

Preoperative Fasting in Children Undergoing Elective Paediatric Surgery

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Background: Pre-operative fasting is important to prevent pulmonary aspiration of gastric contents. Prolonged fasting can have negative metabolic effects which are more pronounced in children. The most recent guidelines recommend preoperative fasting intervals of 6 hours for solid food; 4 hours for formula and non-human milk; 3 hours for breast milk and 1 hour for clear fluids.

This audit assessed local preoperative fasting times amongst the paediatric population undergoing elective surgery within Mater Dei Hospital.

Methods: 113 children under the age of 16 years and who underwent elective surgery within Mater Dei Hospital were enrolled in this audit. The time the child last ate and drank, the time surgery started and duration of surgery were noted from medical records. Results were then anonymised and analysed using a Microsoft Excel® Spreadsheet.

Results: Fasting times ranged from 3 to 20.1 hours with a median of 11.8 hours and a mean fasting time of 11.3 hours.

Most surgeries were planned for the morning and typically the child would start to fast at between 20:00 and 22:00. However, even in surgeries planned for the afternoon, the child still tended to skip breakfast.

Conclusion: This audit highlights the need for increased local awareness about paediatric preoperative fasting guidelines. Initiatives should be directed towards children, relatives and health care workers to optimise the preoperative experience for the child.

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Surgical procedures in the paediatric population are not uncommon, and are increasing in frequency. Amongst the nearly 15,000 procedures performed under general anaesthesia within Mater Dei Hospital in 2021, 600 were elective procedures carried out within the paediatric population.¹

Pre-operative fasting is important to prevent pulmonary aspiration of gastric contents but prolonged fasting can also lead to negative metabolic effects. These include dehydration, ketoacidosis, hypoglycaemia and hypotension on induction. Such metabolic effects are more pronounced in children since they have higher metabolic rates and reduced glycogen stores as compared with adults.^{2,3}

The most recent guidelines recommend preoperative fasting intervals of 6 hours for solid food; 4 hours for formula and non-human milk; 3 hours for breast milk and 1 hour for clear fluids.³

Unfortunately, it is common that medical practitioners may not be aware of the latest guidelines. For instance, Grech et al in 2019, showed that doctors taking care of children awaiting emergency orthopaedic procedures were unaware of the pre-operative fasting guidelines in children. This resulted in unnecessarily long fasting intervals. Amongst the recommendations brought forward, it was suggested to carry out further audits within other fields of paediatric surgery.⁴

The objective of this audit was to assess the extent to which preoperative fasting times in the paediatric population undergoing elective surgery complied with such guidelines.

MATERIALS AND METHODS

Approval from relevant Data Protection Office and Ethical Bodies (UREC-DP2310008MED) was obtained to proceed with this retrospective audit.

All children below the age of 16 years who presented for elective surgery (including but not restricted to General Surgery, Dental Surgery, Ear, Nose and Throat, Orthopaedic surgery and Urology) were included in this audit. Data collection was carried out between October and December 2022 and enrolled a total of 113 children.

Data was collected from medical records and included the time the child last ate or drank, name of

surgery underwent, the time surgery started and the duration of surgery. No patient contact was needed for data collection.

STATISTICAL ANALYSIS

Descriptive statistics were employed to summarise the data, presenting categorical variables such as counts (n) and proportions (%) and medians with interquartile range (IQR). Univariate analysis was performed with parametric tests, where appropriate. Data was first checked for normality and skewness using visual methods. Normality testing was done using the Shapiro-Wilk test. When appropriate, t-tests, Mann-Whitney U tests, Kruskal-Wallis test and chi-squared tests for contingency table analyses (two-sided) were used for univariate analysis. Most results did not show significant skewness, so mean values are reported. Significance was set at $p < 0.05$.

