Exploring the Preoperative Fasting and Perioperative Hemodynamic variability in Elective Surgery Under General Anesthesia

Muhammad Anas[1], Ayesha Jehad[2], Mian Umama Akmal Shah[3], Haseena Gul[3], Mazhar Ali[4], Salma[5], Aqsa[6]
[1]Post Graduate Diploma Pain, Post Graduate Diploma Respiratory therapy, BS Anesthesia/Lecturer Anesthesia, Amanullah Khan Medical & Nursing Institute, Nowshera, Pakistan.
[2]Lecturer, Department of Anesthesia, College of Medical Technology, Bacha Khan Medical College, Mardan, Pakistan.
[3]Anesthesia Trainee Technologist, Medical Teaching Institution, Mardan Medical Complex, Mardan, Pakistan.
[4]Anesthesia Technician, Department of Anesthesia, Al-Shifa Trust Hospital, Rawalpindi, Pakistan.
[5]Dental Trainee Technologist, Mian Rashid Hussain Shaheed Memorial Hospital, Pabbi, Nowshera, Pakistan.
[6]Trainee Nurse, Rehman Medical Institute, Peshawar.
Corresponding Author*: Muhammad Anas (muhammadanas1156@gmail.com)

ABSTRACT

Background: It is usual practice all over the world to abstain from eating or drinking before surgery. Currently, the preferred protocol, according to the American Society of Anesthesiologists guidelines, is the 6-4-2 hour No Per Os protocol for solid, milk, and clear fluids respectively, although it is not universally applicable. Extended fasting may intensify negative outcomes including hemodynamic fluctuations. Hemodynamic stability stands as cornerstone in perioperative care as fluctuation can have serious consequences. This study aim was to explore current prevalence of preoperative fasting and hemodynamic fluctuations in elective surgery under general anesthesia.

Methods: A six-month Cross-sectional comparative study was conducted on 200 patients at Mardan Medical Complex (MMC) approved by the Ethical Committee, Bacha Khan Medical College (BKMC) Mardan. The data was collected through patient interview in preoperative, medical records, and monitoring perioperatively. SPSS software statistical analysis was conducted using repeated measures ANOVA to assess perioperative changes in these parameters. Test statistics, including p-value were computed to determine the significance of hemodynamic variability.

Results: All patients underwent prolonged fasting, with a mean fluid fasting time of 10.33 hours (SD=1.07) and an average solid fasting time of 10.34 hours (SD=1.11). There was a gradual minor drop-in heart rate (HR) from induction to the recovery phase, with statistical significance of 0.02, while no statistically significant variability in mean systolic and diastolic blood pressure was recorded.

Conclusion: The study found that patients were undergoing midnight fasting, with a mean duration of 10.33 hrs. Perioperative hemodynamics showed minor decreases in heart rate from the induction to the recovery phase, with statistical significance of 0.02. Our study contributes to the ongoing discourse on preoperative fasting practices and perioperative hemodynamics.

Key points: Preoperative fasting, Hemodynamic, General Anesthesia, Elective Surgery

HOW TO CITE: Anas M, Jehad A, Shah MUA, Gul H, Ali M, Salma, Aqsa. Exploring the Preoperative Fasting and Perioperative Hemodynamic variability in Elective Surgery Under General Anesthesia. National Journal of Life and Health Sciences. 2024; 3(1), 47-52.
DOI: https://doi.org/10.62746/njlhs.v3n1.1
Date of Submission: 26/01/2024 Date of Revision: 17/04/2024 Date of Acceptance: 19/04/2024

INTRODUCTION

Preoperative fasting is the widely accepted technique in which patients undergoing surgery or other medical procedures, such as significant radiographic investigations (MRIs or CT scans), refrain from eating or drinking anything for a certain amount of time.[1] This is meant to stop stomach contents from getting into the lungs because aspiration pneumonia, a potentially fatal illness, can result from a loss of protective airway reflexes.[2,3] Remarkably, it was discovered in the evolutionary history of preoperative fasting that the original intent behind preoperative fasting was to lessen the chance of vomiting instead of avoiding aspiration.[4]

