

ORIGINAL RESEARCH

Patient factors associated with NPO violations in a tertiary care pediatric otolaryngology practice

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Abstract

Objectives: To determine demographic and patient variables associated with nothing by mouth (NPO) violations prior to surgery in a tertiary care pediatric hospital.

Methods: A retrospective study of patients <18 years of age undergoing elective surgery at a tertiary care children's hospital from 1/1/16 to 4/30/19 who violated their NPO guidelines was performed. Variables associated with a higher rate of NPO violations were analyzed among the different surgical sub-specialties. Additional analyses were performed comparing those with NPO violations to the total group of patients undergoing surgery in the study period.

Results: Of the 42 495 children who underwent elective surgical procedures in the study period, 625 (1.5%) committed NPO violations. The median age for those committing a violation was 3 years, and the majority (n = 421, 67.4%) were between 0 and 6 years of age. Otolaryngology patients committing NPO violations had a longer time between scheduling surgery and operative date than other surgical services ($P < .0001$), but a similar time as the urology service. Otolaryngology patients had the highest number of NPO violations (n = 245, 39.2%) compared to the other surgical services, despite doing 32.4% of the total surgical cases ($P < .001$). Children from Spanish-speaking homes accounted for 137 (21.9%) NPO violations, despite accounting for only 11.2% of total surgeries performed. Patients with Medicaid insurance (n = 438, 63.0%) had a higher rate of NPO violations, despite making up 43.6% of total patients.

Conclusions: NPO violations occurred in 1.5% of patients during the study period, particularly among the youngest age range of the children analyzed, and they were most prevalent in the otolaryngology patients. Spanish speaking families, and those

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with Medicaid insurance had higher rates of NPO violations despite making up a smaller percentage of those being operated on overall. This highlighted the need for improvement in communication of fasting guidelines to caregivers.

Level of Evidence: 3

KEYWORDS

NPO violation prevention, NPO violations, surgery cancellations

1 | INTRODUCTION

Preoperative fasting guidelines have been established as a means to prevent complications from pulmonary aspiration when protective laryngeal reflexes are impacted by anesthesia.¹⁻³ Per anesthesiology guidelines, healthy patients are advised to avoid all solids for 8 hours prior to their procedure, clear liquids up to 2 hours prior, breast milk up to 4 hours prior, and formula or milk up to 6 hours prior.³ This information is often communicated to families either verbally or in written preoperative materials at the time of surgical consultation, on the day prior to the surgery by a member of perioperative team, or at the time of a preoperative visit.⁴⁻⁷ Despite this, the rate of surgical cancellations or delays remains high, and the estimated cancellation rate on the day of surgery is reported to be as high as 18%.⁵ Cancellations and delays in surgery have been noted to have both economic and emotional impact to the patients and their families, and an impact on overall health care costs and efficiency.⁸⁻¹¹ Patients often travel from long distances for their surgical procedures, and delays and cancellations can be frustrating to all involved parties.

Understanding variables that might influence the rate of NPO violations, like language barriers, confusion related to the volume of information provided prior to surgery, etc., is essential to developing tools or methods that can help mitigate these violations. Preventing violations would ultimately allow for cost saving to the health care system, improve operative efficiency, and mitigate the emotional and economic impact such delays have on the patient and the family. The goal of this study will be to determine if there are clear variables or demographic features associated with patients who violate their NPO guidelines with a focus on a tertiary care, urban pediatric hospital practice. If found, then methods to improve our mode of communication of NPO instructions to the patients and families might then be developed.

