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REPORTS OF ORIGINAL INVESTIGATIONS

Slated *versus* actual operating room entry time in a British Columbia health authority

Heure d'entrée planifiée *versus* réelle en salle d'opération dans un réseau régional de la Colombie-Britannique

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Abstract

Purpose *To determine how frequently the published operating room (OR) schedule of case start times correlated with the actual OR entry time for elective cases in the Fraser Health Authority (FHA) in British Columbia, Canada. Society guidelines recommend periods of fasting of two hours prior to the induction of general anesthesia, but patients frequently end up fasting much longer. This review aimed to determine when patients arrive in the OR—either earlier than their scheduled time or later. The premise of some is that patients often arrive earlier, and advising short fasting times on the basis of the OR slate time is unreliable. I wished to determine whether this fear is justified.*

Methods *The computerized OR management database was queried for slated time of entry and actual time of entry for elective surgical cases in 11 hospitals in the FHA. The difference in slated vs actual entry time of patients (in 30 min blocks) was reviewed to examine the proportion of patients entering the OR earlier than 90 min from their slated time. Additionally, anesthesiologists from the Royal Columbian/Eagle Ridge Hospitals were surveyed for their recall of case delays that were related to inappropriate consumption of fluids.*

Results *One hundred and twenty-three thousand eight hundred and sixty-five cases from 11 hospitals over a 32-month period were analyzed. A very small proportion of cases (753 of 123,865 cases, 0.6%) entered the OR earlier than 90 min from their slated time. Relatively few cases were actually cancelled because of inappropriate fluid consumption in the recall of anesthesiologists in two institutions.*

Conclusion *In the FHA, the OR schedule is a reliable guide to providing instructions on timing of preoperative fluid consumption in appropriately selected elective surgical patients. Quality of care and patient satisfaction will safely be enhanced by limiting the period of fasting for elective surgical patients.*

Résumé

Objectif *Nous avions pour objectif de déterminer à quelle fréquence les heures de début de cas planifiées et publiées dans le programme opératoire correspondaient aux heures réelles d'entrée en salle d'opération (SOP) pour les cas non urgents réalisés dans le réseau de l'autorité sanitaire Fraser (FHA) en Colombie-Britannique, au Canada. Les directives de la Société préconisent des périodes de jeûne de deux heures avant l'induction de l'anesthésie générale, mais les patients sont souvent à jeun pour bien plus longtemps. Ce compte-rendu avait pour objectif de déterminer le moment où les patients arrivent effectivement en SOP – soit plus tôt que l'heure planifiée, ou plus tard. La prémisse de certains est que les patients arrivent souvent plus tôt, et il n'est donc pas fiable de recommander des temps de jeûne plus courts en fonction de*

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l'heure planifiée en SOP. Je souhaitais déterminer si cette crainte était fondée.

Méthode *La base de données informatisée de gestion de la SOP a été consultée afin d'en extraire l'heure prévue et l'heure réelle d'entrée en SOP des cas chirurgicaux non urgents dans 11 hôpitaux du réseau FHA. La différence entre l'heure d'entrée prévue vs réelle des patients (en blocs de 30 min) a été passée en revue afin d'examiner la proportion de patients entrant en SOP plus de 90 min plus tôt que l'heure prévue. En outre, les anesthésiologistes des hôpitaux Royal Columbian/Eagle Ridge ont été sondés concernant leurs souvenirs de retards de cas liés à une consommation inappropriée de liquides.*

Résultats *Au total, 123 865 cas réalisés dans 11 hôpitaux sur une période de 32 mois ont été passés en revue. Une très faible proportion de patients (753 des 123 865 cas, 0,6 %) sont entrés plus de 90 min plus tôt en SOP que leur heure prévue. Relativement peu de cas ont été effectivement annulés en raison d'une consommation inappropriée de liquides, selon les souvenirs des anesthésiologistes de deux établissements.*

Conclusion *Dans le réseau FHA, le programme opératoire de SOP est un guide fiable pour fournir des instructions quant au moment de consommation préopératoire de liquides chez les patients de chirurgie non urgente sélectionnés. La qualité des soins et la satisfaction des patients seront améliorés en toute sécurité en limitant la période de jeûne pour les patients de chirurgie non urgente.*

Slated *vs* actual operating room (OR) times: introduction

Preoperative fasting for liquids and solids is prescribed so as to minimize gastric contents prior to the induction of anesthesia. Patients with abnormalities of gastric anatomy or motility may never reliably empty their stomach but elective patients with normal gastric physiology reliably clear non-particulate fluids.[1,2] The time of anesthesia induction for elective cases is generally defined on an operative schedule ("slate") and the prescription for the initiation of the period of fasting for liquids is based on that document.

