Starvation before surgery: is our practice based on evidence?

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The misery articulated by patients denied their morning ‘cuppa’ before coming to hospital for surgery is long-established and apparently ineradicable. A recent (February 2016) small audit of 44 adult patients admitted for elective surgery in five specialties in Oxford found that they had been denied (or denied themselves) drink for an average of 9 h (range 2–24 h) and food for 14 h (range 6–22 h) before being anaesthetized. These data are similar to those acquired 3 years earlier in the same trust in 190 elective patients in 17 surgical specialties, which showed that 70% of patients were fasted over twice the recommended length of time for both food (6 h) and drink (2 h), and 97% starved longer than required (Dr Medha Varanese, personal communication). This aspect of the preoperative care of patients in the immediate period before surgery does not bring us credit, even though its occurrence appears widespread and resistant to efforts aimed at change.\(^1,4\)

In contrast, it is salutary to remind ourselves that aspiration of stomach contents has historically been regarded as a major life-threatening problem associated with anaesthesia. In the USA, in 1951, a study of 300 surgical patients found regurgitation of stomach contents in 26% and aspiration of such material into the lungs in 16%; frank vomiting occurred perioperatively in another 8% of patients. Morbidity and mortality figures for the series were not given.\(^5\) In that study, tracheal tubes, where present (in 72% of cases), had no cuffs, and little influence on whether regurgitated stomach contents found their way into the trachea. In the UK, in 1956, a report of 598 deaths associated with anaesthesia found 110 (18%) to be associated with either regurgitation or vomiting; many of these were cases of emergency abdominal surgery.\(^6\)

What perhaps is more difficult to judge from the early literature is the extent to which individual episodes of regurgitation and aspiration carried a high risk of serious injury or death. The classic paper in the field, that of Mendelson in 1946, reported 66 cases of aspiration during obstetric anaesthesia, an incidence of 0.15% of 44 016 pregnancies in New York.\(^7\) Two deaths occurred, each from solid material obstructing the airway. One interpretation of this early study might be that, despite the aspiration leading to cyanosis, tachycardia, and dyspnoea in most of the

**Key points**

- Adults attending for elective surgery continue to be starved excessively.
- Studies of stomach emptying show that 6 h starvation is sufficient for solid meals of moderate size.
- Studies after liquid alone show an exponential course over time, with a half-time (\(T_{1/2}\)) that depends upon calorific content. For tea with milk, \(T_{1/2}\) is \(\sim 25\) min; for water, \(T_{1/2}\) is \(\sim 15\) min.
- Current ESA guidelines recommend starvation times of 6 h from ‘solid food’ and 2 h from liquids, which may now include tea or coffee with 20% milk.
- Aspiration or airway obstruction from food can occur even following prolonged starvation.

The misery articulated by patients denied their morning ‘cuppa’ before coming to hospital for surgery is long-established and apparently ineradicable. A recent (February 2016) small audit of 44 adult patients admitted for elective surgery in five specialties in Oxford found that they had been denied (or denied themselves) drink for an average of 9 h (range 2–24 h) and food for 14 h (range 6–22 h) before being anaesthetized. These data are similar to those acquired 3 years earlier in the same trust in 190 elective patients in 17 surgical specialties, which showed that 70% of patients were fasted over twice the recommended length of time for both food (6 h) and drink (2 h), and 97% starved longer than required (Dr Medha Varanese, personal communication). This aspect of the preoperative care of patients in the immediate period before surgery does not bring us credit, even though its occurrence appears widespread and resistant to efforts aimed at change.\(^1,4\)

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Starvation before surgery

In 66 cases, the only deaths occurring were from suffocation by solids and that aspiration of liquid into the airway was much less harmful. Nevertheless, the frequency of reports of disasters associated with aspiration over many years rightly makes avoidance of this complication of anaesthesia a huge priority for every patient anaesthetized.

Our aim in this educational piece is to focus on the evidence underlying the starvation of adult patients for elective surgery while reminding the reader of some of the physiological factors associated with delayed stomach emptying and some of the published recommendations.

