
# CAS 2023 Annual Meeting

## Perioperative Abstracts

# Contents

# Anesthesiologists as Perioperative Leaders: A Case of Amiodarone Induced Thyrotoxicosis


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## INTRODUCTION

As surgical care becomes more complex, reliance on health interventions from multidisciplinary teams in the perioperative period has led to better surgical outcomes[1,2,3]. As such, the Anesthesiologist's role has expanded into being a leader in the perioperative period, helping to coordinate consultants and optimize patients. Framed in the context of a patient undergoing a complete thyroidectomy for refractory amiodarone induced thyrotoxicosis (AIT), this case study outlines strategies and leadership skills which contributed to optimal provision of care by an anesthesiology team. Management of this complex patient highlights pertinent qualities crucial to the Perioperative Anesthesiologist Leader, such as inter-professional communication, learning agility, collective flexibility and shared consensus.

## CASE PRESENTATION

A 58-year-old male with multiple comorbidities presented with amiodarone induced thyrotoxicosis complicated by new angina, refractory atrial fibrillation and ongoing hyperthyroidism symptoms despite optimal medical therapy with digoxin, propranolol, methimazole and prednisone. Given the medical complexity, Anesthesia coordinated extensive multidisciplinary meetings with hematology, cardiology and general surgery to discuss timing of the surgery, medical optimization of the patient and to create a shared consensus and formalized care plan.

Collective flexibility by the multidisciplinary team, established by building rapport, allowed the case to be done during the day ensuring ample ancillary help for surgery and anesthesia. Coordination of these meetings and shared mental models allowed the team to discuss and balance benefits and risks of preoperative interventions such as plasma exchange and delaying surgery to investigate the patient's palpitations and worsening angina.

The communicative rapport built by these meetings allowed for prompt cardiac workup. The presence of a cardiac occlusion had the potential to delay surgery. If the patient's angiogram revealed significant thrombosis, rather than implementing standard treatment with stenting, our learning agility and collective flexibility lead to the decision of potential balloon angioplasty instead, for timely definitive treatment and avoidance of the need for dual antiplatelet therapy. Fortunately, no coronary disease was detected, and the thyroidectomy was completed with an unremarkable intraoperative course.

## CONCLUSION

The literature describing successful application of leadership skills by anesthesiologists has notably been set within the confines of the operating room[4,5]. Nevertheless, anesthesiologists are equipped with comprehensive knowledge for assessment, risk stratification, optimization, and post-operative care that requires outreach and coordination with sub-specialties and allied health professionals throughout a patient's admission. As such, Anesthesiologists are in the unique position to improve patient care and safety, utilizing our leadership skills. This abstract underscores essential qualities of communication, adaptability, teamwork and decision making with a united goal of improved perioperative patient care.

**REFERENCES**


1. Batchelor TJP, Rasburn NJ, Abdelnour-Berchtold E, et al. Guidelines for enhanced recovery after lung surgery: Recommendations of the Enhanced Recovery after Surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS). *Eur J Cardio-thoracic Surg*. 2019;55(1):91-115. doi:10.1093/ejcts/ezy301
2. Rocca G Della, Vetrugno L, Coccia C, et al. Preoperative evaluation of patients undergoing lung resection surgery: Defining the role of the anesthesiologist on a multidisciplinary team. *J Cardiothorac Vasc Anesth*. 2016;30(2):530-538. doi:10.1053/j.jvca.2015.11.018
3. Whiteman AR, Dhesi JK, Walker D. The high-risk surgical patient: A role for a multi-disciplinary team approach? *Br J Anaesth*. 2016;116(3):311-314. doi:10.1093/bja/aev355
4. Davies JM. Team communication in the operating room. *Acta Anaesthesiol Scand*. 2005;49(7):898-901. doi:10.1111/j.1399-6576.2005.00636.x
5. Boet S, Larrigan S, Martin L, Liu H, Sullivan KJ, Etherington C. Measuring non-technical skills of anaesthesiologists in the operating room: a systematic review of assessment tools and their measurement properties. *Br J Anaesth*. 2018;121(6):1218-1226. doi:10.1016/j.bja.2018.07.028

# A Novel Tool to Evaluate Obstructive Sleep Apnea Using Point of Care Ultrasound (PoCUS)


## AUTHORS

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## INTRODUCTION

Obstructive sleep apnea (OSA) is a common condition associated with increased postoperative cardiorespiratory complications, morbidity and mortality and perioperative resource utilization. [1] Screening tools like the STOP-Bang questionnaire commonly used to assess for OSA suffer from poor specificity whereas the gold standard polysomnography is restricted by logistics and feasibility. A previous paper has demonstrated the feasibility of performing a Point of Care Ultrasound (PoCUS) screen in the pre-operative setting. [2] In this study, we discuss the advantage of using a PoCUS screening tool in addition to the STOP-Bang questionnaire for pre-operative screening for OSA.