The reliability of the OR schedule depends on the institution, and individual anesthesiologists may not know the performance of their own operating suite. I chose to undertake a quality review of the performance of our hospital, and of all hospitals in the Fraser Health Authority (FHA) in British Columbia, to compare the slated time for patient arrival into the operating theater *vs* the actual time of patient entry as recorded in an electronic OR management system.

Methods

The FHA consists of 11 hospitals with 96 anesthetizing locations (four to 15 locations each) sited in different facilities ranging from exclusively outpatient services and small community institutions to a large tertiary referral hospital. A common Surgical Information Systems service in the FHA collects surgical data, including the slated times for elective operations, from the operating room management (ORMIS) modules of Meditech, and actual operating theatre and other perioperative times from the handwritten OR record which is transcribed into ORMIS. I requested a query of this database for case descriptions including procedure and booking priority, and case times (slated, in OR, start anesthesia, leave OR).

In the analysis, I considered only elective non-cardiac cases published on the OR slate, categorized in our system as priority 2b and 3a (Table 1). I excluded cases in these categories whose slate time was given as earlier than 07:30 hr or after 17:00 hr, as our system does not allow elective cases to be slated earlier or later than those hours, as well as cases with clear typographic errors in the data entry, such as elective cases entering the OR prior to 07:00 hr, and those without priority codes. Data were entered into Microsoft Excel 2016 for descriptive analysis. No inferential statistical analyses were performed. Case scheduled time and time of OR entry were converted into minutes and the difference was calculated as the minutes early (negative numbers) or late (positive numbers). Each surgical case had its time difference binned into one 30-min time epoch.

It was possible that a healthcare provider purposely delayed entry of a patient into the OR because of inadequate preoperative fasting. To examine whether results were skewed in this fashion, a short survey (four questions) was circulated through the University of British

Table 1 Case slating categories

Category	Time guideline*
1A	< 30 min
1B	< 8 hr
1C	< 24 hr
2A	< 72 hr
2B	< 3 weeks
3A	> 3 weeks