2 | METHODS

2.1 | Study population

This study was approved by the Institutional Review Board of Ann & Robert H. Lurie Children's Hospital of Chicago (IRB# 2019-2409). This is a retrospective case series of consecutive patients <18 years of age undergoing elective surgery between 01/01/2016 to 04/30/2019. Patients with NPO violations were identified through an EPIC search,

and their electronic medical records (EMR) were analyzed. Data was extracted including gender, age, insurance product, operating specialty (otolaryngology, urology, pediatric surgery, and others), and primary language spoken in the home. Additional data collected included the time between the preoperative consultation (surgery scheduling) and surgery, the day of the week the surgery was scheduled, and the time of day the surgery was scheduled (ie, morning vs afternoon cases). Within the NPO violation cohort, patients were excluded if they were >18 years of age (n = 8), undergoing inpatient surgery (n = 50), undergoing emergent surgery (n = 4), or undergoing surgery at one of the hospital's ambulatory surgery centers (n = 65). Additional patients were excluded when distance from hospital data was lacking (n = 5), when surgery took place on a Saturday (n = 1), when distance from hospital was far enough to be an outlier (n = 9), and when days between the preoperative surgery consultation and surgery were large enough to be outliers (n = 12).

To provide denominator information for an additional analysis of the NPO violation data, an additional search of the EMR was performed. A total of 42 495 surgeries took place in the study period, and data was extracted for this group including age, gender, surgical service, language spoken in the home, insurance product, and day of week.

Data collected from otolaryngology patients with NPO violations was then compared to patients with NPO violations from the other surgical services to analyze trends in NPO violations across the different specialties. Patients with and without NPO violations were then compared to assess for associations between patients who had NPO violations vs those who did not for the variables being analyzed.

2.2 | Statistical analysis

Statistical analyses were performed using SPSS 24.0 (Armonk, New York). Categorical data is presented as frequencies and percentages. Within the NPO violations cohort, continuous variables (age in years, days between clinic visit and surgery, and distance in miles between home and hospital) were nonparametrically distributed and descriptive statistics are presented as median and interquartile range (IQR). 95% confidence intervals (CI) were calculated for these data. The surgical specialties were stratified into otolaryngology, urology, pediatric surgery, and others for comparison. Within this cohort, multivariate comparison of continuous variables, when stratifying for surgical specialty, were performed utilizing the Kruskal-Wallis test and a

Dunn-Bonferroni correction for multiple comparisons. Chi-square analysis was used to compare categorical variables between surgical subspecialties within the NPO cohort and categorical predictors of NPO violation within the larger all-inclusive cohort. All tests were two-tailed and were considered significant at $P < .05$.

3 | RESULTS

A total 42 495 patients underwent elective surgery during study period. Six hundred and twenty-five patients (1.5%) had NPO violations. Of those with NPO violations, 245 (39.2%) patients were undergoing otolaryngology procedures, and the remainder urology ($n = 92$, 14.7%), pediatric surgery ($n = 97$, 15.5%), or other surgical subspecialty procedures ($n = 191$, 30.6%). The median age of children with NPO violations was 3 years (IQR 8 years), and the majority ($n = 421$, 67.4%) were between 0 and 6 years of age. English was primary language for 469 (75%), and 137 (22%) spoke Spanish at home.

TABLE 1 Descriptive data for the entire group of patients ($n = 625$) who violated their NPO instructions on the day of their surgical procedure

Variable	Analyzed	Total patients n (%)
Gender	Male	378 (60.5)
	Female	247 (39.5)
Age at surgery	0-6 years	421 (67.4)
	7-12 years	125 (20.0)
	13-18 years	79 (12.6)
Language spoken	English	469 (75.0)
	Spanish	137 (21.9)
	Other	19 (3.0)
Race	Non-Hispanic/Latino	353 (56.5)
	Hispanic/Latino	272 (43.5)
Insurance product	Medicaid	438 (70.1)
	Blue cross	109 (17.4)
	Managed care	53 (8.5)
	Other	25 (4.0)

TABLE 2 Stratification of data by surgical service for those committing NPO violations in the study period

