Preoperative Fasting - The Slippery Slope of Changing Guidelines

The Impetus for Change

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Overview

- Discuss the evidence “supporting” the status quo
- Discuss the reasons for change
- Win this debate
- Stay friends with everyone!
- Stimulate discussion
• What is the first rule of evidence based medicine?
  – Know the evidence!!!!
• Where did fasting guidelines originate?
Curtis Lester Mendelson

Am J Obstet Gynecol 1946

66/44,016 pregnancies (1932 – 1945) had aspiration (0.15%)

2 deaths due to complete airway obstruction with large particulate matter
Where did fasting guidelines originate?

... Following aspiration of neutral liquid (distilled water, normal saline, or neutralized liquid vomitus) in equal quantities to the preceding series of acid experiments, the animals go through a brief phase of labored respirations and cyanosis, but within a few hours they are apparently back to normal, able to carry on rabbit activities uninhibited. ... The gross pathology was negligible. The ...
“Aspiration of stomach contents into the lungs is preventable. The dangers of this complication as an obstetric hazard may be avoided by: (a) withholding oral feeding during labor and substituting parenteral administration where necessary; (b) wider use of local anesthesia where indicated and feasible; (c) alkalinization of, and emptying the stomach contents prior to the administration of a general anesthetic; (d) competent administration of general anesthesia with full appreciation of the dangers of aspiration during induction and recovery; (e) adequate delivery-room equipment, including transparent anesthetic masks, tiltable delivery table, suction, laryngoscope, and bronchoscope; and (f) differential diagnosis between the two syndromes described, and prompt institution of suitable therapy.”

1. Withhold oral feeding
2. Avoid GA where possible
3. Alkalinize stomach
4. Be competent
5. Be prepared (see 4)
6. Quickly treat the right problem (see 4)
Aspiration Pneumonitis—Mendelson’s Syndrome

Mendelson’s Syndrome, or postoperative aspiration pneumonia, was first described in obstetrical cases by Mendelson in 1946. Classically, there is a history of vomiting after inhalation anesthesia, either during the operation or in the early postoperative period. Two to five hours after aspiration there is a dramatic onset of cyanosis, dyspnea, tachycardia, and shock. Examination of the patient shows no localized signs of lung disease but generalized adventitious sounds and bronchospasm. The patient presents pulmonary edema with rales, wheeze, and rhonchi throughout both lungs. There is a bloody, frothy sputum and marked pulmonary congestion. A very high pulse and respiratory rate are common, and gross pulmonary edema may supervene, with a rapidly deteriorating course resulting in death from cardiac failure. X-ray of the chest shows soft, patchy, mosaic scattered through the lung fields but no evidence of lung collapse. Postmortem examination of the lungs will show gross swelling of tissue and a pink frothy edema fluid throughout the trachea, bronchi, bronchioles, and alveoli. Microscopically, peribronchial hemorrhages and exudate, areas of necrosis of bronchiolar epithelium, and a marked leukocytic reaction can be seen. Free hydrochloric acid can often be demonstrated by staining.

Wyckoff has emphasized the prevention of this catastrophe, and it must diligently be pursued. However, aspiration of gastric contents can and will continue to occur, even in the face of conscientious efforts toward prevention. No single method or combination of techniques recommended is completely foolproof. Obvious vomiting is not a prerequisite to the entrance of stomach contents into the respiratory tree.

Silent aspiration is a hazard recognized by all those indoctrinated in the complications attending anesthesia. The origin of material found in the pharynx of an anesthetized individual is not easily identified. The addition of gastric contents to pharyngeal secretions does not always impart a characteristic appearance, odor, or consistency to the resultant material. For these reasons, it is not always easy to know when aspiration of gastric contents has occurred, or when immediate vigorous suctioning and irrigation of the respiratory tract is indicated.

Recognizing the facts that this critical illness can occur in spite of conscientious efforts toward prevention and that relatively little attention is devoted to treatment of this condition in recent literature, we present the following case report.