It's been discussed for a long time how long a patient must fast before surgery. A big lunch, according to John Snow, complicated the ether delivery process and caused uncomfortable vomiting. Practical instructions for fasting were first published by Sir Joseph Lister in 1883. He recommended a cup of tea or beef-tea around two hours prior to surgery and distinguished between clear liquids and solid food.[4] 'No Per Os after midnight' for healthy patients started to become widely accepted in the 1960s. Mendelson examined aspiration cases under general anesthesia in 1946 to highlight the dangers of aspirating solid food, while the neutralized aspirated liquid vomitus caused less severe respiratory symptoms.[5]

According to Presta *et al.* (2018), a number of anesthetic societies in the USA, UK, Canada, and European now instruct elective patients to Nill Per Os two hours for clear fluids and six hours for solids before surgery. This rule can improve patient wellbeing, lessen thirst, and ensure safety.[5] American Society of Anesthesiologists (ASA) (2017 & 2023), the Association of Anesthetists of Great Britain and Ireland (AAGBI) (2010), the Royal College of Nursing (RCN) (2005), and the European Society of

Anesthesia (ESA) (2011) have been published Preoperative fasting guidelines which is known as the 2-4-6 rule. According to their recommendations, children should Nill per Os two hours for clear fluids, four hours for breast milk, and six hours for solids, nonhuman milk, and formula milk.[6-8]

Merchant *et al*. (2020) reported a survey of 971 anesthetists from Canada, Australia and New Zealand, and Europe. Although 85.0% of subjects affirmed that their instructions adhered to current guidelines, approximately 50.4% enforced prolong fasting and did not allow clear fluids intake after midnight. The primary reasons cited included issues with a variable operating room schedule.[9]

Abebe *et al.,* (2016) reported their findings from Gaborone, Botswana, where the mean fasting periods were 15 .9 ± 2.5 hours for solids and 15 .3 ± 2.3 hours for liquids. Notably, the mean fasting periods were 7.65 times longer for clear liquids and 2.5 times longer for solids compared to the guidelines set by the ASA.[10] In a study by Wood *et al.* (2016) in Alberta, it was observed that preoperative NPO (nothing by mouth) times exceeded the recommended durations in 70% of the studied patients (n = 37). The median time spent NPO preoperatively was not significantly different between complex (11. 5 hours) and noncomplex groups (10 .8 hours).[11] It is concluded that currently, 2-4-6-hour NPO status protocol for solid, milk and clear fluids respectively is most preferred according to updated ASA guidelines, and AAGBI 2009, but is not fully applicable mostly in the world. Moreover, recent evidence suggests that current 2 hours fasting of clear fluids neither adds to aspiration risk as water and other clear fluids almost empty within 30 min and an hour respectively nor usually severe and long lasting if patients aspire.[12]

Extended fasting has not been shown to decrease gastric volume or gastric acidity.[13] However, it may intensify negative outcomes, including increased thirst and irritability, leading to hypovolemia and adverse physiological and metabolic effects. These effects include down-regulated immune function, extended wound healing, decreased muscle strength, and increased overall morbidity, putting patients at risk of increased insulin resistance, hypoglycemia, and dehydration. As a result, there is a greater need for fluid replacement during surgery, which increases the potential risk for blood loss during the operation and can contribute to hemodynamic instability.[14,15]