Stomach emptying after meals containing solid food

Mendelson reported that the two patients in his series who died from suffocation brought about by solid food had ingested their meals 8 and 6 h before the attempt to anaesthetize them. These obstetric patients are a reminder that, in some circumstances, the stomach retains undigested food for a very long period of time.

Physiological stomach emptying after meals of different sizes was studied thoroughly by Moore et al. in 1981 using separate isotopes for the solid and liquid elements of meals. Figure 1 shows their data for the retention of food (and liquid) in the stomachs of 10 healthy males eating 14 meals to satiety over 30 min following a 20 h period of starvation. We note that 1.7 kg of food and drink was consumed, in approximately equal quantities, and that the solid food component was removed approximately linearly over time with a time to half emptying (T\textsubscript{1/2}) of 277 min (~4.5 h). These data, if extrapolated from 5.5 h, suggest that a traditional preoperative 6 h fast following such a large meal may leave ~30% of the solid component in the stomach.

Moore et al. compared their findings for the large meal with those for smaller meals of total mass 900 g and 300 g, both half solid and half liquid, and found striking differences with T\textsubscript{1/2}, respectively equal to 146 and 77 min (Table 1). For these smaller meals, extrapolation of their measurements suggests that no solid food would remain at the traditional 6 h starvation time. A helpful way of thinking of the rate at which solids leave the stomach is that a wide range of intermediate meal sizes (~150-450 g of solids) all empty at a fairly constant rate in terms of grams per minute in the approximate range 1.0–1.5 g min\textsuperscript{-1} in a linear manner. With such ‘zero-order’ elimination kinetics, the use of a half-life (T\textsubscript{1/2}) can be misleading, unless it is clear that it is measured from the time of meal consumption.

The ‘theatre breakfast’ has been of interest. Cornflakes with sugar and milk were followed by Heading et al. who found a near-linear elimination of the solid component with T\textsubscript{1/2} = 102 min (Table 1). Miller et al., writing from a setting in which the standard fast after a small breakfast was 2–4 h, found that buttered toast with tea or coffee and milk left a residual volume in the stomach at ~3.5 h that was not significantly different from the volume after a fast of ~12 h, in both cases ~10 ml (Table 1). In this case, direct sampling of liquid from the stomach by tube was used following induction, a technique recognized as incapable of retrieving sizeable solid lumps of food.

The use of separate isotopes to label solid and liquid food has made it possible to identify the stomach emptying of these components concurrently. As shown in Figure 1, liquid is more speedily removed from the stomach and the emptying tends to take a more exponential course. As for the solid component, T\textsubscript{1/2} is greater the larger the volume of liquid present in such a meal.

Newer techniques using ultrasound or magnetic resonance imaging have not been able to follow separately the emptying of solid and liquid components of a normal mixed meal but have tended to confirm the findings of the earlier studies for separate solid and liquid meals, namely the fairly linear elimination of solid foods and the more exponential elimination of liquids.

Table 1 lists the findings from several studies of stomach emptying after meals containing solids. Table 2 summarizes the influences of several factors on the physiological rates of emptying of solid and liquid components of meals, including meal size, time of day, and age.

Stomach emptying after meals containing only liquids

Several studies are available from which we can assess the speed of emptying of the stomach following liquid intake. Figure 2 shows an example time course of stomach emptying from a study of 11 healthy volunteers following a 300 ml drink of beef extract in water. Two measurement techniques gave indistinguishable values for T\textsubscript{1/2}, at 20 min. The traditional term ‘clear fluids’ seems to have been introduced to encourage exclusion of milk. To what extent a beef-extract drink can be regarded as ‘clear’ will be a subjective judgement. Concern to permit patients both to relieve their sense of thirst and to have some choice with regard to what to drink led Hutchinson et al. to compare the effects a cup (150 ml) of either coffee or orange juice taken 2–3 h before operation with an overnight fast on stomach contents and pH (see Table 3). No significant differences were found. Of relevance is that coffee has been found elsewhere not to affect gastric emptying of a liquid meal in healthy volunteers.