Report of a Case

The patient, a 55-year-old male, was admitted to Providence Hospital on March 18, 1960, with a diagnosis of acute appendicitis. He had been seen by one of us on Feb. 16, 1960, for a routine physical examination. At that time, the chest x-ray, hemoglobin, white blood cell count, sedimentation rate, and electrolytes were normal. An electrocardiogram taken at that time at the patient's request was normal. He was 5'10" (115 kg) overweight and was placed on a regular diet. Appendectomy was scheduled to begin March 18, when he developed acute abdominal pain associated with nausea, anorexia, and vomiting. The patient denied any history of appendicitis and stated that at admission he had 10,000 per cu. mm. with 85% segmented neutrophils, 17% lymphocytes, and 2% monocytes. The urinalysis was normal, and the flat plate of the abdomen was negative. The diagnosis of acute appendicitis was confirmed at surgery.

He was brought to the operating room for emergency surgery at 2:30 a.m., after having received 100 mg. of penicillin (Benzyl) sodium, 1/4 mg. of neeap, intramuscularly at 1:00 a.m. He was intubated and did not appear depressed. Gastric suction was achieved immediately after injection of 200 mg. of thiopental sodium and 30 mg. of succinylcholine chloride intravenously. Anesthesia was maintained with 2 liters of nitrous oxide, 1 liter of oxygen, and Breithe. Muscle relaxation was achieved with 0.05 mg. of succinylcholine given as an intravenous drip, with a total of 200 mg. being used during the 75-minute procedure. At the termination of surgery, the patient was extubated,4 and making efforts to remove his endotracheal tube and to stand up. Removal of the tube, the patient exhibited immediate and severe hypoxia requiring an additional 40 mg. of neeap sodium for 20 minutes to lower the PaO2 level by artificial ventilation with 100% oxygen and suctioning of the pharynx. After full muscle relaxation had occurred, he was moved to his room at 4:50 a.m., in an apparently good condition.

His postoperative progress was apparently satisfactory until 1 p.m., when he rapidly became acutely and critically ill with a clinical picture of dyspnea, tachypnea, pneumonia, influenza, bloody sputum, and a cough productive of foamy pink fluid. There were rales, wheezes, and rhonchi throughout both lungs. He appeared to have pulmonary edema. An electrocardiogram showed atrial tachycardia. Swellings of the left shoulder was noted. A diagnosis of aspirat pneumonia was entertained clinically and confirmed by postoperative chest x-ray (Fig. 1).

2.6 mg. of hydromorphone, intravenously, and 3000 mg. of atropine in 500 cc. of 5% dextrose in water was administered over 5 minutes. Aspiration of 402 mg. of hydromorphone was given, the patient was semiconscious and deteriorating rapidly. Within the next hour, his dyspnea subsided, by 5 p.m. His chest was clear, he was acetating well, and his color was described as good. By the next morning, he appeared to be completely recovered, although a repeat chest x-ray showed only slight improvement. He was given streptoc and penloquin for 3 days.

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A recent case brought to our attention has led us to reconsider the significance of one of our experiments with Rhesus monkeys, performed in 1974. In this case, which cannot be reported fully because of continuing litigation, a young woman anesthetized without endotracheal intubation aspirated gastric contents into her airway. The gastric volume, greater than 0.4 mL/kg and with pH less than 2.5, was never published.

• gastric residual fluid volume >0.8 mL/kg and pH <2.5
Problems

- Problems with the concept of volume reduction
  - The stomach is never empty!!
• Splinter WM, and Schaefer JD: Ingestion of clear fluids is safe for adolescents up to 3 h before anaesthesia. Br J Anaesth 1991; 66: pp. 48-52
• Schreiner MS, Triebwasser A, and Keon TP: Ingestion of liquids compared with preoperative fasting in pediatric outpatients. Anesthesiology 1990; 72: pp. 593-597
6-4-2
Problems with the 6 hour part