Hemodynamic stability refers to the maintenance of consistent blood flow and circulatory parameters during surgical procedures. In perioperative settings, hemodynamic stability is characterized by the maintenance of hemodynamic parameters (such as blood pressure, heart rate, etc.) within 20% of baseline values. It stands as a cornerstone in perioperative care and surgical medicine and is a crucial aspect of anesthesia management, as fluctuations can lead to serious consequences such as hypotension, arrhythmias, myocardial ischemia, myocardial infarction, stroke, and death.[16] Its significance can be distilled into aspects such as safeguarding organ functionality, ensuring anesthesia safety, guiding effective medical care, optimizing surgical precision, accelerating postoperative recovery, diminishing morbidity and mortality, fortifying infection control.[13,17] All patients scheduled for surgery should be monitored, but the degree of monitoring can vary. Hemodynamically stable patients require maybe nothing more than continuous electrocardiographic (ECG) monitoring, regular non-invasive blood pressure measurement, and peripheral pulse oximetry (Spo2). In cases where hemodynamic perturbations are expected or for high-risk patients who may not tolerate significant derangements in hemodynamics, invasive hemodynamic monitoring may be beneficial. Literature has shown that fasting times are still not fixed, and there are two approaches to starvation before surgery: standard fasting and prolonged fasting. There has been no study conducted in Khyber Pakhtunkhwa (KPK) to explore preoperative fasting practices. Moreover, there has been no study conducted anywhere to determine hemodynamic parameters at every phase of general anesthesia in elective surgery. The study's aim was to determine the current prevalence of preoperative fasting and perioperative hemodynamic variability.

MATERIAL AND METHODS

A six-month cross-sectional comparative study was conducted from September 2023 to February 2024 at the Department of Anesthesia, Main Operation Theater in a tertiary care hospital, Mardan Medical Complex, Mardan, Pakistan, after obtaining ethical approval (Letter# CEC/BKMC/382) on 5/9/2023. Patient data collection in the OT occurred only after obtaining informed consent in the preoperative period. A total of 200 patients were recruited based on convenience sampling. Patients with ASA 1-3, BMI < 30, and Age 18-65 undergoing general anesthesia for elective surgery were included in the study. Emergency surgeries and patients with physical status ASA 4 or 5 and BMI >30 were excluded. Data including demographics, fasting status, and physical status were collected through patient interview in preoperative, medical records, and monitoring perioperatively. Blood pressure and heart rate were collected from patient monitoring at intermittent intervals: three recordings at T-1 (induction phase), three recordings at T-2 (maintenance phase), and three recordings at T-3 (recovery phase).

The data mentioned above were obtained from patients who met the inclusion and exclusion criteria and underwent general endotracheal anesthesia following MMC standards for the practical conduct of anesthesia. Patients experienced almost 100% prolonged fasting. For induction, propofol at 2 mg/kg, atracurium at 0.5 mg/kg for intubation, and tramadol at 2 mg/kg were administered to achieve balanced anesthesia. An appropriate-sized endotracheal tube

(ETT) was placed and secured, followed by mechanical ventilation. Anesthesia was maintained using isoflurane at a MAC of 1.2 or adjusted accordingly. The paralytic agent was repeated at a 1/3 dose until recovery, while analgesia was planned for both the intraoperative and postoperative periods, patients' normovolemia was maintained using intravenous deficit and maintenance fluid. A reversal agent (neostigmine + glycopyrrolate) was administered when signs of muscular power regeneration appeared, and patients were extubated under the awake plane when responding to verbal commands. Attention was given to airway management to prevent respiratory and hemodynamic changes.

Statistical analysis was performed using SPSS 22 statistical software. Descriptive statistics was used to summarize the data including mean, standard deviation, minimum, and maximum values. The hemodynamic parameters comprised measurements of heart rate and systolic and diastolic blood pressure obtained at three intervals for induction phase, maintenance phase and recovery phase, computed into a single mean separately for every phase. Statistical analysis was conducted using repeated measures ANOVA to assess perioperative changes in these parameters. Test statistics, including p-value were computed to determine the significance of observed variability.