## METHODS

After institutional research ethics board approval, patients having OSA and non-complaint to treatment, scheduled for elective surgery were approached. Preoperative clinical and airway examination, OSA screening using the STOP-Bang questionnaire and other demographic data were collected. Pre-defined upper airway and neck ultrasound scans were performed as part of the 5-parameter PoCUS tool. Parameters were shortlisted from an earlier feasibility evaluation utilizing biological plausibility, anatomical area covered, and consistency of area under curve (AUC) estimates to inform this decision. [2] The PoCUS tool included: upper airway length (UAL), coronal tongue base thickness (TBT), distance between lingual arteries (DLA), lateral pharyngeal wall thickness (LPW) and internal carotid artery intimal media thickness (CIMT). Images were de-identified and assessed by blinded assessors. Subsequently patients underwent either a PSG or home sleep apnea test [ResMed ApneaLink™ device] (HST). Patients were classified into mild, moderate or severe OSA using apnea-hypopnea index (AHI) cut-offs of >5, >15 and >30. Diagnostic accuracy statistics were calculated for each parameter, as per the Standards for Reporting Diagnostic accuracy studies (STARD) checklist. Diagnostic accuracy was assessed using receiver-operating characteristic (ROC) curves and the AUC within the cohort for STOP-Bang alone and STOP-Bang in addition to the PoCUS tool for AHI's of >5, >15 and >30.

## RESULTS

1352 patients presenting for elective, non-cardiac surgeries were approached for participation, and 142 consented. Subsequently, 108 patients underwent a PoCUS evaluation at the time of the pre-operative visit and 61 patients had a PSG with 26 patients opting for an HST. Due to constraints imposed the pandemic, however, only 87 patients were

able to complete both a PoCUS and PSG/ HST. We were able to successfully complete data acquisition for all PoCUS parameters in the pre-operative period and 12, 50, and 25 patients had AHI's >5, >15 and > 30 respectively. The combination of STOP-Bang and PoCUS yielded better AUC's across the three AHI cut-offs (0.785 AHI>5, 0.776 AHI>15, 0.778 AHI>30) when compared to STOP-Bang alone (0.591 AHI>5, 0.624 AHI>15, 0.639 AHI>30).

## DISCUSSION

Our findings demonstrate that the addition of the 5 parameter PoCUS to the traditional STOP-Bang questionnaire improves sensitivity, specificity, and positive and negative predictive values. ROC curves (figure) show an improved diagnostic accuracy of the combined PoCUS & STOP-Bang tool as compared to STOP-Bang alone. We believe that this finding opens up new avenues to improve the detection of OSA in the perioperative period, thus facilitating risk stratification and improving resource utilization in situations where traditional diagnostic modalities (PSG/ HST) are unavailable or impractical.

## REFERENCES


1. Point-of-Care Ultrasound for Obstructive Sleep Apnea Screening: Are We There Yet? A Systematic Review and Meta-analysis. Anesth Analg 2019;129(6): 1673-91
2. Novel Point of Care Ultrasound Tool to Evaluate Obstructive Sleep Apnea Patients in the Perioperative Setting: A Feasibility Study. e-abstract A1090; 2019 ASA Meeting, Orlando, FL.