Variable analyzed	Otolaryngology n = 245	Urology n = 92	Pediatric surgery n = 97	Other specialties n = 191	P value
Gender male	142 (58%)	87 (95%)	60 (62%)	88 (46%)	<.001
Female	103 (42%)	5 (5%)	37 (38%)	103 (54%)	
Median age (IQR) at surgery (years)	4 (5.4)	1 (5.7)	3 (9.0)	4 (10.9)	<.001
	95% CI 3-4	95% CI 1-2	95% CI 2-5	95% CI 3-6	
Median distance (IQR) to hospital (miles)	12 (21.8)	14.5 (33.0)	11 (22.5)	15 (28.6)	.20
	95% CI 11.4-16	95% CI 10.2-25.6	95% CI 10.1-17.5		
Median days (IQR) between scheduling and surgery	26 (33)	29 (37.5)	11 (19)	16 (23)	<.001
	95% CI 24-30	95% CI 23-38	95% CI 10-19	95% CI 14-20	

Medicaid was the most common insurance ($n = 438$, 70%) documented in the NPO patients (Table 1).

When stratifying by surgical subspecialty there was a significant association between subspecialty and gender ($P < .001$), and age at surgery ($P < .001$). The median age at time of surgery was analyzed for the different sub-specialties. The urology patients were younger (median 1 year of age, 95% CI 1-2 years) than the other three subspecialties (otolaryngology: 4 years, 95% CI 3-4 years, $P < .01$; pediatric surgery: 3 years, 95% CI 2-5 years, $P < .05$; all other services: 4 years, 95% CI 3-6 years, $P < .001$). The otolaryngology (median 27 days) and urology patients (median 28 days) had similar number of days between preoperative consultation and surgery date, when compared to pediatric surgery (15 days) and all other surgical services (16 days). This difference was significant ($P < .001$). The median distance traveled to the hospital was similar between the services ($P = .20$) (Table 2).

An additional analysis was performed looking at the influence of the time of day and the day of the week on the incidence of NPO violations for the different surgical services (Table 3). NPO violations were more likely to occur in the 12 to 2:30 PM group overall ($n = 210$, 33.6%). The time of day differences were significant at $P = .003$. Thursday was the day of the week least associated with NPO violations overall ($n = 79$, 12.6%).

Comparisons were made between those with NPO violations, and the total of cases during the study period. Otolaryngology patients accounted for the highest percentage of NPO violations (39.2%) among the surgical services despite performing 32.4% of all the cases in the study period. The youngest age group (0-6 years of age) accounted for higher proportion of NPO violations (60.6%). Spanish language patients accounted for 11.2% of all cases, but 21.9% of all NPO violations. Medicaid patients accounted for 43.6% of all cases, but 63.0% of all NPO violations. These differences were significant. Gender differences were not significant (Table 4).

4 | DISCUSSION

Fasting violations prior to surgical procedures remain common despite standard NPO guidelines established by national

TABLE 3 Distribution of time of day and day of week incidence of NPO violations for the different surgical services

Variable analyzed	Otolaryngology n = 245	Urology n = 92	Pediatric surgery n = 97	Other specialties n = 191	P value
7:30-9:30 AM	66 (26.9)	16 (17.4)	29 (30.0)	75 (39.3)	
9:30-12 PM	61 (24.9)	31 (33.7)	34 (35.1)	53 (27.7)	
12-2:30 pm	96 (39.2)	39 (42.4)	27 (27.8)	48 (25.1)	.003
2:30-5 PM	22 (9.0)	6 (6.5)	7 (7.6)	15 (7.9)	
Monday	64 (26.9)	21 (22.8)	32 (33.0)	31 (16.2)	
Tuesday	37 (15.1)	34 (37.0)	8 (8.2)	40 (20.9)	
Wednesday	54 (22.0)	19 (20.7)	21 (21.6)	48 (25.1)	<.001
Thursday	22 (9.0)	10 (10.9)	16 (16.5)	31 (16.2)	
Friday	68 (27.8)	8 (8.7)	20 (20.6)	41 (21.5)	