Data was gathered into an Excel® sheet (version 16.76, Microsoft, California, US) and analysed using RStudio (RStudio: Integrated Development Environment for R, Version 2023.06.1+524, Boston, Massachusetts, USA), with R version 4.0.3 (The R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Data was collected from a total of 113 medical records. The median age of patients was 6.0 years (IQR 3.0 - 9.0 years). Most surgeries were within the general surgical speciality (41%), followed by Ear, Nose, Throat (ENT) (19.4%) and orthopaedic surgeries (16%). The rest included cardiothoracic, dental, ophthalmic, plastic surgery and urology.

Most cases were done in the morning (n=91, 80.5%), with 21 cases (18.5%) being done in the afternoon. Only one case was done electively in the evening.

Fasting times ranged from a minimum of 3 hours to a maximum of 20.1 hours, as shown in [Figure 1](#). The mean fasting time was 11.3 hours (SD: 3.1, 95%CI: 10.9 - 12.0 hours). In 109 cases (96%), the fasting time was longer than 6 hours. In 49.6% of cases (n=53), the last oral intake had been 12 hours or later. There was no relationship between fasting time and age, as shown in [Figure 2](#).

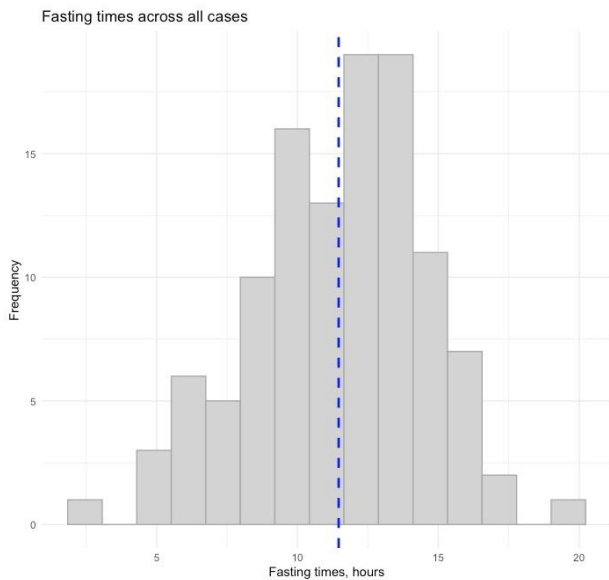


Figure 1 Distribution of fasting times in hours, with blue dashed line indicating mean value (11.3 hours)

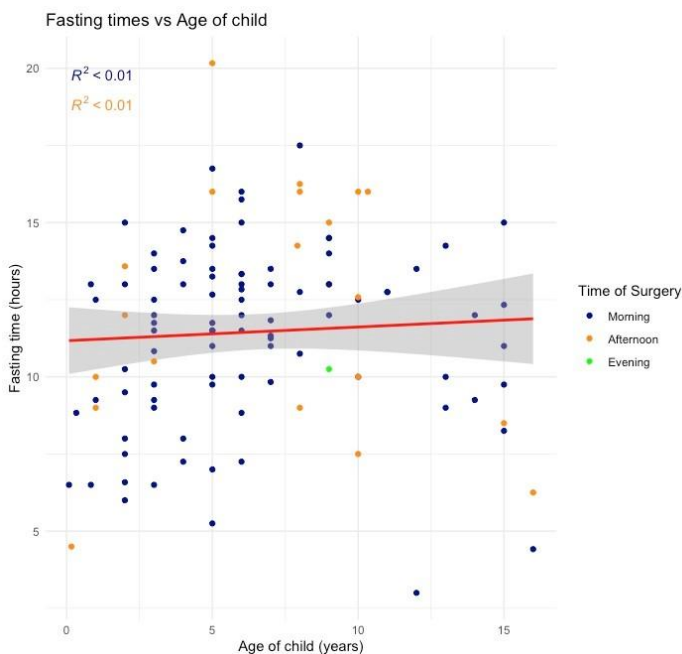


Figure 2 Scatter plot, fasting time in hours in relationship to age of child. This has been categorised by time of surgery. Red line indicates best fit, with confidence intervals in grey.