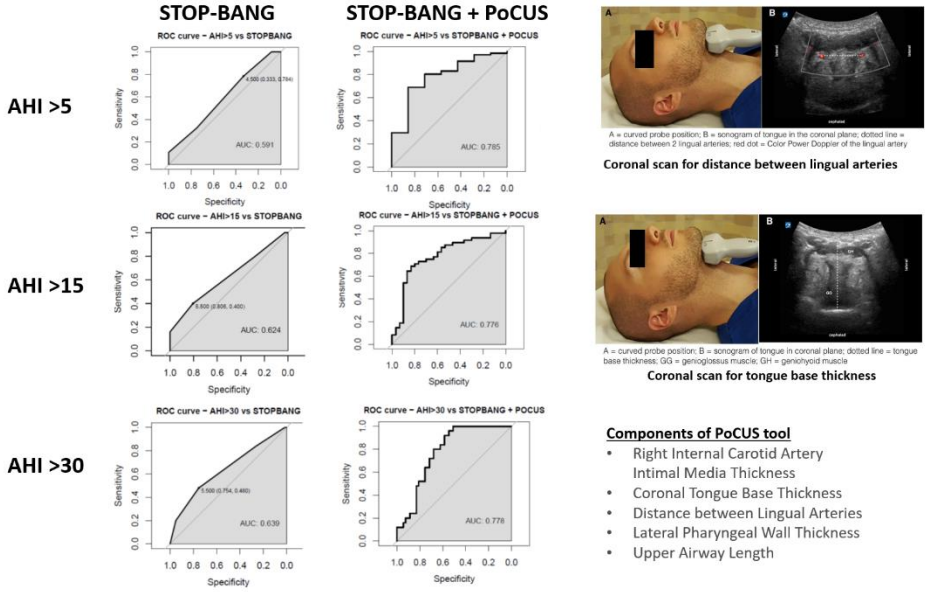


Figure 1

# Adherence to Preoperative Fasting Instructions in Pediatric Patients Undergoing Anesthesia for Non-Cardiac Elective Surgeries


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## INTRODUCTION

Preoperative fasting guidelines (NPO, nil per os) aim to reduce the risk of gastrointestinal regurgitation and pulmonary aspiration when patients are under anesthesia for surgery [1]. Pulmonary aspiration can lead to hypoxia, respiratory compromise, and even death. Excessive fasting before surgery can have detrimental effects on children (e.g., anxiety, hypoglycemia, hypovolemia) [2]. Therefore, shorter NPO fasting guidelines have recently been advocated by national guidelines across the world. The aim of this study was to assess how well preoperative fasting guidelines are being followed in non-cardiac elective surgeries in different demographics at our academic institution. In our institution, patients are currently instructed to fast two hours longer than national guidelines. We hypothesize that a large proportion of patients will significantly exceed the recommended institutional fasting instructions.

## METHODS

Upon receiving institutional ethics and data access approval, we performed a retrospective cohort study on pediatric patients undergoing non-cardiac elective surgeries at our institution (January–March 2020). For each patient, we recorded anesthetic start time and the time they last ate and drank before surgery. Statistical analysis included descriptive statistics and logistic regression to find any association between age/sex/procedure and meeting/exceeding fasting times.

## RESULTS

Out of 673 patients, 98.0% met the national solid fasting guidelines and 96.7% met the national liquid fasting guidelines. Of these patients, 31.4% exceeded solid fasting guidelines by >8 hours and 84.5% exceeded liquid fasting guidelines by >2 hours. All patients <15 years had greater odds of excessive solid fasting (OR 1.5 [0.74,3.15], p=0.238). Furthermore, all patients 15–17 years had greater odds of excessive liquid fasting (OR 3.4 [1.78,6.62], p<0.001). Patients undergoing a urological procedure had decreased odds of excessive liquid fasting (OR 0.4 [0.20,0.87], p=0.019). See **Table 1** for full results.

## DISCUSSION

Our results support our initial hypothesis. Over 80% of patients exceeded the fasting guidelines by at least 2 hours. Adverse events due to prolonged preoperative fasting status

may be due to nonadherence to the fasting guidelines. Information is potentially not being relayed effectively in the preoperative clinic. Whilst it is important to improve communication in the preoperative clinic, it is equally important to encourage appropriate intake closer to the recommended guidelines. Special instructions should be provided to populations identified to have a greater odds of prolonged fasting (e.g., patients <15 years for solids).

## REFERENCES


1. Disma, N., Frykholm, P., Cook-Sather, S. D., & Lerman, J. (2021). Pro-con debate: 1- vs 2-hour fast for clear liquids before anesthesia in children. Anesthesia & Analgesia, 133(3), 581–591. https://doi.org/10.1213/ane.0000000000005589
2. Dennhardt, N., Beck, C., Huber, D., Sander, B., Boehne, M., Boethig, D., Leffler, A., & Sümpelmann, R. (2016). Optimized preoperative fasting times decrease ketone body concentration and stabilize mean arterial blood pressure during induction of anesthesia in children younger than 36 months: A prospective observational cohort study. Pediatric Anesthesia, 26(8), 838–843. https://doi.org/10.1111/pan.12943