Introduction

While prospective fasting is the main concept in anesthesia to prevent perioperative pulmonary aspiration of gastric contents in elective procedures, prolonged fasting has negative impact on intravascular volume status, blood glucose level, behavioral, and patient/patient satisfaction (1). Discomfort resulting from hunger and thirst is clearly in favor of shorter fasting times of 2 h for clear fluids. Both comfort and safety issues have been considered in currently used fasting guidelines, e.g., the fasting guidelines of the American Society of Anesthesiology (ASA) which recommend 2 h fasting for clear fluids, 4 h for breast milk and formula, and 4 h for food and other fluids (2). According to several surveys, liberalized fasting times seem to be generally applied, but with some variations in clinical practice (3–5). In the authors’ institution, the concept of 2 h fasting for clear fluids and 4 h for other fluids and light meals has been established several years ago and is routinely applied in children undergoing general anesthesia or deep sedation with the preservation of spontaneous ventilation (6,7).

Modern magnetic resonance scanners produce high resolution images and allow accurate volume measurement of various organs (8,9). Magnetic resonance imaging (MRI) has been used in adults to examine gastric volume and emptying (10–13) and as a procedure.
• What does the literature say about actual patient outcomes?
• Does fasting actually reduce risk of aspiration?
Table 1. Procedures Performed by NPO Status

<table>
<thead>
<tr>
<th>Procedure</th>
<th>NPO</th>
<th>Not NPO</th>
<th>Missing NPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 82,546</td>
<td>25,401</td>
<td>31,195</td>
<td></td>
</tr>
<tr>
<td>Airway (bronchoscopy)</td>
<td>713 (0.86)</td>
<td>202 (0.80)</td>
<td>369 (1.18)</td>
</tr>
<tr>
<td>Bone (fracture reduction)</td>
<td>1,699 (2.06)</td>
<td>949 (3.74)</td>
<td>554 (1.78)</td>
</tr>
<tr>
<td>Cardiac (catheterization or echocardiogram)</td>
<td>966 (1.17)</td>
<td>303 (1.19)</td>
<td>480 (1.54)</td>
</tr>
<tr>
<td>Dental</td>
<td>485 (0.59)</td>
<td>70 (0.28)</td>
<td>94 (0.30)</td>
</tr>
<tr>
<td>Foreign body removal (nose, ear, or skin)</td>
<td>9 (0.01)</td>
<td>5 (0.02)</td>
<td>9 (0.03)</td>
</tr>
<tr>
<td>Gastrointestinal (upper or lower endoscopy)</td>
<td>9,794 (11.86)</td>
<td>638 (2.51)</td>
<td>2,619 (8.40)</td>
</tr>
<tr>
<td>Oncology (lumbar puncture or bone marrow)</td>
<td>14,226 (17.23)</td>
<td>2,199 (8.66)</td>
<td>4,254 (13.64)</td>
</tr>
<tr>
<td>Neurology (EEG)</td>
<td>4,623 (5.60)</td>
<td>1,476 (5.81)</td>
<td>1,923 (6.16)</td>
</tr>
<tr>
<td>Ophthalmology examination</td>
<td>68 (0.08)</td>
<td>30 (0.12)</td>
<td>31 (0.10)</td>
</tr>
<tr>
<td>Radiology (MRI or CT scan)</td>
<td>44,168 (53.51)</td>
<td>17,963 (70.72)</td>
<td>18,789 (60.23)</td>
</tr>
<tr>
<td>Sexual abuse examination</td>
<td>15 (0.02)</td>
<td>3 (0.01)</td>
<td>8 (0.03)</td>
</tr>
<tr>
<td>Surgical (minor procedure)</td>
<td>6,881 (8.34)</td>
<td>1,914 (7.54)</td>
<td>2,548 (8.17)</td>
</tr>
</tbody>
</table>