In a partner study to that of Hutchinson et al., the addition of ranitidine to drinks of coffee or orange juice was found to increase stomach pH substantially (Table 3) and reduce the proportion of patients from about half to ~7% who had the combination of content volume >25 ml plus pH <2.5 that had established itself as a level of concern at that time. A further study from the Calgary group, without ranitidine, found in 211 patients that the time of consumption of a 150 ml drink, in this case of tea, coffee, apple juice, or water, in the time range 3–8 h and beyond, had no effect on volume or pH. Although these

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**Figure 1** Time course over 5.5 h of the percentage retention in the stomach of a large meal. Ten healthy males (25–43 y) consumed a total of 14 meals, each over 30 min after a 20 h solid food fast. The meal was self-selected from a wide range of food and drink. The average meal weight was 1692 g; the liquid–solid ratio was 1:10; mean kilocalorie consumption was 1945 provided by 34% carbohydrate, 21% protein, and 45% fat. Figure drawn from the data of Moore et al. Error bars show standard error of the mean.
articles from Canada did not mention milk, subsequent enquiry showed that some patients were permitted milk in their tea or coffee.34

A study from Norway examining volumes of water from 20 to 450 ml ingested with diazepam 1.5 h before induction of anaesthesia found no effect of drink volume on stomach contents or pH (Table 3) and therefore made a case for reducing the time between a modest intake of water and surgery to 1–2 h in healthy patients, but made the observation that the larger volumes often led to an inconvenient diuresis shortly before surgery was due to commence.28

A period followed these studies in which the uptake and subsequent physiological effects of a wide variety of drinks containing carbohydrates, amino acids, and peptides have been studied using different modalities.35–41 Potential indications for the widespread application of these potentially expensive potions is limited by availability and the fact that patients may have to be given them to take home for preoperative use.

Returning to the more universally available liquids, a recent study asked ‘Does adding milk to tea delay gastric emptying?’ Hillyard et al.29 used both the paracetamol absorption technique and ultrasound to compare stomach emptying after 300 ml of black tea or the more traditional ‘cuppa’ consisting of 250 ml of tea and 50 ml of (full-fat, 4%) milk (Table 3). No significant difference was found in either measure; T½ measured by ultrasound was close to 23 min. An expectation that milk might increase the emptying time of a drink recently led Okabe et al.32 to examine the hypothesis that it is the calorific value of a drink, rather than its volume, that determines the rate with which it leaves the stomach. Useful their study used commonly available milk, orange juice, and water (as well as ‘gum syrup’ with which to manipulate calorific content). Their results are shown in Figure 3.

Several striking features are contained within these data. First, we see that a drink of 500 ml of water is largely absorbed within 30 min and no longer detectable at 60 min, consistent with the findings of other similar experiments.37,42 Second, 20% of a large (500 ml) intake of milk appears to remain in the stomach 2 h after it is drunk, whereas a smaller dose of milk (330 ml) is removed in 120 min. Third, these data support the hypothesis that it is the energy content of the drink that determines the T½ of the exponential absorption. Interestingly, the pairs of drinks of similar calorific value had very different osmolarities, suggesting that this property of a liquid in the stomach does not play a major role in its rate of elimination. This in turn suggests that absorption across the wall of the stomach is unlikely to be a major route of exit from the stomach.

Table 3 gives the findings of several studies on gastric emptying after the intake of liquids alone.

### Published guidelines regarding preoperative starvation

Modern guidelines for preoperative starvation can be regarded as similar to that given by Lord Lister in 1882: ‘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.’27 Of the many guidelines from recent years, those from 2011 of the European Society of Anaesthesiology (ESA)34 and the American Society of Anesthesiologists (ASA)35 are influential and typical.