**Table 1: Descriptive statistics of characteristics**

| Characteristic | Overall (N=673) |
|---|---|
| Age at OR (years); mean (SD) | 6.4 (4.86) |
| Age in categories; n(%) | |
| 0-2 | 152 (22.6) |
| 3-5 | 216 (32.1) |
| 6-8 | 110 (16.3) |
| 9-11 | 66 (9.8) |
| 12-14 | 54 (8.0) |
| 15+ | 75 (11.1) |
| Sex; n(%) | |
| Male | 393 (58.4) |
| Female | 280 (41.6) |
| Surgical Procedure; n(%) | |
| ORTH | 73 (10.8) |
| ENT | 246 (36.6) |
| UROL | 98 (14.6) |
| PAEDS | 105 (15.6) |
| DDS | 79 (11.7) |
| PLAS | 52 (7.7) |
| Other | 20 (3.0) |
| Percentage that fasted from solids for at least 8 hours | 648 (96.3) |
| Percentage that fasted from solids for at least 6 hours | 661 (98.0) |
| Percentage that fasted from liquids for at least 2 hours | 651 (96.7) |
| Percentage that fasted from liquids for at least 1 hour | 664 (98.7) |
| Percentage that exceeded fasting guidelines for solids by at least 2 hours (10 hours or more since last ate) | 613 (91.1) |
| Percentage that exceeded fasting guidelines for liquids by at least 2 hours (4 hours or more since last drank) | 562 (83.5) |
| Percentage that exceeded fasting guidelines for solids by at least 8 hours (16 hours or more since last ate) | 211 (31.4) |
| Percentage that exceeded fasting guidelines for liquids by at least 8 hours (9 hours or more since last ate) | 295 (43.8) |
| Amount of time fasted from solids in hours:mins; mean (SD) | 14:25 (2:58) |
| Amount of time fasted from liquids in hours:mins; mean (SD) | 8:36 (4:43) |

# Adult Elective Surgery Cancellations at a Tertiary Care Hospital

**Submission ID**

45

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## INTRODUCTION

Unexpected postponement or cancellation of elective surgery negatively impacts patient outcomes and system efficiency. The overall published rate of cancellation on the day of surgery varies from 5% to 40% (1, 2). Reasons for cancellation include fasting and medication violations, and incomplete preoperative optimization (3). Previous studies have suggested that approximately 55% of surgery cancellations are preventable with improved preoperative assessment and patient education (4). The primary objective of this study was to identify the incidence and causes of cancellation on the day of elective surgery at an academic university hospital over a 30-month period.

## METHODS

The study was approved by the University Research Ethics Board. A retrospective review was performed of adult patients who experienced day-of-elective surgery cancellations in the operating room between November 3, 2019 and April 13, 2022. Cancelled cases were identified from the operating room administrative database. Reasons for cancellation were determined from the Electronic Medical Record. Cancellations were classified as “avoidable” or “unavoidable”. Avoidable cancellations were defined as those which would not have been cancelled with improved preoperative optimization and/or education. All other cancellations were deemed unavoidable. The extent of preoperative optimization was recorded as being either none, phone, or in-person. Descriptive statistics were used to summarize the data and compare reasons for cancellations between different modalities of the pre-admission clinic (PAC) assessment. A chi-squared test was used to compare the distribution of PAC status and the reason for cancellation.

## RESULTS

8140 elective surgeries were scheduled during the study period. 953 cases were cancelled on the day of surgery. 292 were excluded due to duplicate recording and administrative errors. The overall rate of cancellation was 661/8140 (8%). 78/661 (11.8%) were deemed avoidable and 583/661 (88.2%) were unavoidable. Of the avoidable cancellations, 27/78 (34.6%) were due to failure to optimize a medical condition, 17/78 (21.8%) failed to comply with preoperative medication administration instructions, 17/78 (21.8%) were deemed to require further investigation, 14/78 (17.9%) patients failed to comply with NPO instructions, and 3/78 (3.8%) did not have a full understanding of surgery. Of the avoidable cancellations, 32/78 (41%) did not receive a PAC prior to the surgery, 32/78 (41%) received a phone PAC,

and 14/78 (18%) received an in-person PAC. Of the unavoidable cancellations, 416/583 (71.3%) were displaced by emergency cases and 61/583 (10.5%) were due to overbooking of the operating room.

## DISCUSSION

This is one of the first studies to identify the reasons for last-minute cancellations of elective surgery in a tertiary care facility. A large proportion of avoidable cancellations (59%) had been assessed at the PAC clinic. This study suggests there is potential for improved education and optimization of elective surgical patients.