Entries in each cell are the counts and column percentages stratified by NPO status. For example, airway procedures comprised 0.86% of the 82,546 procedures for which NPO status is known. Examples are given in parentheses for some procedures and are not meant to be an exhaustive classification. CT = computed tomography; EEG = electroencephalogram; MRI = magnetic resonance image; NPO = nil per os.
<table>
<thead>
<tr>
<th>Major complications*</th>
<th>Rate per 10,000 (95% CI)</th>
<th>Events</th>
<th>N</th>
<th>Odds Ratio (95% CI for Odds Ratio)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPO</td>
<td>5.57 (4.08–7.43)</td>
<td>46</td>
<td>82,546</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Not NPO†</td>
<td>5.91 (3.31–9.74)</td>
<td>15</td>
<td>25,401</td>
<td>1.06 (0.55–1.93)</td>
<td>0.88</td>
</tr>
<tr>
<td>Not NPO for liquids‡</td>
<td>0.00 (0–79.2)</td>
<td>0</td>
<td>464</td>
<td>0.00 (0.00–14.86)</td>
<td>1.00</td>
</tr>
<tr>
<td>Aspiration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPO</td>
<td>0.97 (0.42–1.91)</td>
<td>8</td>
<td>82,546</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Not NPO†</td>
<td>0.79 (0.10–2.84)</td>
<td>2</td>
<td>25,401</td>
<td>0.81 (0.08–4.08)</td>
<td>0.79</td>
</tr>
<tr>
<td>Not NPO for liquids‡</td>
<td>0.00 (0–79.2)</td>
<td>0</td>
<td>464</td>
<td>0.00 (0.00–85.57)</td>
<td>0.83</td>
</tr>
</tbody>
</table>

* Major complications defined as death, aspiration, cardiac arrest, or unplanned admission. † Defined as NPO for solids and nonclears but not NPO for liquids (< 2h).
‡ Defined as solids < 8h or nonclears < 8h or liquids < 2h.
NPO = nil per os.
Pulmonary aspiration is rare, the associated morbidity and mortality is hard to study.
Pediatric Anesthesia

Pulmonary aspiration in pediatric anesthetic practice in the UK: a prospective survey of specialist pediatric centers over a one-year period

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Keywords
paediatric, anaesthesia; complications; pulmonary aspiration; mortality

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Summary

Background: Pulmonary aspiration of gastric contents is a potentially devastating complication of anaesthesia.

Aims: This prospective multicenter survey of specialist pediatric centers in the UK set out to establish the incidence, risk factors, and the outcomes of such events. The survey took place over a twelve-month period via a web-based secure reporting system.

Results: Over the twelve-month period, 24 cases of pulmonary aspiration were reported. Over that time period, there were 118,371 cases performed at the eleven pediatric centers. The overall incidence of pulmonary aspiration is therefore 1 in 4952 cases or 1 in 10,000 cases. Over that time period, there were 18 cases during elective surgery and six cases in non-elective/emergency surgery. The incidence of pulmonary aspiration in the elective situation is therefore 1 in 5078 cases or 2.2 per 10,000 cases. The incidence in emergency procedures is 1 in 498 cases or 2.2 per 10,000 cases. The timing and severity of desaturation were recorded. In the study period, 8 of 24 cases did not deteriorate, 13 of 24 deteriorated with immediate effect, and the further 3 of 24 deteriorated within the next hour. The deterioration was mild in 11 patients requiring medical management only, and the deterioration was severe in five patients. These five patients required ventilation for varying durations of time. All patients made a full recovery.

Conclusions: This multicenter survey of specialist pediatric centers in the UK over a one-year period reveals a low incidence of pulmonary aspiration in both elective and emergency cases. All patients made a full recovery.

Introduction

Pulmonary aspiration remains a potentially devastating complication of anaesthesia in all age groups. The incidence has been previously estimated in the adult population at 1 in 2800 (1.7 per 10,000) and 1 in 5000 (1.6 per 10,000) cases (1,2). Some studies have shown that pulmonary aspiration occurs more frequently in children (3). Warren et al. (4) from the Mayo Clinic published their experience in 1999. They reported an overall incidence of pulmonary aspiration in children of 1 in 2523 (3.8 per 10,000). This group noted a much higher rate of aspiration during emergency procedures of 1 in 377 (2.5 per 10,000) cases against a rate of 1 in 4544 cases during elective procedures.