RESULTS

A total of 200 elective surgical patients were recruited, of which 37% (n=74) were male and 63% (n=126) were female. Among the total, 42% (n=84) were aged 18–30 years, 16% (n=32) were aged 41-50 years, 14% (n=28) were aged 31-40 years, and 2% (n=4) were aged 61-70 years (Table 1). The mean weight of the patients was 67.76 (14.22) kg, and their height was recorded with a mean of 1.63 (SD±0.10) meters. The BMI of the sample was recorded with an average of 25.44 (SD±4.97) (Table 2). All patients were on prolonged fasting. The patients had a fluid fasting time with a mean of 10.33 hrs. (SD=1.07), with the last liquid intake quantity averaging 178 ml (SD=53.19). The average solid fasting time (hrs.) was 10.34 (SD=1.11). Among them, 66.5% (n=133) had their last fluid intake in the form of clear fluids (juices without pulp, water), and 33% (n=67) consumed pulp juices, milk, or milk tea (Table 3).Maximum patients had no concurrent medical history, accounting for 75% (n=150). 18.5% (n=37) had a history of hypertension, 3% (n=6) were suffering from Diabetes mellitus (DM), and 1% (n=2) had a history of epilepsy. Additionally, 1% (n=2) of patients had suffered from both DM and hypertension. A similar situation was observed regarding patients' concurrent drug/medication history: 75% (n=150) were not taking any medication, 20% (n=40) were taking anti-hypertensive drugs, 2.5% (n=5) were using oral hypoglycemic agents, and 2.5% (n=5) were taking anti-epileptic medications.

Table 1: According to Age and Gender, patients were distributed

Patient Gender	Age of patients					Total
	18-30	31-40	41-50	51-60	61-70	
Male	30	16	10	18	0	74
Female	54	36	18	14	4	126
Total	84	52	28	32	4	200

Table 2: Patients Anthropometrics

Parameters	Weight (kg)	Height (in meter)	BMI
Mean	67.760	1.636	25.4479
Mode	60.0	1.5	21.64
Std. Deviation	14.2216	.1057	4.97026
Minimum	42.0	1.5	14.50
Maximum	110.0	1.8	38.96
Total N	200	200	200

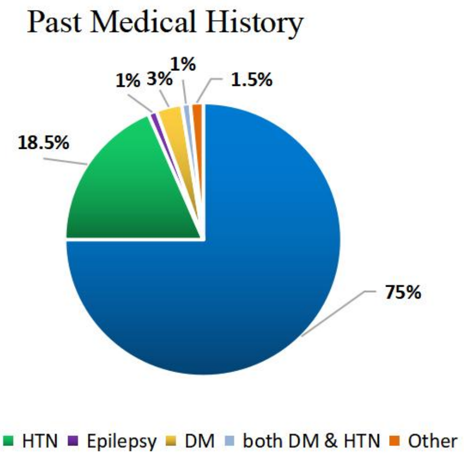

Figure 1: Past Medical History

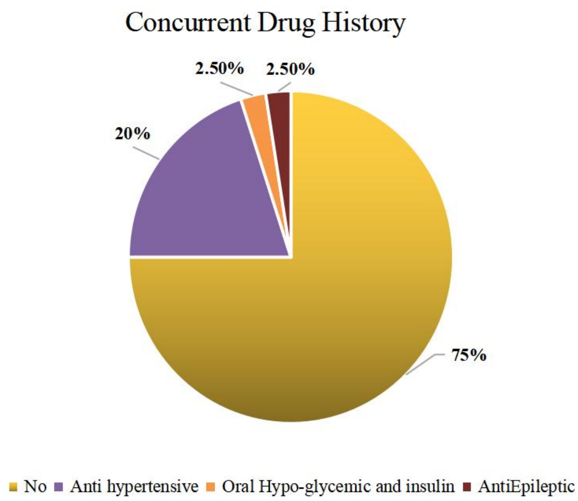

Figure 2: Concurrent Drug History

Out of 200 patients 73.5% (n=147) were feeling hungry and 94% (n=188) were feeling thirsty. The reason for delays in surgery time is mentioned in table 1 below.cThe majority of patients were planned for intermediate-type surgery, comprising 67.5% (n=135). Major surgeries accounted for 10.5% (n=21), while minor surgeries were recorded at 22% (n=44).