## REFERENCES


1. Haana V, Sethuraman K, Stephens L, Rosen H, Meara JG. Case cancellations on the day of surgery: an investigation in an Australian paediatric hospital. ANZ J Surg 2009;79:636–40.
2. Rai MR, Pandit JJ. Day of surgery cancellations after nurse-led pre-assessment in an elective surgical centre: The first 2 years. Anaesthesia 2003;58:692–9.
3. Talalwah N Al, McIltrot KH. Cancellation of Surgeries: Integrative Review. J Perianesthesia Nurs 2019;34:86–96
4. Kaddoum R, Fadlallah R, Hitti E, El-Jardali F, Eid G El. Causes of cancellations on the day of surgery at a Tertiary Teaching Hospital. BMC Health Serv Res 2016;16:259.

# Comparison of BNP and NT-ProBNP in Adult Patients Undergoing Preoperative Cardiac Risk Prediction Testing


## AUTHORS

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## INTRODUCTION

Myocardial injury after noncardiac surgery (MINS) is a strong and independent predictor of 30-day mortality[1]. B-type natriuretic peptide (BNP) and N-terminal pro B-type natriuretic peptide (NT-ProBNP) have predictive value in identifying patients at increased risk of developing MINS and other perioperative vascular events. Although incremental threshold values of NT-ProBNP have been correlated with an increasing degree of risk of perioperative cardiac events, a similar relationship with BNP values has not been established. As many hospitals provide BNP assays rather than NT-ProBNP, the primary objective of this study was to examine the relationship between BNP and NT-ProBNP in a group of adult patients undergoing elective non-cardiac surgery.

## METHODS

This was a single-centre correlational study in 456 patients undergoing elective noncardiac surgery. This study was approved by the Research Ethics Board (REB) and all participants gave informed consent for enrollment in the study. Eligibility criteria included patients >65 years old, Revised Cardiac Risk Index ≥1, or patients >45 years old with significant cardiovascular disease. To allow simultaneous serum sampling of BNP and NT-ProBNP, patients at preoperative pre-surgical screening (PSS) who met local guidelines for preoperative BNP testing (lab-based BNP Abbott analysis) also had an additional 5mL of blood drawn for measurement of NT-ProBNP (point-of-care NT-ProBNP Roche analysis). The Abbott test and point-of-care Roche test are immunoassays for the quantitative determination of BNP and NT-ProBNP in venous blood, respectively. A log-transformed linear regression model was used to quantify the relationship between BNP and NT-ProBNP.

## RESULTS

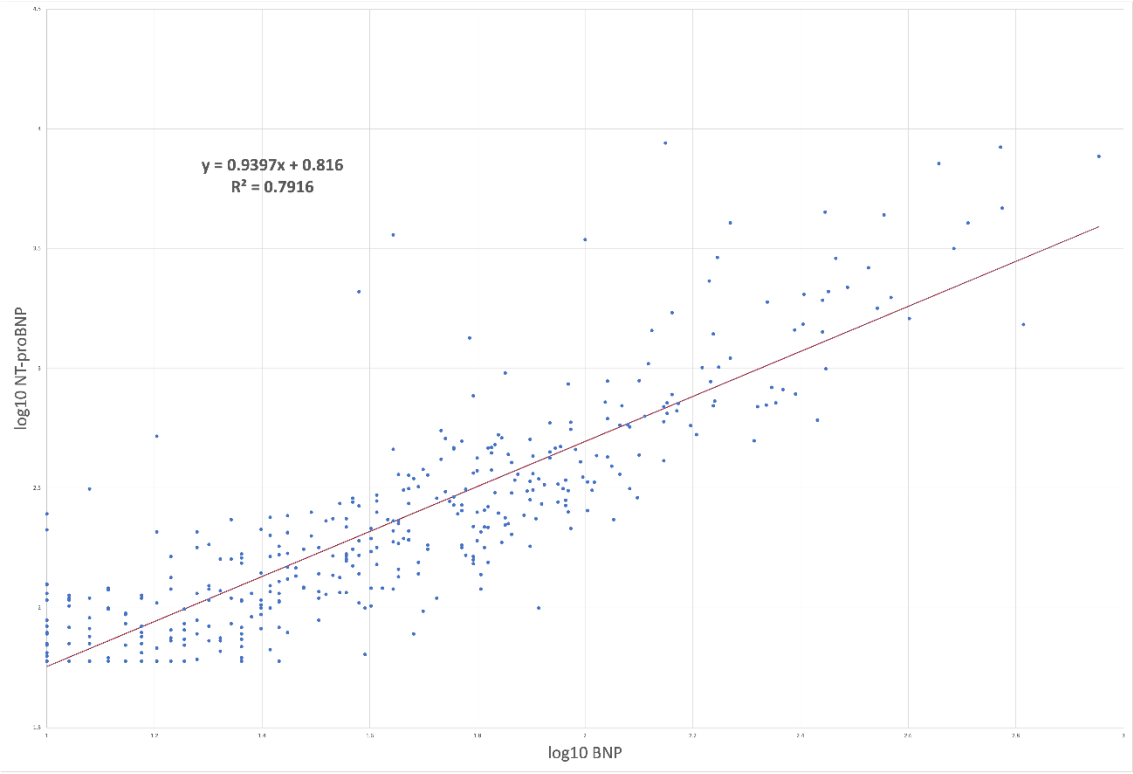
Among 456 adult patients (mean age 67 years, SD= 12; 50.4% male) who underwent preoperative BNP and NT-ProBNP measurement, median (IQR) BNP was 36 pg/mL (73 - 15) and median (IQR) NT-ProBNP was 166 pg/mL (348.25 - 78). A linear regression model revealed a strong linear correlation between logBNP and logNT-ProBNP values (Figure 1), with a correlation coefficient (Pearson's r) of 0.89 and a coefficient of determination ($r^2$) of 0.79 ($F(1,454) = 1724.70$, $p < 0.001$).