- 118,371 cases (included 12 pediatric centers)
- 2/10,000 cases overall
- 2.2 per 10,000 cases for non-elective
- 16 of the 24 cases deteriorated required care
- 5 required ICU
- no deaths
• Overall mortality estimate 1/45000 to 1/180,000
• About ¼ due to aspiration
<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock climbing</td>
<td>25 hours</td>
</tr>
<tr>
<td>Regular skydiving</td>
<td>50 hours</td>
</tr>
<tr>
<td>Riding a motorcycle</td>
<td>55 hours (cross-country, one way)</td>
</tr>
<tr>
<td>Being a 65-year-old man</td>
<td>336 hours (2 weeks)</td>
</tr>
<tr>
<td>Skiing</td>
<td>340 hours</td>
</tr>
<tr>
<td>Flying on a scheduled airline</td>
<td>1,200 hours</td>
</tr>
</tbody>
</table>

About 5 hr of commercial flight

• What am I Actually Advocating?

−6-4-0
Pediatric Anesthesia

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

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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 1-10/10 000.

What this article adds

- With a regimen allowing free clear fluids until called to the operating suite the incidence of pulmonary aspiration was 1/10 000.

Implications for translation

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

Keywords:
- anesthesia; general; pediatric; fasting; hypoglycaemia; aspiration; aspiration of gastric contents; incidence

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Summary

Background: International guidelines recommend 2 h of clear fluid fasting prior to general anesthesia. The pediatric anesthesia unit of Uppsala University Hospital has been implementing a more liberal fasting regime for more than a decade: thus, children scheduled for elective procedures are allowed to drink clear fluids until called to the operating suite.

Aim: To determine the incidence of perioperative pulmonary aspiration in pediatric patients allowed unlimited intake of clear fluids prior to general anesthesia.

Method: Elective pediatric procedures between January 2005 and December 2013 were reviewed retrospectively by reviewing anesthesia charts and discharge notes in the electronic medical record system. All notes from the care unit and available clear fluids were examined for cases showing vomiting, regurgitation, and/or aspiration. Pulmonary aspiration was defined as radiological findings consistent with aspiration and/or postoperative symptoms of respiratory distress or vomiting during anesthesia.

Results: Of the 10 015 pediatric anesthetics included, aspiration occurred in three (0.03%) or 3/10 000 cases. No case required cancellation of the surgical procedure, intensive care or ventilation support, and no deaths attributable to aspiration were found. Pulmonary aspiration was suspected, but not confirmed by radiology or postoperative symptoms, in an additional 1 case.

Conclusion: Shortened fasting times may improve the perioperative experience for parents and children with a low risk of aspiration.

10 015 pediatric cases retrospectively review

- 3 aspirations
  - 0 cancellations
  - 0 ICU admissions
  - 0 deaths
• What’s the harm in current fasting guidelines?
• 1350 consecutive healthy children

• Mean fasting times
  – 12 hours solids
  – 8 hours fluids

• Majority of children were very hungry or starving!
Improved hemodynamics and metabolic state
<table>
<thead>
<tr>
<th>Risk</th>
<th>Annual</th>
<th>Lifetime</th>
</tr>
</thead>
<tbody>
<tr>
<td>You will die of heart disease.</td>
<td>1:340</td>
<td>1:3</td>
</tr>
<tr>
<td>You will die of cancer.</td>
<td>1:500</td>
<td>1:5</td>
</tr>
<tr>
<td>You will die in an automobile accident.</td>
<td>1:5,000</td>
<td>1:45</td>
</tr>
<tr>
<td>You will be murdered.</td>
<td>1:11,000</td>
<td>1:93</td>
</tr>
<tr>
<td>You will die from AIDS.</td>
<td>1:11,000</td>
<td>1:97</td>
</tr>
<tr>
<td>You will die in an airplane crash.</td>
<td>1:250,000</td>
<td>1:4,000</td>
</tr>
</tbody>
</table>

I'd like to make a rebuttal.
• Scientometrics
  – The science of measuring and analyzing science
  – In fact – Medical facts have half lives!!
The half-life of truth was 45 years
• Central Venous Pressure
  – Good for Fluid Responsiveness

**Conclusions:** There are no data to support the widespread practice of using central venous pressure to guide fluid therapy. This approach to fluid resuscitation should be abandoned. *(Crit Care Med 2013; 41:1774–1781)*
KEEP CALM & ACCEPT CHANGE