Variable analyzed	n (%) of NPO violations n = 625	n (%) of total cases n = 42495 ^a	P value
Otolaryngology	245 (39.2)	13 789 (32.4)	
Urology	92 (14.7)	5122 (12.1)	
Pediatric surgery	97 (15.5)	6182 (14.5)	<.001
All other services	191 (30.6)	17 402 (41.0)	
Male gender	378 (60.5)	24 950 (58.7)	
Female gender	247 (39.5)	16 908 (39.8)	.70
Age 0-6 years	421 (60.6)	24 617 (57.9)	
Age 7-12 years	125 (18.0)	9804 (23.1)	<.001
Age 13-18 years	79 (11.4)	8074 (19.0)	
English language	469 (75.0)	36 899 (86.8)	
Spanish language	137 (21.9)	4764 (11.2)	<.001
Other language	19 (3.0)	832 (2.0)	
Medicaid	438 (63.0)	18 513 (43.6)	
Blue cross	109 (17.4)	14 800 (34.8)	
Managed care	53 (8.5)	6059 (14.3)	<.001
Other	25 (4.0)	3123 (7.3)	

TABLE 4 Analysis of NPO violations compared to the entire volume of surgical cases performed during the study period

^aGender data not recorded in 12 patients; calculations based on total n = 42 483.

Anesthesiology Societies to prevent the risk of aspiration or regurgitation of gastric contents during procedures requiring general anesthesia or sedation.^{2,3} Our study showed that 625 children committed NPO violations prior to planned ambulatory surgical procedures during the study period at our tertiary care institution. The largest subset of patients who violated NPO guidelines were undergoing otolaryngology procedures (n = 245, 39.2%), and this likely reflected the large volume of cases performed by otolaryngology at our institution (32.4% of all operating room cases in the study period). There was an overall sense by our group that there were high rates of NPO violations affecting our patient/family satisfaction when cases delayed or cancelled, and the delays were affecting the operative team work flow and efficiency. This high incidence, particularly among the Spanish speaking families, prompted this analysis, and the subsequent ongoing development of a new NPO Guideline tool to be provided to our families with their preoperative instructions.

Prior studies have reported NPO violation rates of 3.5% to 4.5% in their analyses of surgical cancellations on the day of surgery.^{5,9} Our rate of cancellation was lower (1.5%) than these other studies, but this analysis included a much larger volume of patients. Otolaryngology, pediatric surgery, and urology patients had the highest numbers of NPO violations at our institution, as might be expected given these services represented the highest volume of operative cases. The urology subset of patients that violated NPO were younger (median age 1) when compared to otolaryngology (median age 4) and pediatric surgery (median age 3) patients. These differences likely reflect the types of procedures being performed by the various surgical services. When analyzing those who violated NPO instructions compared to those who did not, 60.6% of those who had violations were in the 0 to 6 years of age range. In addition, the greater number of male patients committing NPO violations was likely influenced by the high volume of urologic procedures (often done in young, male patients) performed at our institution.

In their analysis of 63 patients who committed NPO violations compared to 189 who did not, Beazley et al² found that age, gender, Medicaid insurance product, race, and non-English speaking parent(s) were not predictors of NPO violations on logistic regression analysis. They found that when asked the reason for the NPO violation the parents reported that they either “did not understand phone instructions, did not receive printed instructions, or the child was inconsolable or crying constantly.” In contrast, our study did show a relationship between age, insurance product, and language spoken in the home and frequency of NPO violations. The reasons for NPO violations in our patients were not specifically analyzed, but may be similar to those described. Both studies reported on patients being seen at a children’s hospital in large, metropolitan areas serving needs of children from broad demographic backgrounds.

Our data showed a gap in our communication of fasting guidelines to Spanish speaking families in that 11.2% of the total surgeries were performed on children from Spanish speaking homes, but 21.9% of the NPO violations occurred in this subset. In addition, 43.6% of total surgeries in the study period were performed on patients with Medicaid insurance, but those with Medicaid accounted for 63.0% of NPO violations. Accounting for these differences, and how they may relate to language barriers, access and understanding of the preoperative educational information, literacy, and cultural differences, will be an important element in developing new tools and/or means of communications to our patients and caregivers.