## DISCUSSION

BNP was significantly associated with NT-ProBNP in 456 adult patients undergoing preoperative cardiac risk prediction testing, with an explained variance ($r^2$= 0.79) comparable to that previously reported in the literature ($r^2$= 0.81)[2]. Although these observations suggest a strong correlation between BNP and NT-ProBNP, several studies demonstrate that consideration of certain patient factors, including age, body mass index, renal function, anemia, and atrial fibrillation, may improve the accuracy of formulas used to convert BNP to NT-ProBNP[3]. We plan future studies to examine the ability of these conversion formulas to validate BNP thresholds to predict perioperative cardiac risk using outcome data.

## REFERENCES


1. Duceppe, E., et al., *Canadian Cardiovascular Society Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Noncardiac Surgery.* Can J Cardiol, 2017. 33(1): p. 17-32.
2. Rorth, R., et al., *Comparison of BNP and NT-proBNP in Patients With Heart Failure and Reduced Ejection Fraction.* Circ Heart Fail, 2020. 13(2): p. e006541.
3. Kasahara, S., et al., *Conversion formula from B-type natriuretic peptide to N-terminal proBNP values in patients with cardiovascular diseases.* Int J Cardiol, 2019. 280: p. 184-189.

# Do Standard Preoperative Fasting Instructions Ensure an Empty Stomach in Diabetic Patients? A Cross-Sectional Non-Inferiority Comparative Study


## AUTHORS

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## INTRODUCTION

The physiology of diabetes mellitus can increase the risk of perioperative aspiration but there is limited and contradictory evidence on the incidence of “full stomach” in fasting diabetic patients. The aim of this study is to assess the baseline gastric content (using gastric ultrasound) in diabetic and non-diabetic patients, scheduled for elective surgery, who have followed standard pre-operative fasting instructions.

## METHODS

This was a prospective, non-inferiority study of 180 patients (84 diabetics and 96 non-diabetics). Bedside ultrasound was used for qualitative and quantitative assessment of the gastric antrum in the supine and right lateral decubitus positions. Fasting gastric volume was estimated based on the cross-sectional area (CSA) of the gastric antrum and a validated model.[1] We hypothesized that diabetic patients would not have a higher baseline fasting volume compared to non-diabetic patients, with a non-inferiority margin of 0.4 mL/kg. Secondary aims included the comparison of the incidence of “full stomach” (solid content or >1.5mL/kg of clear fluid) between the 2 groups, estimation of the 95th percentile of the gastric volume distribution in both groups, and examination of the association between gastric volume, glycemic control, and diabetic comorbidities.

## RESULTS

The baseline gastric volume [SD] was similar in the diabetic (0.81 [0.61] mL/kg) and non-diabetic (0.87 [0.53] mL/kg) groups. The gastric volume was not higher in diabetic patients (mean difference was -0.07 mL/kg [95% CI: -0.24 to 0.10 mL/kg]). Thirteen (15.5%) diabetic and 11 (11.5%) non-diabetic patients presented > 1.5 mL/Kg of gastric volume ($p$>0.05). There was no correlation between the gastric volume and either the time since diagnosis or HbA1C.