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### Table 1 Gastric emptying after meals containing solids. The results of studies examining stomach emptying in healthy volunteers of meals containing solids. T½, time to half emptying of the stomach; SEM, standard error of the mean. *No significant difference found; †no significant difference found.

<table>
<thead>
<tr>
<th>Meal/drink</th>
<th>Reference</th>
<th>T½ (SEM) min</th>
<th>Time to assay (min)</th>
<th>Rate of emptying (g min⁻¹)</th>
<th>Residual pH</th>
<th>Residual volume (mL)</th>
<th>Comment</th>
<th>Participant number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cornflakes, sugar (35 g) and milk (150 ml)</td>
<td>Heading et al.3</td>
<td>102 (20) solids, 33 (5) liquid</td>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td>9 adults</td>
</tr>
<tr>
<td>Filling meal (1692 g) – half liquid</td>
<td>Moore et al.8</td>
<td>277 (44) solids, 178 (22) liquid</td>
<td></td>
<td>1.9</td>
<td></td>
<td></td>
<td>See Fig. 1 near-linear emptying of solids</td>
<td>10 males</td>
</tr>
<tr>
<td>900 g meal, half liquid</td>
<td>Moore et al.8</td>
<td>146 (26) solids, 81 (12) liquid</td>
<td></td>
<td>1.5</td>
<td></td>
<td></td>
<td>Near-linear emptying of solids</td>
<td>10 males</td>
</tr>
<tr>
<td>300 g meal, half liquid</td>
<td>Moore et al.8</td>
<td>77 (5) solids, 40 (4) liquid</td>
<td>199</td>
<td>0.9</td>
<td>1.9† (median)</td>
<td>10.9†</td>
<td>Near-linear emptying of solids</td>
<td>10 females</td>
</tr>
<tr>
<td>Buttered toast with tea/coffee with milk</td>
<td>Miller et al.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Study of 4 h fast from light meal</td>
<td>11 females</td>
</tr>
<tr>
<td>No intake for 12 h</td>
<td>Miller et al.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Study of 4 h fast from light meal (control)</td>
<td>16 males</td>
</tr>
<tr>
<td>Small (300 g) meal, half liquid</td>
<td>Goo et al.11</td>
<td>64.8 (6.4) am</td>
<td></td>
<td>1.1</td>
<td></td>
<td></td>
<td>Near-linear emptying of solids</td>
<td>16 males</td>
</tr>
<tr>
<td>Small (300 g) meal, half liquid</td>
<td>Goo et al.11</td>
<td>97.1 (11.5) pm (50% increase)</td>
<td></td>
<td>0.9</td>
<td></td>
<td></td>
<td>Near-linear emptying of solids</td>
<td>16 males</td>
</tr>
</tbody>
</table>
Perhaps the Rolls-Royce of earlier systematic reviews is the 156 page evaluation by Brady et al. in the Cochrane Database of Systematic Reviews of 2003.

The Cochrane review of 2003 identified 38 relevant randomized controlled comparisons made within 22 trials worldwide and reviewed preoperative fasting and the association with perioperative complications. It was undertaken at a time when ‘nil by mouth from midnight’ was still in favour. Under ‘implications for practice’, the authors wrote of their findings:

There was no evidence that participants given fluids two to three hours preoperatively were at an increased risk of aspiration/regurgitation (as measured by their gastric volume and pH) than participants who had followed a standard fast (nil by mouth from midnight). Unsurprisingly, a drink during the preoperative period was noted to be beneficial in terms of patients’ experience of thirst. In addition, there was no indication that participants given fluids up to 90 minutes before induction of anaesthesia were at increased risk of regurgitation/aspiration but this was based on very small numbers of participants.

The ASA recommendation for fluids starvation in healthy adults undergoing elective surgery is as follows:

It is appropriate to fast from intake of clear fluids at least 2h before elective procedures requiring general anesthesia, regional anesthesia, or sedation/analgesia (i.e. requiring monitored anesthesia care). Examples of clear liquids include, but are not limited to, water, fruit juices without pulp, carbonated beverages, clear tea and black coffee. These liquids should not include alcohol. The volume of liquid ingested is less important than the type of liquid ingested.