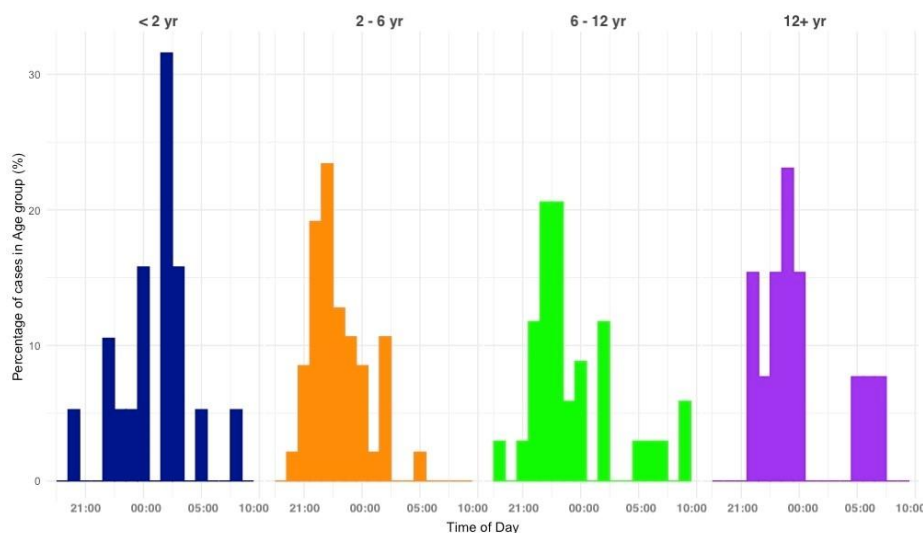


Figure 3 Distribution of time to start fasting, categorized by age group

Most children who were planned for a morning surgical procedure started their fast between 20:00 and 22:00 the night before, as shown in [Figure 3](#). Infants tended to be fasted later on with most of the infants included in our study being fed between 02:00-03:00 during the night. This was statistically significant when compared to children between the age of 2-6 years (3.0 hours earlier, $p=0.0008$) and nearly significant when compared to children of ages between 6 – 12 years (1.6 hours earlier, $p= 0.08$). Surprisingly, 60% of children planned for surgery in the afternoon still skipped breakfast. This meant that longer fasting times occurred in surgeries carried out in the afternoon.

Excessively prolonged fasting times were noted across all surgical specialities covered by the study. Fasting times were not dependant on type of surgery, as shown in [Figure 4](#).

DISCUSSION

Our audit shows that there is poor adherence to the current paediatric fasting guidelines, with nearly all children being fasted for more than 6 hours. This was across all ages, and across all surgical specialities. Indeed, only 5 children were fasted for 6 hours or less.

Adherence to fasting guidelines is well known to be poor, including in adults.⁵ Aroonpruksakul et al studied 309 children prior to surgery, and found the mean fasting time was 11.1 hours for food.⁶ Engelhardt et al described a fasting time for solids of 12 hours, in a population of 1,350 children presenting for elective dental treatment under