## DISCUSSION

Our data suggest that the current fasting guidelines from the American Society of Anesthesiologists are equally effective in preventing a “full stomach” prior to elective surgery in diabetic and non-diabetic patients.

## REFERENCES


1. Perlas A, Mitsakakis N, Liu L, Cino M, Haldipur N, Davis L, Cubillos J, Chan V: Validation of a mathematical model for ultrasound assessment of gastric volume by gastroscopic examination. Anesth Analg 2013; 116:357–63

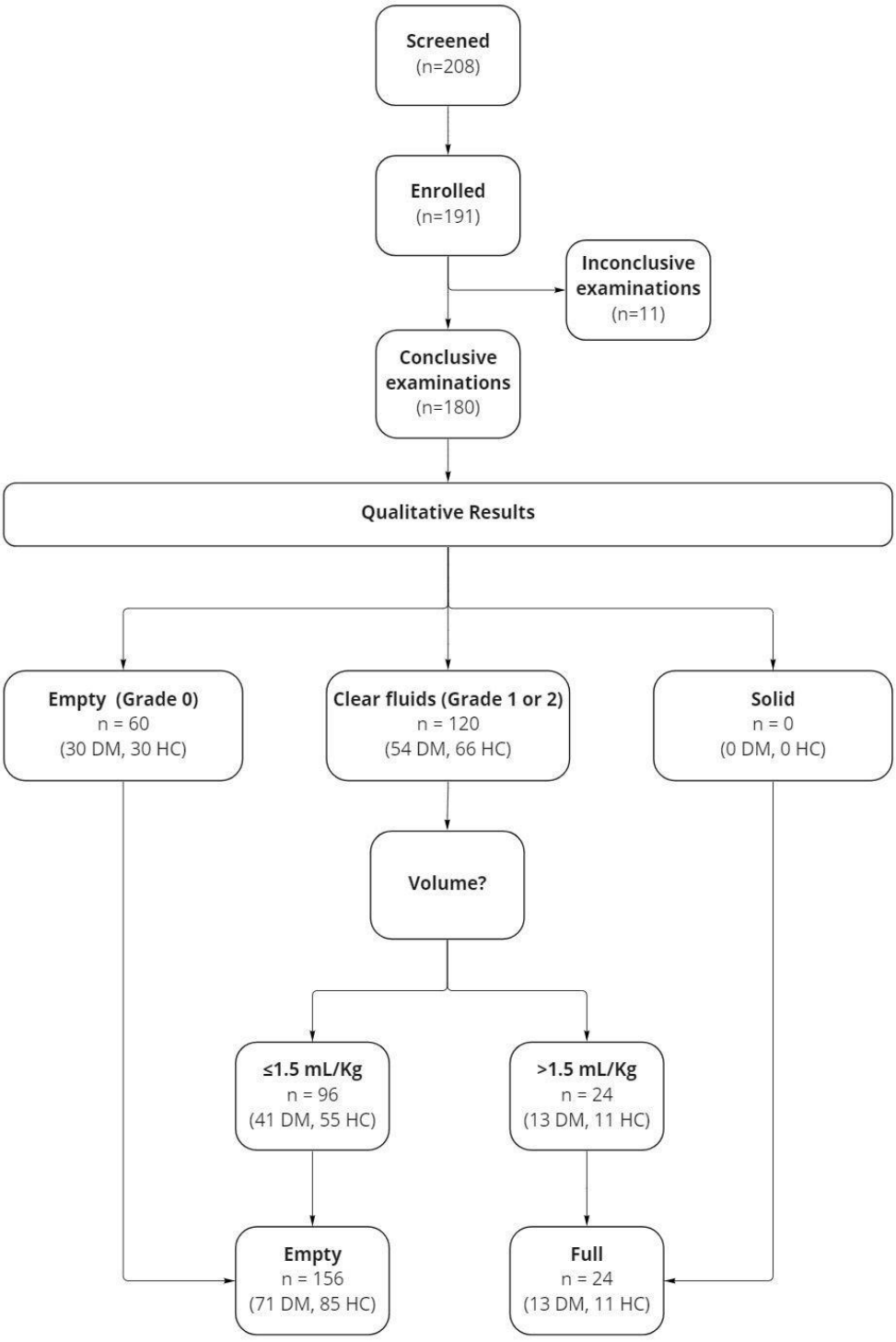
Screened
(n=208)
Enrolled
(n=191)
Inconclusive examinations
(n=11)
Conclusive examinations
(n=180)
Qualitative Results
Empty (Grade 0)
n = 60
(30 DM, 30 HC)
Clear fluids (Grade 1 or 2)
n = 120
(54 DM, 66 HC)
Solid
n = 0
(0 DM, 0 HC)
Volume?
≤1.5 mL/Kg
n = 96
(41 DM, 55 HC)
>1.5 mL/Kg
n = 24
(13 DM, 11 HC)
Empty
n = 156
(71 DM, 85 HC)
Full
n = 24
(13 DM, 11 HC)