* Time the booking surgeon suggests the patient can wait for the operation

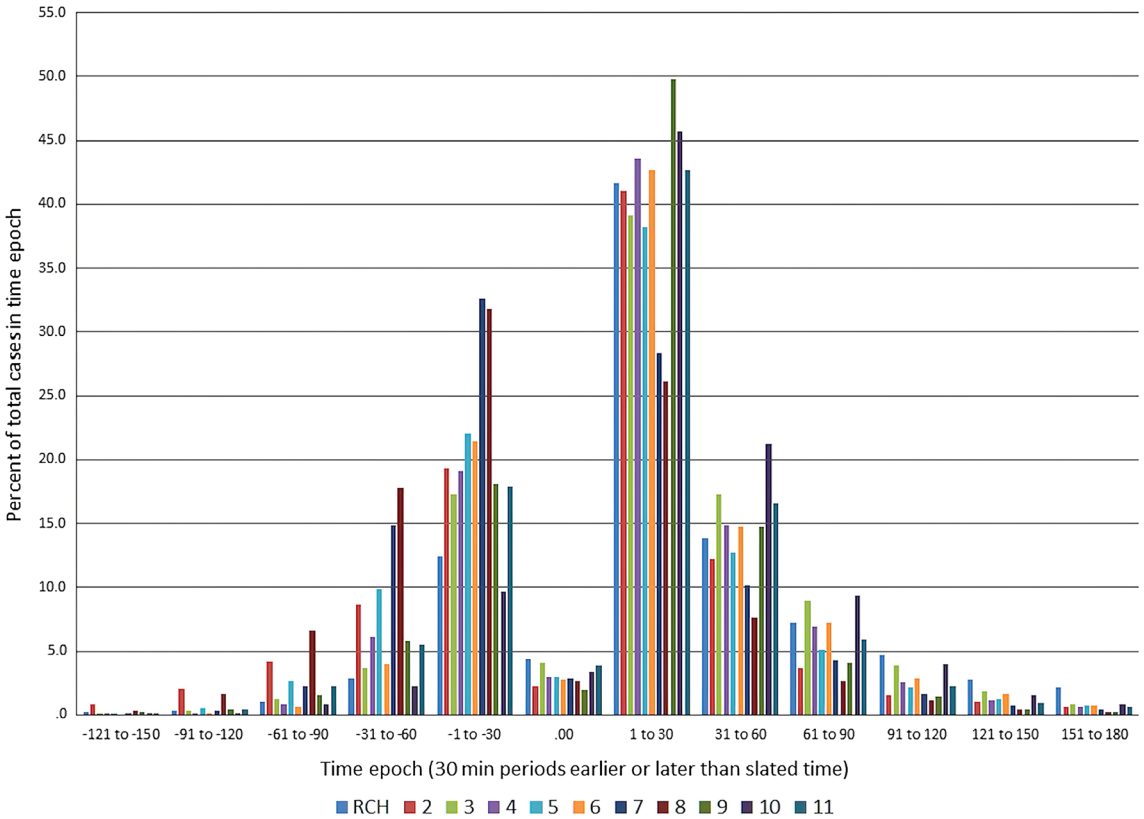

Fig. 1 Eleven Fraser Health Authority Hospitals: difference between slated and actual operating room entry time in 30-min epochs early or late—percentage of total patients

Columbia Qualtrics to Royal Columbian Hospital (RCH) and Eagle Ridge Hospital anesthesiologists asking whether they had cancelled or delayed cases because of failure of fasting for fluids or solids.

As a quality improvement project with no patient involvement, Research Ethics Board review was waived.

Results

Data were extracted from the ORM for the period January 1 2016 through August 31 2018, totalling 165,732 cases. When non-elective cases and those with obvious timing errors were excluded, 124,956 cases from all 11 hospitals were available for analysis, of which 123,865 were within five hours of slated times. We reviewed these 123,865 cases.

The results of the database analysis are presented in Fig. 1 for all hospitals. Figure 2 shows data for the RCH. Table 2 provides detailed numbers for the RCH, and for all FHA hospitals combined. In summary, 753 (0.6%) of patients were recorded as entering the operating theatre earlier than 90 min before their slated time.

Responses to the "delay" survey were received from 26 of 39 anesthesiologists (67%), during which time approximately 16,000 anesthetics would have been performed. Eighteen anesthesiologists denied having delayed a case because liquids were consumed too close to the OR time, while eight anesthesiologists reported having delayed at least one case for a total of 11 patients. Reported reasons for having failed to fast according to institution standards include nine patients who failed to follow instructions, seven patients who were apparently instructed incorrectly, and one case who had a prior case cancelled, and who was therefore moved up in the scheduling.

Discussion

For many years, prescribing fasting for solid food and liquids after midnight had been routine so as to minimize the risk of aspiration of gastric contents. Nevertheless, 30 years ago evidence was promulgated that prolonged fasting for clear liquids in normal physiologic states was unnecessary as it was shown that clear fluids passed through the stomach quite quickly: 90% within 60 min.[3] As