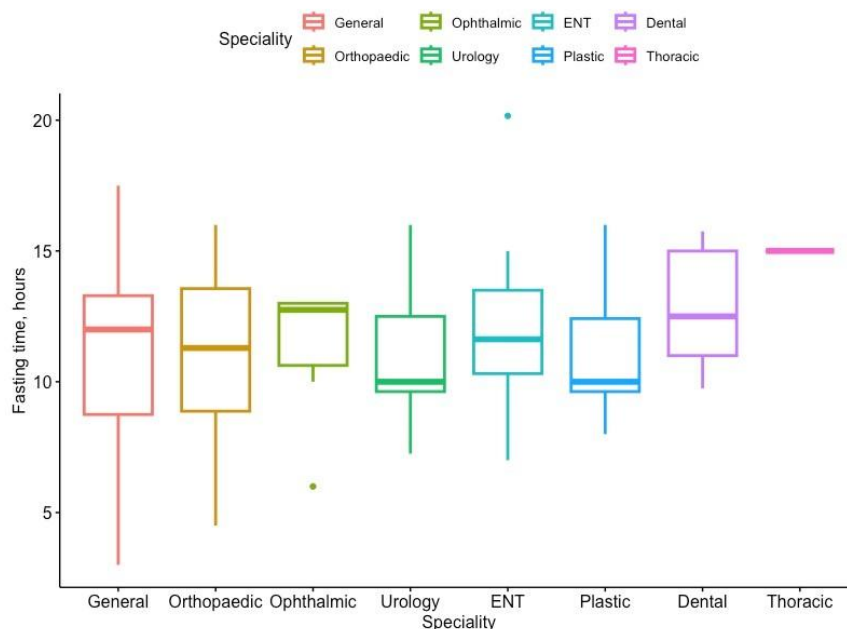


Figure 4 Boxplot for fasting times in hours categorized by surgical speciality. No statistical differences may be seen.

general anaesthesia.⁷ Rawlani et al performed an audit similar to ours, with 85 children enrolled, with a detailed history of last oral intake, and also of instructions given to parents.⁸ It was then followed up with an educational campaign, and re-audited. The mean fasting times for solids in the initial audit was 9.4 hours, and for clear fluids it was 6.6 hours. This is considerably shorter than the mean fasting times found in our audit, and indeed, only 13% of children were fasted for 12 or more hours, compared to 49.5% of children in our audit. On the other hand, Beck et al describe how the introduction of a 6-4-2 guidelines decreased last oral intake to around 2 hours for clear fluids,⁹ so it is possible to have children who are not severely fasted before surgery.

The relationship between surgical speciality and fasting times is not surprising, given that the guidelines are generic. There is no evidence to suggest otherwise, but there might be medical conditions that increase the risk of pulmonary aspiration that may be encountered more frequently in certain types of procedures. For instance, general surgeons might encounter children for a gastric fundoplication, which is performed to alleviate the symptoms of gastric regurgitation.

The main risk for a non-fasted child who is to undergo surgery is pulmonary aspiration following regurgitation. In a review by Phillips et al it was noted that in children allowed clear fluids until 2 hours

before scheduled time of anaesthesia, gastric contents and risk of aspiration pneumonitis was similar to those who have endured a longer fast whilst the complications of a prolonged fasting regimen were avoided.¹⁰ In fact, ultrasound studies that determined gastric emptying after light meals have shown a mean gastric emptying time of less than 4 hours.¹¹⁻¹² Similarly, gastric emptying time was shorter than one hour, after intake up to 5 mL/kg clear fluids.¹³ Most of these studies were small, with around 20 – 30 children involved, but collectively indicate that gastric emptying is faster than previously thought.

In fact, the actual risk of pulmonary aspiration has not been corroborated in recent studies. Beck et al⁹ did not find any increased risk in over 12,000 children, despite average fasting times being shorter than recommended. Indeed, regurgitation occurred in 0.26% of cases, with suspected pulmonary aspiration in 0.08%. All recovered with no consequences. It should be noted that in this study, fasting times were significantly shorter than in our sample, especially for light meals (9.3 hours), for milk (formula: 6 hours, breastmilk: 4.8 hours) and for clear fluids (2.3 hours), although for heavy meals, the fasting times were longer at 14 hours. We did not collect data on the type of last meal, as this was not recorded on the medical records, but it would seem that in our local sample, children would be given one last meal before midnight, and nothing else afterwards.

An optimal fasting practice may lead to lower incidences of dehydration, ketoacidosis, hypoglycaemia and cardiovascular complications during anaesthesia. Hence, it becomes critical that systematic analysis is directed to align observed fasting practises in paediatric surgery with international guidelines and best practices.

This study was not powered to explore reasons for not implementing the latest guidelines. However, other studies have listed suboptimal preoperative instructions, parental concerns, and institutional barriers.¹⁴ Newton et al conducted a quality improvement project in a teaching paediatric hospital, and found that parents were unwilling to wake children in the middle of the night to feed them, and generally erred on the side of safety.¹⁴ Similarly, contradictory advice given to parents from different specialities ultimately confuses parents on what to do.^{14,15} Changes in the surgical list order also upset fasting times and in fact provisional fasting to allow theatre flexibility was one of the main drivers towards excessively prolonged fasting noted by Kouvarellis et al¹⁶ We suspect the same issues may play an important role in our local setting.