If the reasons mentioned previously were the most common factors in commitment of NPO violations, then a closer look at how information is passed on to our patients is essential. At our institution, a standardized “surgery packet” is provided to all caregivers/patients who will likely be scheduling ambulatory surgery. The packet describes the preoperative preparations for surgery including NPO guidelines, although specific surgical times are not provided until the day prior to surgery. On the day prior to surgery, the family is contacted by the surgical prescriber, who provides the specific arrival time and fasting guideline to each individual patient (a voice mail message is left for those who do not answer). The information is provided in the language spoken in the home either by a Spanish speaking team member or by utilizing the telephone language line where appropriate. Despite consistency in this process, with the same individuals providing this information day after day, NPO violations still occur as described. Interestingly, fewer NPO violations occurred on Thursday despite an equal distribution of cases being performed each day of the week.

In a review of elective surgery cancellations at the Children’s Hospital of Boston, where patients were seen in a Preoperative Assessment Clinic (POAC) prior to surgery, the authors noted a decrease in day of surgery cancellations between 2 time periods analyzed including those for NPO violations.⁵ This was felt to be due to documenting patient and family feedback on their NPO instructions at the time of the POAC visit in the second time period analyzed, and then reinforcing this information when contacting the family the evening before to provide surgical times. Most patients are not seen in a POAC at our institution, but they are required to undergo a history

and physical with their primary care physician within 30 days of their surgical procedure, in addition to providing surgical clearances related to comorbidities where indicated. Patients were likely not receiving any NPO guidance at the time of these encounters. Establishing a similar POAC may not be feasible at some institutions given geographic and/or resource constraints for many of patients. Asking caregivers to repeat the fasting instructions as a means of reinforcing the information likely has value regardless of the institutional preoperative process.

Noncompliance with preoperative requirements including dietary restrictions, arrival time at the hospital, and completion of required pre-surgical forms was shown to be associated with the parent’s level of state anxiety.¹⁰ In their study on threat perception, anxiety, and noncompliance with preoperative fasting instructions, Kushnir et al⁸ noted that mothers who did not comply with fasting requirements perceived the surgical procedures as more threatening, were more anxious, and had lower scores of conscientiousness when compared to mothers who were compliant. Parental anxiety can affect the child’s preoperative anxiety, lengthens recovery times, causes higher pain levels, and longer hospital stays. Developing strategies to improve parental anxiety were suggested. At our institution, our child life services utilize distraction tools (ie, games on tablets, magic wands, bubbles) to help improve anxiety levels in our patients. Additional studies looking at the use of coping kits preoperatively are underway to help waylay patient anxiety prior to surgery. Informing our patients and caregivers about these resources preoperatively will hopefully reduce noncompliance rates with NPO instructions over time.

In our efforts to provide more consistent messaging to our patients, a tool is being developed to be included in surgery packets outlining NPO instructions for families. The tool uses written word and illustrations to communicate fasting guidelines, and the form will initially be provided in English and Spanish. A quality project can then be designed around use of this tool to determine if there are reductions in NPO violation rates. A designated Spanish interpreter in the Otolaryngology clinic may also help improve patient education in preparation for surgery in this subset of patients. A current initiative to increase rates of families signing up for MyChart is a priority at our institution. This, and text messaging reminder tools, may be additional options for communication with our families to help decrease rates of day of surgery cancellations.

Weaknesses of this study include its retrospective nature, and the inability to hone-in on specific reasons for each NPO violation, that is, parental anxiety, language barriers, information overload. Our hope will be to gather information on reasons for NPO violations moving forward to better understand how best to communicate with caregivers preoperatively, particularly after incorporation of our NPO education tool in our surgery packets. Despite these weaknesses, when analyzing our data for those committing NPO violations, when compared to total patients undergoing surgery, we were able to identify gaps in communication to our Spanish speaking families and Medicaid patients. Bridging these gaps will be important next steps in the battle against NPO violations.

5 | CONCLUSIONS

NPO violations occurred most commonly among otolaryngology patients when compared to other surgical services. Younger children in the 0 to 6 year age range were more likely to commit NPO violations. A disproportionate number of children from Spanish speaking homes, and who had Medicaid insurance, had NPO violations suggestive of a gap in communication to these patients. Means to bridge these gaps are needed to improve satisfaction and efficiency of the operative experience for all involved.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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