care 2010
- Numerous case reports of efficiency of LMA as rescue device

LMA supreme




Airway Tube (15mm connector)
Drain Tube
LMA-Supreme Manifold
Fixation Tab
Integrated Bite Block
Elliptical Airway Tube
Modified cuff
Drain tube opening
Pilot Balloon

- No evidence for decreased incidence of aspiration after rapid sequence induction
- Review of 163 RCT (18 non-pharmacological)

Neilipovitz, Can J Anesth september 2007

Always keep a plan B in mind

Don’t hesitate to initiate it !

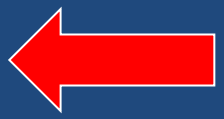
Regional

General anesthesia

Fasting recommendations for healthy patients undergoing elective procedures.

Ingested material	Minimal Fasting Period (applied to all ages)
Clear liquids (water, fruit juices without pulp, carbonated beverages, clear tea, black coffee)	2 hours
Breast milk	4 hours
Infant formula	6 hours
Non-human milk	6 hours
Light meal (toast and clear liquids)	6 hours

- Adults and children should be encouraged to drink clear fluids up to 2h before surgery (including caesarean section)
  - Water, pulp-free juice, tea, coffee without milk
  - Milk added up to about one fifth of total V = clear



- Patients should not have their operation delayed just because they are chewing gum, sucking a boiled sweet, smoking prior to induction

- Obesity, gastro-oesophageal reflux, diabetes, pregnant women not in labour: same guidelines

Perioperative fasting Guidelines ESA, Eur J Anaesthesiol 2011

Absolute vrijheid voor de chirurg:
blijf van mijn operatie planning

Overnight fasting

- Dehydration: - 1 liter: thirst, drowsiness, dizziness
- No regular tablets ??!!
- Compensation: less dizziness, reduction in PONV, more patients discharged same day
- Allowing fluids up to 2 hrs before surgery
- Postoperative insulin resistance: preoperative fluid and carbohydrates !

Clear fluids preoperatively

No differences in gastric volume or lower gastric pH values in children permitted clear fluids vs fasted children

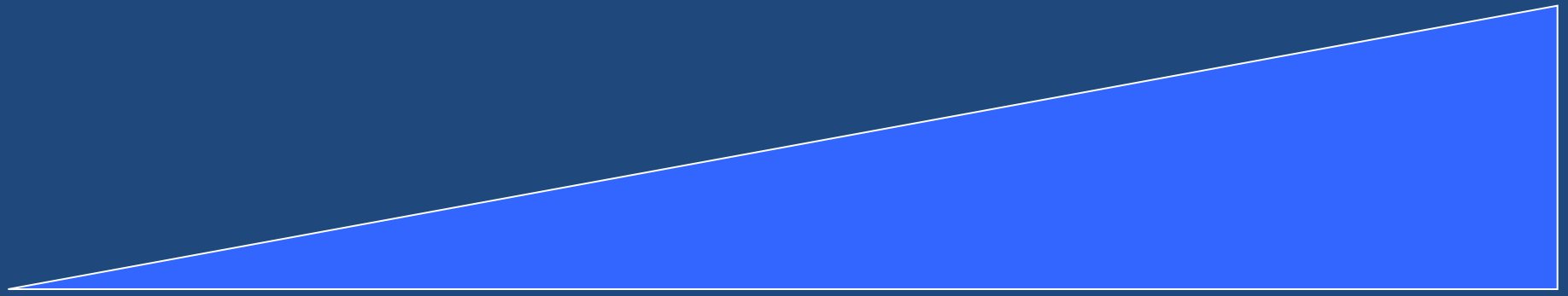
Cochrane, 2009

Half-emptying time of 500 ml saline is 12 min !
1 L water: after 30 min, diuresis X 8

Procedural sedation

Table 1. Continuum of Depth of Sedation: Definition of General Anesthesia and Levels of Sedation/Analgesia

	Minimal Sedation (Anxiolysis)	Moderate Sedation/Analgesia (Conscious Sedation)	Deep Sedation/Analgesia	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful* response to verbal or tactile stimulation	Purposeful* response after repeated or painful stimulation	Unarousable, even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired



Non-anesthesiologist
Outside hospital

Specialist
Supervised nurse
In-hospital

Anesthesiologist

Titration of risk

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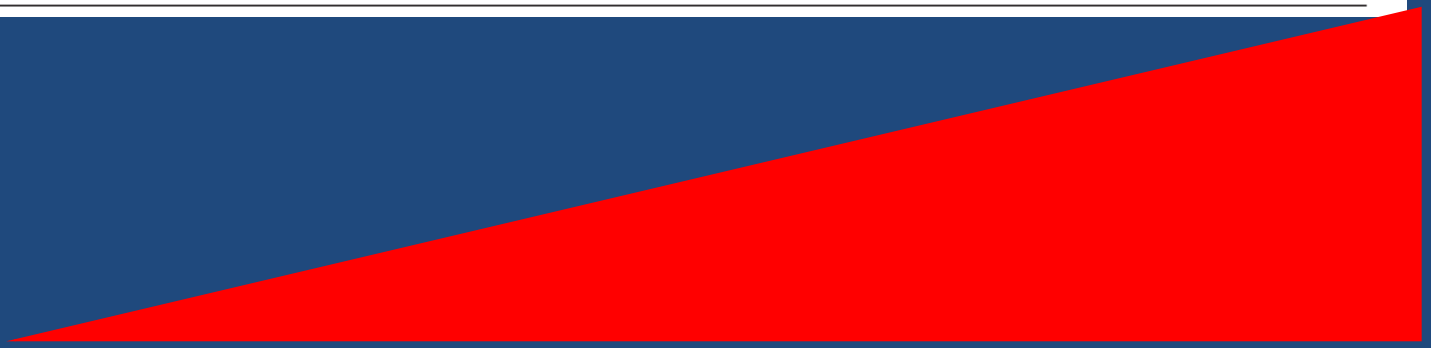

0%
Clinical signs

Saturation
Capnography

70%
Full monitoring

ASA 1

ASA 3-4

NICE clinical guideline

sedation in children and young people

- Fasting is not needed for
  - Minimal sedation
  - Sedation with nitrous oxide
  - Moderate sedation during which the child will maintain verbal contact with healthcare professional
- Deeper levels of sedation (no verbal contact): 2-4-6 rule
- Emergency: patient not fasted: consider urgency, target depth of sedation

Risk factors for aspiration

- Airway difficulties:
  - Laryngospasm
  - Technically difficult intubation
- Old age
- Gastro-oesophageal reflux
  - Hiatus hernia
  - Bowel obstruction
  - Raised ICP

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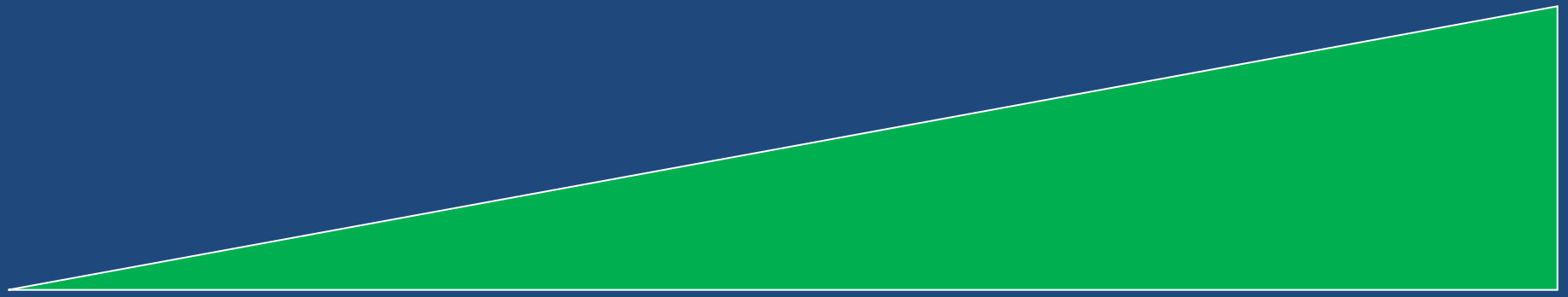


No fasting

Preop fasting
Cfr guidelines

- During GA airway reflexes are lost, and airway manipulations are common vs sedation, no airway manipulations and reflexes intact

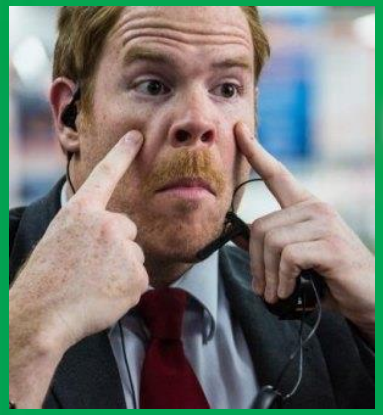
Pre-procedural fasting in emergency sedation.

Emergency Med J 2010

- Adults: 4657 patients were administered emergency sedation
  - 17 case vomited
  - No pulmonary aspiration
- Children: 17672 children were sedated:
  - 156 cases vomited (ketamine)
  - no pulmonary aspiration

The risk of aspiration during emergency procedural sedation is very low, no evidence exists to support pre-procedural fasting

Sedatie is moeilijk



THINK

SAFETY FIRST