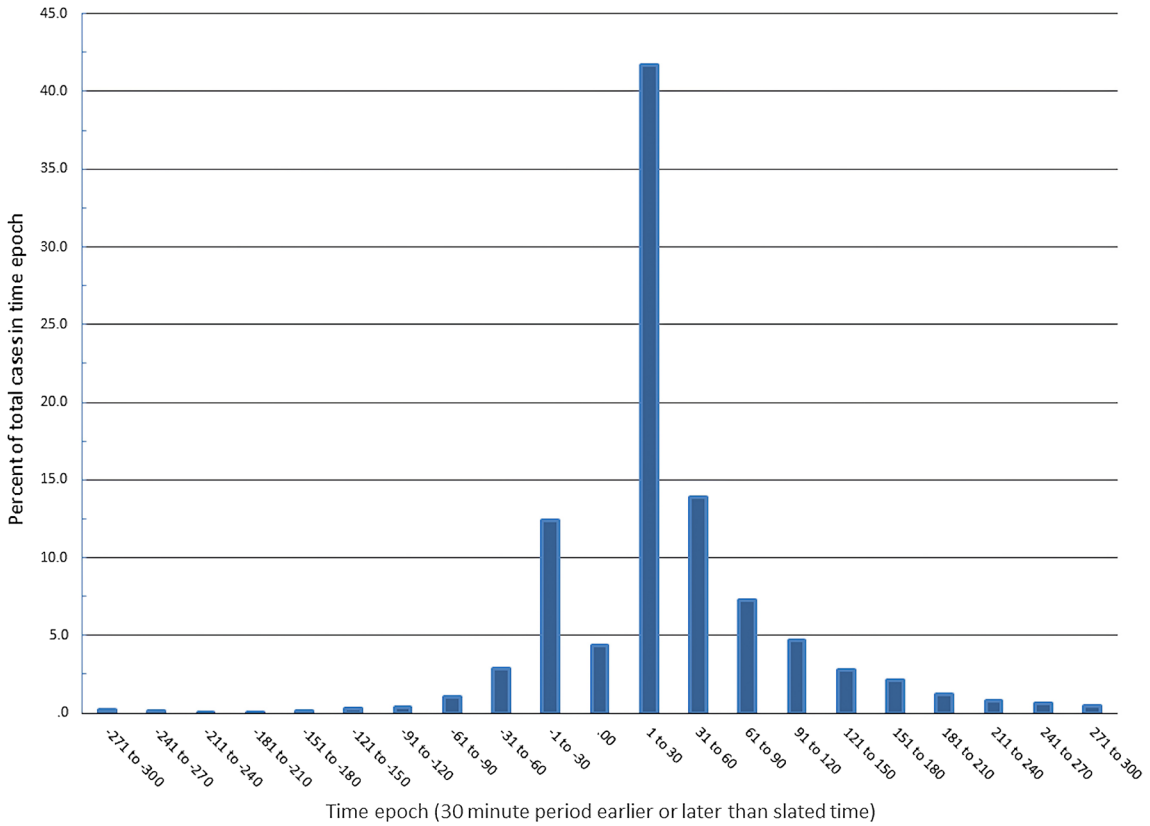

Fig. 2 Royal Columbian Hospital: difference between slated and actual operating room entry time in 30 min epochs early or late—percentage of total patients

a consequence, most anesthesia societies have modified their recommendations such that fasting of clear fluids is recommended for only two to three hours[4,5] in elective patients.

Nevertheless, it is not clear how well these liberal fasting guidelines are being implemented into clinical practice. There are a variety of reasons why this might be so, but often there is simply the fear that a surgical procedure will be delayed because the patient consumed fluids too close to the time of the anesthetic.[6,7]

There is a significant body of literature in OR scheduling,[8] typically related to efficiency of operating theatre and staff utilization and first case start times. A smaller body of research addresses subsequent cases and the accuracy of timing those cases.[9,10] It is clear that operating theatre environments vary widely, particularly in North America where operative days are typically scheduled consecutively, compared with Australasia and Europe where morning and afternoon slates may be separated.

Anesthesiologists in Canada typically follow the Canadian Anesthesiologists' Society fasting guidelines (two hours of liquid fasting preoperatively) prior to anesthesia. Nevertheless, to enhance flexibility, the standard advice from the hospital preadmission clinic in our institution is to fast for solid foods from bedtime the night before surgery, and for clear fluids from three hours prior to surgery, and patients are asked to present to the hospital two hours preoperatively. There remains resistance—both passive and active—from some surgeons, and not infrequently patients are instructed to fast completely from midnight. Their major fear is that a case will be delayed if the OR schedule changes and the patient presents to the OR prior to their slated time. This review shows that patients rarely present to the OR before their slated time: only 0.6% of FHA patients entered the OR more than 90 min early, and 0.2% of patients entered the OR more than two hours earlier than their slated time. Concerns about transgressing the "two-hour rule" therefore apply to a very small number of patients in this review.