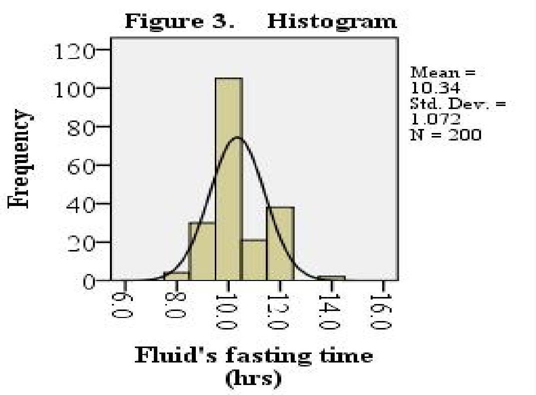

Figure 3: Fluids fasting time in hours

Table 3. Reason for Surgical Delay

Reason for delay	Frequency	Percent
Not delayed	91	45.5%
Prior case takes longer	53	26.5 %
Change order of case	32	16 %
Incorrect order	24	12 %
Total	200	100 %

The average surgical time was recorded as 1.5 hours (SD=0.64), with a mean intraoperative blood loss of 202.5 ml (SD=29.32), ranging from a minimum of 20 ml to a maximum of 300 ml.

Table 4: Surgery Time & Blood loss Statistics

Parameters	Surgery time (hrs.)	Intraoperative blood loss(ml)
Mean	1.503	202.500
Std. Deviation	.6429	292.4867
Minimum	.5	20.0
Maximum	3.0	3000.0

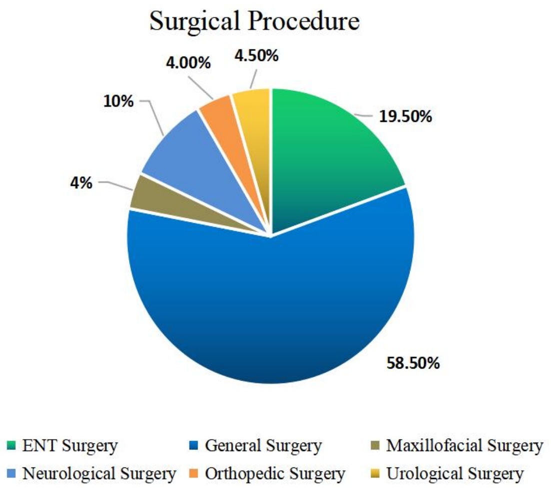

Figure 4: Different Surgical procedures performed

The different surgical procedures performed, the recorded patients' hemodynamics during surgery, were transformed and computed into a single mean separately for the induction phase, maintenance phase, and recovery phase, taken at three intervals for each phase, with a single mean computed. There was a gradual minor drop in hemodynamics from the induction phase to the recovery phase. Heart rate (HR) had fallen from the induction phase to the recovery period with statistical significance of 0.02. There is not enough evidence to conclude that there is a significant difference in the mean systolic arterial pressure (SAP) and diastolic arterial pressure (DAP) across perioperative intervals (induction, intra-op, recovery) (Table 5-7).

Table 5: Perioperative Heart Rate (HR) of patients

Parameters	Mean HR at Induction	Mean HR Intra-OP	Mean HR at Extubation
Mean	106.1133	101.9667	100.9667
Std Deviation	13.57357	13.18180	13.12973
Minimum	80.00	74.33	66.67
Maximum	141.33	142.00	154.67
P value for HR intervals		0.02	

DISCUSSION

In this study, we investigated the prevalence of preoperative fasting and perioperative hemodynamic parameters in patients undergoing surgery under general anesthesia These findings provide valuable insights into the potential impact of fasting practices on hemodynamic stability. Our results indicated that patients, on average, fasted for approximately 10.33 hours for fluids and 10.34 hours for solids. Notably, 66.5% of the patients had their last fluid intake in the form of clear fluids, such as juices without pulp or water, while 33% consumed pulp juices, milk, or milk tea prior to surgery. The literature findings support and complement our observations. Alvi & Nouman (2016) reported prolonged durations of fasting at Aga Khan University Hospital, Karachi, Pakistan that only 4% of children could be labeled as having the optimum fasting. Based on the current guidelines, in 96% of children, the guidelines were not followed. [18] The fasting timing of these children was evaluated and the median solid fasting time was 12.0 hours [range 6-48 hrs]. Most of the children were fasted for more than 6 to 10 hrs. The median fasting duration for juices/syrupy liquids was 8 hours [range 4-24 hrs.].[18] Siddiqui et al. (2021) conducted a study at Civil Hospital Karachi, Pakistan. In their study, 59.25% of cases were delayed due to previous cases running longer than expected. The second most common reason (14.44%) was a change in the sequence and order of procedures, which resulted in delays for 17 cases.[19] In our study, we found that 44.5% of cases were delayed, with 26.5% due to prior cases taking longer, 16% due to changes in the order of cases, and 12% delayed due to incorrect case order. Collectively, these results show that although current guidelines recommend specific fasting durations, our study, along with literature findings, claims that clinical practice mostly does not align with these guidelines.[19]