With regard to starvation from food, the ASA guidelines for these patients can be summarized as 6h from a ‘light meal or non-human milk’ and 8h or more from a meal containing ‘fried or fatty foods or meat’. A ‘light meal’ is said typically to consist of ‘toast and clear fluids’. Interestingly, no routine preoperative use is recommended by the ASA for any pharmacological

### Table 2 Factors found by some studies to be associated with a delay in stomach emptying

<table>
<thead>
<tr>
<th>Factor</th>
<th>Observation</th>
<th>Study group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of day</td>
<td>Solid (but not liquid) meal emptying was slower (by ~50%) in the evening (8 pm) than the morning (8 am)</td>
<td>16 healthy males (21-42 y)</td>
</tr>
<tr>
<td>Size of meal</td>
<td>Solid and liquid meals showed T½ that increased greatly (~×4) with meal mass</td>
<td>10 healthy males (25-43 y)</td>
</tr>
<tr>
<td>Female gender</td>
<td>Following a 300 g meal, for females T½ for solid and liquids were 92 and 54 min, respectively; for males the figures were 60 and 30 min.</td>
<td>15 healthy males (21-53 y) and females (23-44 y)</td>
</tr>
<tr>
<td>Age</td>
<td>The liquid (but not solid) half of a 900 g meal was absorbed more slowly in older than younger men. Retention at 120 min was 40% in older and 25% in younger men.</td>
<td>10 young males (24-51 y) and 10 aged males (71-88 y)</td>
</tr>
<tr>
<td>Menstrual cycle luteal phase</td>
<td>Solid (but not liquid) meal emptying was slower (by 36%) in the luteal phase than the follicular phase</td>
<td>7 normally menstruating females (33-44 y)</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>Following 750 ml of water, T½ was 11 min in pregnancy and 18 min in controls, with respective emptying times of 75 min and 120 min. In 11 labouring women, emptying was prolonged.</td>
<td>11 healthy pregnant Jamaican women (&gt;34 weeks) were compared with 11 healthy non-pregnant women and 11 women in labour.</td>
</tr>
<tr>
<td>Opiates</td>
<td>Morphine (7.5 mg i.v.) --halved the rate of gastric emptying after a small meal of orange juice with an egg sandwich. [Interestingly, Naloxone (2 mg i.v.) had a similar effect.] Even lower doses of morphine may have a substantial effect</td>
<td>6 healthy volunteers (23-32 y)</td>
</tr>
</tbody>
</table>

**Fig 2** Time course over 60 min of the percentage residual volume/radioactivity in the stomach after a 300 ml intake of beef extract (Oxo) in water. Eleven healthy volunteers (5 men, 6 women; 25-72 y) drank the liquid over 3-5 min after an 8 h fast. Green line: data obtained by ultrasound. Blue line: data obtained by scintigraphy using 250 μCi of 99mTc-sulphur colloid. Figure modified from Holt et al. Error bars show standard deviation.

**Table 2** Factors found by some studies to be associated with a delay in stomach emptying
agents relating to the gastrointestinal (GI) system, including GI stimulants (e.g. metoclopramide), H₂-receptor blockers (e.g. ranitidine), proton pump inhibitors (e.g. omeprazole), antacids (e.g. sodium citrate), antiemetics (e.g. ondansetron), or anticholinergics (e.g. glycopyrrolate). Dexamethasone is not mentioned.