This would mean that is necessary to improve education of healthcare professionals and family members in order to reduce oral fasting times, as shown by Rawlani et al⁸ Canping Li et al demonstrated that efforts by a multidisciplinary team to educate parents and raise awareness amongst all healthcare professionals involved in a child's peri-operative care effectively translated into shorter fasting times.¹⁷ This is particularly relevant in the local situation where paediatric patients are assessed pre-operatively in the generalist settings and translation of fasting practices of adults into fasting intervals for paediatrics is very likely.

The use of pre-printed instructions for parents has also shown to have a beneficial effect, with a decrease of mean fasting times from 8.5 to 6.0 hours.¹⁸ At times, this was not enough, even when supplemented by phone calls on the day before surgery.¹³ Furthermore, such instructions usually advise nil-by-mouth for clear fluids for two hours prior to admission. This fails to consider, registration and preparation time before anaesthetic induction.^{14,15}

SUMMARY BOX

KNOWN FINDINGS

- Most recent guidelines recommend preoperative fasting intervals for healthy children of 6 hours for solid food; 4 hours for formula and non-human milk; 3 hours for breast milk and 1 hour for clear fluids.
- Excessively prolonged preoperative fasting has negative metabolic effects especially pronounced amongst the paediatric population.
- Suboptimal preoperative information, parental concerns and institutional barriers are amongst the commonest reasons identified to be contributing towards excessively prolonged preoperative fasting.

NEW FINDINGS

- Excessively prolonged preoperative fasting times (with a mean fasting time of 11.3 hours) noted amongst 113 paediatric patients undergoing elective surgery within Mater Dei Hospital.
- Excessively prolonged fasting times noted across all ages and surgical specialities.
- Quality improvement measures directed towards the multidisciplinary team caring for children peri-operatively should be implemented with further re-auditing.

The responsibility of ensuring that children are not overly fasted should not lie solely on the parents or guardians. Indeed, institutional procedures may have a greater impact.^{8,14,15}

Educational campaigns aimed at health care professionals involved in pre-operative assessment of paediatric surgical patients would be a start.¹⁹ This will help ensure pre-operative instructions communicated to patients are in keeping with guidelines. This may be done by designing leaflets summarising main points about pre-operative fasting and distributing these at pre-operative clinics will also help increase awareness. Nursing staff in paediatric surgical wards also play an important role, and may be offered such initiatives as well.

Younger children should be placed first in a surgical list, unless there are impelling reasons. The first patient should be identified, to ensure appropriate

fasting times. Any delays in theatre which would translate into excessively prolonged fasting times should be communicated clearly and timely with staff in these wards and also discussed with caring anaesthetist.

One intervention that has proven particularly efficient is the administration of a glucose drink to any child on arrival to hospital and whose induction is expected to occur more than 60 minutes later.^{14,15} This has been shown safe clinically, and also by gastric ultrasound^{20,21} and does not increase gastric acidity.²²

LIMITATIONS

The current audit has a number of limitations, especially the low number of cases evaluated. There was no intention to evaluate complications due to fasting or to regurgitation, as the number of cases that would need to be included would have been

much higher. Our aim was to evaluate compliance with recently published guidelines, both internationally and locally.

Another limitation is that we did not evaluate the type of meal that the children would have last taken before fasting. Similarly, we did not obtain information on what instructions were given at the preoperative assessment, or reasons for such long fasting times. This was not possible with the methodology used in this audit.

CONCLUSION

Our audit highlights the importance of further efforts in order to optimise fasting times amongst the elective paediatric population. Such efforts should be followed up by re-auditing in order to ensure ongoing optimisation of peri-operative care amongst elective paediatric surgical population.

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