Our study concentrated on the adult population aged 18-65, classified as ASA 1-3, presenting with hypertension and diabetes mellitus, who were undergoing ENT & maxillofacial, general surgery, and neurosurgery procedures. In our research, we determined fasting durations (liquid fasting hours, liquid quantity taken(ml), solid fasting hours), and hemodynamic parameters (SAP, DAP, HR). It's important to acknowledge the limitations of our study. Firstly, our research was limited to non-cardiac thoracic surgeries, non-cancer patients, and individuals with critical comorbid i.e. ASA 4-5. This exclusion of certain patient groups may affect the generalizability of our hemodynamic findings to broader surgical populations. Secondly, the parameters we recorded were based on non-invasive monitoring techniques. While these methods are valuable for their safety and convenience, they may not provide beat to beat variability detail as invasive monitoring techniques.

Table 6: Perioperative Systolic BP (SAP)

SAP	Mean	Std. Deviation	Minimum	Maximum
Mean SAP at Induction	137.1183	17.80585	95.67	192.33
Mean SAP at Intra-OP	132.8800	17.60263	82.67	199.00
Mean SAP at Extubation	133.1717	13.41857	99.33	167.67
P-value for SAP intervals		0.287		

SAP; systolic arterial pressure, DAP; diastolic arterial pressure, OP; operative

Table 7: Perioperative Diastolic BP (DAP)

DAP	Mean	Std. Deviation	Minimum	Maximum
Mean DAP at induction	77.6083	15.55425	45.67	113.33
Mean DAP at Intra -OP	75.0817	15.44036	43.33	114.00
Mean DAP at Extubation	74.9583	14.40981	47.00	106.67
P-value for DAP intervals	0.55			

CONCLUSION

The study found that the majority of patients were fasting at midnight with a mean duration of 10.33 hours. Perioperative hemodynamics showed <20 +/- variability, and there was a gradual minor drop-in heart rate from the induction to the recovery period, with statistical significance of 0.02. However, there is not enough evidence to conclude that there is a significant difference in mean SAP & DAP across perioperative intervals (induction, intra-op, recovery). Our study contributes to the ongoing discourse on preoperative fasting practices and perioperative hemodynamics. It underscores the need for healthcare providers to carefully evaluate and potentially revise fasting protocols to minimize unnecessary fasting durations. The impact of fasting duration in the context of fasting hours on hemodynamic variability is still not truly justified and requires further investigation.

ACKNOWLEDGMENT

We are deeply obliged to Muhammad Tayyab and Syed Arshad Ullah, Lecturers at College of Medical Technology, BKMC who guided us during our research. Their keen valuable suggestions made this work to end.

DISCLOSURES

There is no conflict of interest.