European recommendations have shown a degree of liberalization. The Scandinavian guidelines from 2005 included the recommendation of a drink of 150 ml of water (with oral medication) up to 1 h before anaesthesia. The ESA guidelines encourage fluids up to 2 h before elective surgery but present a marked change on the subject of milk: in relation to what constitutes a clear fluid ‘all but one member of the guidelines group consider that tea or coffee with milk added (up to about one fifth of the total volume) are still clear fluids’. Since such drinks are clearly not ‘clear’ in the OED sense of being ‘unclouded’ or ‘transparent’, these recommendations now lack a suitable generic term for what they regard as safe drinks. Given the

<table>
<thead>
<tr>
<th>Meal/drink</th>
<th>Reference</th>
<th>Liquid volume (pH)</th>
<th>$T_{1/2}$ (SEM)</th>
<th>Time to assay (min)</th>
<th>Residual pH</th>
<th>Residual volume (ml)</th>
<th>Comment</th>
<th>Participant number (ages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus pectin with sucrose and water</td>
<td>Hunt et al.</td>
<td>750 (6.5)</td>
<td>21.8 (1.3)</td>
<td>0–120</td>
<td></td>
<td>Exponential emptying</td>
<td></td>
<td>21 (21–50 y)</td>
</tr>
<tr>
<td>Beef extract in water</td>
<td>Holt et al.</td>
<td>300</td>
<td>21(3.0)$^*$</td>
<td>0–60</td>
<td></td>
<td>Exponential emptying</td>
<td></td>
<td>11 (25–72 y)</td>
</tr>
<tr>
<td>Water with ranitidine 150 mg</td>
<td>Sutherland et al.</td>
<td>160</td>
<td>141</td>
<td>2.1</td>
<td>20.6</td>
<td></td>
<td></td>
<td>25 (18–60 y)</td>
</tr>
<tr>
<td>Water with ranitidine 150 mg</td>
<td>Sutherland et al.</td>
<td>160</td>
<td>145</td>
<td>6.7</td>
<td>10.0</td>
<td></td>
<td></td>
<td>25 (18–60 y)</td>
</tr>
<tr>
<td>No intake</td>
<td>Sutherland et al.</td>
<td>10 (indicator)</td>
<td>151</td>
<td>1.7</td>
<td>29.9</td>
<td></td>
<td></td>
<td>25 (18–60 y)</td>
</tr>
<tr>
<td>Ranitidine 150 mg</td>
<td>Sutherland et al.</td>
<td>10 (indicator)</td>
<td>138</td>
<td>6.3</td>
<td>9.7</td>
<td></td>
<td></td>
<td>25 (18–60 y)</td>
</tr>
<tr>
<td>Coffee</td>
<td>Hutchinson et al.</td>
<td>150</td>
<td>151</td>
<td>2.2</td>
<td>24.5</td>
<td></td>
<td></td>
<td>50 (18–60 y)</td>
</tr>
<tr>
<td>Orange juice</td>
<td>Hutchinson et al.</td>
<td>150</td>
<td>163</td>
<td>2.0</td>
<td>23.7</td>
<td></td>
<td></td>
<td>50 (18–60 y)</td>
</tr>
<tr>
<td>No intake</td>
<td>Maltby et al.</td>
<td>150</td>
<td>153</td>
<td>2.0</td>
<td>23.2</td>
<td></td>
<td></td>
<td>50 (18–60 y)</td>
</tr>
<tr>
<td>Coffee with ranitidine</td>
<td>Maltby et al.</td>
<td>150</td>
<td>161</td>
<td>5.7</td>
<td>14.3</td>
<td></td>
<td></td>
<td>50 (18–60 y)</td>
</tr>
<tr>
<td>Orange juice with ranitidine</td>
<td>Maltby et al.</td>
<td>150</td>
<td>142</td>
<td>5.4</td>
<td>14.8</td>
<td></td>
<td></td>
<td>50 (18–60 y)</td>
</tr>
<tr>
<td>Tea, coffee, apple juice, or water</td>
<td>Scarr et al.</td>
<td>0</td>
<td>159</td>
<td>6.2</td>
<td>9.7</td>
<td></td>
<td>No effect of starvation time on pH or volume</td>
<td>50 (18–60 y)</td>
</tr>
<tr>
<td>Water (black)</td>
<td>Hillyard et al.</td>
<td>200</td>
<td>300</td>
<td>22.7</td>
<td>60</td>
<td>As pre-drink</td>
<td></td>
<td>9 (30–36 y)</td>
</tr>
<tr>
<td>Water</td>
<td>Greenfield et al.</td>
<td>330</td>
<td>117</td>
<td>2.0</td>
<td>12.5</td>
<td></td>
<td>Endoscopy patients</td>
<td>44 (mean 46 y)</td>
</tr>
<tr>
<td>Tea (black)</td>
<td>Greenfield et al.</td>
<td>0</td>
<td>overnight fast</td>
<td>2.0</td>
<td>10.0</td>
<td>Endoscopy patients</td>
<td>44 (mean 48 y)</td>
<td></td>
</tr>
<tr>
<td>‘Clear fluids’</td>
<td>Philips et al.</td>
<td>388 (50–1200; 30 ml premixed in 70%)</td>
<td>120$^*$</td>
<td>2.6</td>
<td>21</td>
<td></td>
<td></td>
<td>50 (&gt;18 y)</td>
</tr>
<tr>
<td>No intake</td>
<td>Philips et al.</td>
<td>30 (premixed in 44%)</td>
<td>120$^*$</td>
<td>2.3</td>
<td>19</td>
<td></td>
<td></td>
<td>50 (&gt;18 y)</td>
</tr>
<tr>
<td>Tea with milk (4%)</td>
<td>Hillyard et al.</td>
<td>250 + 50</td>
<td>23.6</td>
<td>60</td>
<td>As pre-drink</td>
<td></td>
<td></td>
<td>9 (30–36 y)</td>
</tr>
<tr>
<td>Water</td>
<td>Okabe et al.</td>
<td>500</td>
<td>60</td>
<td>60</td>
<td></td>
<td>As pre-drink</td>
<td></td>
<td>8 (median 27 y)</td>
</tr>
</tbody>
</table>
potential importance to many of our patients of allowing tea and coffee with up to 20% milk, it is perhaps worth noting the approach taken by the guideline group:

In reaching consensus, particular emphasis was placed upon the level of evidence, ethical aspects, patient preferences, clinical relevance, risk/benefit ratios and degree of applicability. For example, a pragmatic solution to an acceptable amount of milk in tea or coffee was agreed based upon the unpublished experience accumulated by several members of the group over many years.

The more senior of the current authors is reminded of the consultant who taught him as a junior over several years to use the drug chart to prescribe elective Caesarean patients their premedication with a cup of tea 1–2 h before surgery. At least with regard to non-pregnant patients, the recent evidence from studies involving milk add experimental evidence to what is described above as a pragmatic solution.

In relation to food, the ESA guidelines are simple: ‘solid food should be prohibited for 6 h before elective surgery in adults’. It is interesting that the caution suggested in the ASA guidelines regarding meal size is absent here. Recent studies have not examined this matter, but we have seen from the 1981 study depicted in Figure 1 that about 30% of the solid material from a heavy meal can still be present in the stomach even after a 6 h fast. Yet recent evidence has shown that drinks that patients prefer, such as tea with milk and juice, can be regarded at safe up to 1–2 h before surgery in elective patients (Table 3), with 2 h perhaps remaining the best soft target period for practical purposes. For water, 1 h appears entirely satisfactory, with or without medication (Fig. 3).

The evidence we have reviewed reminds us that no patient is excluded from a risk of aspiration of stomach contents, for however long the patient is starved. Large meals have been shown to leave a substantial proportion of food in the stomach even after a 6 h fast (Fig. 1). Yet recent evidence has shown that drinks that patients prefer, such as tea with milk and juice, can be regarded as safe at up to 1–2 h before surgery in elective patients (Table 3), with 2 h perhaps remaining the best soft target period for practical purposes. For water, 1 h appears entirely satisfactory, with or without medication (Fig. 3).

**Declaration of interest**

None declared.

**MCQs**

The associated MCQs (to support CME/CPD activity) can be accessed at http://www.oxforde-learning.com/journals/ by subscribers to BJA Education.

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