It is possible that there were more cases who presented for surgery earlier than is shown here, as early cases may simply have been delayed. Reason for change in OR entry time is not available from this data, and it is possible that cases were deliberately delayed to increase fasting time. Nevertheless, this brief survey does not support that proposition—very few cases are reported by RCH

Table 2 Summary of "time difference"* into the operating room by 30-min epochs

Time epoch	No of cases RCH	% of total cases RCH	No. cases All FHA	% of cases All FHA
−271 to −300	16	0.21	54	0.04
−241 to −270	11	0.14	20	0.02
−211 to −240	4	0.05	32	0.03
−181 to −210	7	0.09	55	0.04
−151 to −180	8	0.10	68	0.05
−121 to −150	23	0.30	183	0.15
−91 to −120	31	0.40	341	0.28
−61 to −90	85	1.09	991	0.80
−31 to −60	230	2.96	3,478	2.81
−1 to −30	986	12.69	10,818	8.73
0.00	347	4.47	28,099	22.69
1 to 30	3,318	42.70	48,130	38.86
31 to 60	1,107	14.25	18,012	14.54
61 to 90	579	7.45	7,005	5.66
91 to 120	376	4.84	3,156	2.55
121 to 150	225	2.90	1,492	1.20
151 to 180	170	2.19	886	0.72
181 to 210	97	1.25	476	0.38
211 to 240	66	0.85	277	0.22
241 to 270	49	0.63	177	0.14
271 to 300	35	0.45	115	0.09
Total	7,770	100	123,865	100

*"Time difference" is time of entry into the operating room (OR) minus slated time of OR entry. Negative numbers represent entry time earlier than slated time

RCH = Royal Columbian Hospital; FHA = all of Fraser Health Authority hospitals

anesthesiologists to be deliberately delayed to increase the fasting time for fluids.

Operations subsequent to a first case will have their start time influenced by factors such as the duration of the preceding case, delays leaving the OR (i.e., waits for the postoperative care unit), the OR "changeover" (cleaning and preparation) time, delays for preparation of unprepared patients, staff breaks, and so on. For operations to start earlier, the preceding case must have taken less time than predicted on the OR slate, or an earlier case must have been cancelled. In our system, operation duration is assigned by an algorithm based on real surgical times custom to the individual surgeon and procedure. One might therefore expect a procedure to start late rather than early. This review supports that contention: 10% of patients entered the operating theatre an hour or more after their slated time *vs* 3% an hour or more before their slated time. Perhaps remarkably, the remaining 87% were within an hour of their proposed time.

This review suggests that providing appropriate instructions to patients based on the slated operating time, and achieving compliance, will infrequently result in patients consuming fluids too close to the proposed operating time. This in turn would minimize prolonged fasting times. Long starvation times were found in the "BigFAST" study,[11] which found in Brazil "almost 80% (n = 2,962) of the patients were operated on after eight or more hours of fasting and 46% (n = 1,718) after more than 12 hr." Similarly, short fasting times will not pose an increased risk of aspiration to appropriately selected patients: Maltby *et al*. showed this in their seminal article in 1991.[2] Further, while the actual incidence of aspiration is not clearly known, it is thought to be rare. In a recent review, Beck *et al*.[12] reported that 34% of 3,324 children receiving anesthesia in ten German pediatric centres had prolonged fasting times for clear fluids with 0.33% regurgitation, 0.12% suspected aspiration, and 0.06% confirmed aspiration.

There are several limitations to this review. This is essentially a retrospective review and a prospective project may be more robust in quality and extent of data. The data analyzed from the ORMIS system was entered manually at

several points, initially on a paper OR record prior to being transcribed manually into the ORMIS database. Entry or transcription errors may have occurred at any point. I have attempted to manage this by removing obviously incorrect data. I am not able to report why patients entered the OR early or late (and this was not the intent of the study). I could not rule out that patients may have been deliberately delayed by a provider. I am not able to review whether there were any clinical sequalae to early or late arrival.

Liberalized fasting guidelines may also improve care of patients undergoing procedures out of the operating theatres. Nevertheless, I was not able to consider this group of patients.

This review examined 11 hospitals across our health region of different sizes and patient populations. It is possible that detailed statistical analysis might have shown differences in case mix, patient population, and surgical predictability between institutions, although Fig. 1 shows a very similar pattern for all institutions and the key finding (patients earlier than 90 min) is similar. Clinically useful statistical differences seemed unlikely, so I elected not to perform these analyses. Nevertheless, it is not certain that another institution or health system would have the same pattern in arrival times to an OR.

Lastly, it is appropriate to emphasize that the proposed fasting times recommended by the various societies apply to elective patients without gastric motility disorders or gastric outlet obstruction—in such patients, gastric emptying may be unpredictably delayed.

Conclusion

This review confirms that, in the FHA, the anesthesia start time for electively slated patients is within one hour of the slated time in 87% of cases, and cases start more than 90 min early in only 0.6% of cases.

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