REFERENCES

1. Lambert E, Carey S. Practice Guideline Recommendations on Perioperative Fasting: A Systematic Review. Vol. 40, Journal of Parenteral and Enteral Nutrition. SAGE Publications Inc.; 2016. p. 1158–65.
2. Schmidt AR, Buehler KP, Both C, Wiener R, Klaghofer R, Hersberger M, et al. Liberal fluid fasting: impact on gastric pH and residual volume in healthy children undergoing general anaesthesia for elective surgery. Br J Anaesth. 2018 Sep 1;121(3):647–55.
3. Apfelbaum JL. Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. Anesthesiology. 2017;126(3):376–93.
4. Maltby JR. Fasting from midnight e the history behind the dogma. 2006;20(3):363–78.
5. Presta M V., Bhavani SS, Abdelmalak BB. Nil per os guidelines: What is changing, what is not, and what should? Vol. 84, Minerva Anestesiologica. Edizioni Minerva Medica; 2018. p. 1413–9.
6. Yimer AH, Haddis L, Abrar M, Seid AM. Adherence to pre-operative fasting guidelines and associated factors among pediatric surgical patients in selected public referral hospitals, Addis Ababa, Ethiopia: Cross sectional study. Ann Med Surg. 2022 Jun 1;78.
7. Fasting P, Agarkar M, Blanck JF. 2023 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting : Clear Liquids with or without Protein , Chewing Fasting Duration — A Modular Update of the 2017 American Society of Anesthesiologists Practice Guidelines for. 2023;(2):132–51.
8. Anesthe DEL. G UIDELINES TO THE

Revised Edition 2023. 2023;16–55.
9. Merchant RN, Chima N, Ljungqvist O, Kok JNJ. Preoperative Fasting Practices Across Three Anesthesia Societies: Survey of Practitioners. JMIR Perioper Med. 2020;3(1):e15905.
10. Abebe WA, Rukewe A, Bekele NA, Stoffel M, Dichabeng MN, Shifa JZ. Preoperative fasting times in elective surgical patients at a referral hospital in Botswana. Pan Afr Med J. 2016;23:1–8.
11. Brunet-Wood K, Simons M, Evasiuk A, Mazurak V, Dicken B, Ridley D, et al. Surgical fasting guidelines in children: Are we putting them into practice? J Pediatr Surg [Internet]. 2016;51(8):1298–302. Available from: http://dx.doi.org/10.1016/j.jpedsurg.2016.04.006
12. Thomas M, Morrison C, Newton R, Schindler E. Consensus statement on clear fluids fasting for elective pediatric general anesthesia. Paediatr Anaesth. 2018 May 1;28(5):411–4.
13. Yurashevich M, Chow A, Kowalczyk JJ, Traynor AJ, Carvalho B. Preoperative fasting times for patients undergoing caesarean delivery: Before and after a patient educational initiative. Turkish J Anaesthesiol Reanim. 2019 Aug 1;47(4):282–6.
14. Yimer AH, Haddis L, Abrar M, Seid AM. Adherence to pre-operative fasting guidelines and associated factors among pediatric surgical patients in selected public referral hospitals, Addis Ababa, Ethiopia: Cross sectional study. Ann Med Surg [Internet]. 2022;78(May):103813. Available from: https://doi.org/10.1016/j.amsu.2022.103813
15. Buitenwerf E, Boekel MF, Van Der Velde MI, Voogd MF, Kerstens MN, Wietasch GJKG, et al. The haemodynamic instability score: Development and internal validation of a new rating method of intra-operative haemodynamic instability. Eur J Anaesthesiol. 2019;36(4):290–6.
16. Kratz T, Hinterobermaier J, Kratz NTC, Wulf H, Steinfeldt T, Zoremba M, et al. Pre-operative fluid bolus for improved haemodynamic stability during minor surgery : A prospectively randomized clinical trial. 2018;(April).
17. Schmidt AR, Fehr J, Man J, Souza GD, Wang E, Claure R, et al. Pre-operative fasting times for clear liquids at a tertiary children ' s hospital ; what can be improved ? 2021;266–72.
18. Alvi NI. A prospective, cross-sectional survey of preoperative fasting of pediatric surgical patients in a university hospital. Anaesthesia, Pain Intensive Care. 2016;20(2):171–5.
19. Siddiqui MA, Perchani A, Raza H, Soomro A, Kamlesh, Luhana S. To explore the impact of following the pre-operative fasting guidelines by ASA (American society of anesthesiologists), in improving patient outcome. Prof Med J. 2021;28(7):1018–21.