Figure 1

# Impact of Sugammadex vs. Neostigmine Reversal on Post-Operative Recovery and Postoperative Complications in Patients with Obstructive Sleep Apnea Undergoing Bariatric Surgery: A Double-Blind, Randomized Controlled Trial


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## INTRODUCTION

Residual neuromuscular blockade can be associated with serious postoperative complications. Sugammadex is a newer neuromuscular blocking drug (NMBD) reversal agent that rapidly and completely reverses rocuronium. Whether sugammadex has any advantages over neostigmine in obese patients with obstructive sleep apnea (OSA) is unclear. We investigated whether Sugammadex would reduce discharge time from the operating room (OR) compared with Neostigmine in morbidly obese patients with OSA undergoing bariatric surgery.

## METHODS

This was a prospective, double-blinded randomized controlled superiority trial with two parallel groups. Patients were randomized 1:1 into reversal of NMBD with sugammadex or neostigmine. Research Ethics Board approval was obtained, and informed consent was taken from all subjects. Our inclusion criteria were adult patients with OSA undergoing elective bariatric surgery under general anesthesia. Primary outcome was the time from administration of NMBD reversal agent to discharge from the OR. Secondary outcomes were the time from administration of NMBD reversal agent to the time: the patient opened eyes to command, extubation, moves independently from the table to the bed, readiness for discharge from PACU and in-hospital complications. Mann-Whitney test was used to compare the outcomes between treatment groups.

## RESULTS

We randomized 120 patients into 2 groups of 60 patients. Overall median BMI was 48.1 $kg/m^2$([IQR]) [43.0, 53.5]. The median time from drug administration to discharge from OR was 13.0 min [10.0, 17.0] in the Sugammadex group and 13.5 min [11.0, 18.3] in the Neostigmine group (P = 0.274). The median duration of stay in PACU was 150.0 min [125.5, 177.0] in the Sugammadex group and 127.0 min [108.8, 149.0] in Neostigmine (P = 0.004). There were no differences in other secondary outcomes.

## DISCUSSION

There was no reduction in recovery time or postoperative complications in morbidly obese patients with OSA when Sugammadex was used instead of Neostigmine.

## REFERENCES


1. Kheterpal S, Vaughn MT, Dubovoy TZ, Shah NJ, Bash LD, Colquhoun DA, Shanks AM, Mathis MR, Soto RG, Bardia A, Bartels K, McCormick PJ, Schonberger RB, Saager L. Sugammadex versus Neostigmine for Reversal of Neuromuscular Blockade and Postoperative Pulmonary Complications (STRONGER): A Multicenter Matched Cohort Analysis. Anesthesiology. 2020 Jun;132(6):1371-1381. doi: 10.1097/ALN.0000000000003256. PMID: 32282427; PMCID: PMC7864000.
2. Li G, Freundlich RE, Gupta RK, Hayhurst CJ, Le CH, Martin BJ, Shotwell MS, Wanderer JP. Postoperative Pulmonary Complications' Association with Sugammadex versus Neostigmine: A Retrospective Registry Analysis. Anesthesiology. 2021 Jun 1;134(6):862-873. doi: 10.1097/ALN.0000000000003735. PMID: 33730169; PMCID: PMC8114582.
3. Blobner M, Hunter JM, Ulm K. How robust are the STRONGER and STIL-STRONGER studies? Br J Anaesth. 2022 Sep 28:S0007-0912(22)00465-2. doi: 10.1016/j.bja.2022.08.021. Epub ahead of print. PMID: 36182557.
4. Echeverry, Germán; Polskin, Lily; Tollinche, Luis E; Seier, Kenneth; Tan, Kay See; McCormick, Patrick J; Fischer, Gregory W; Grant, Florence M. Routine use of sugammadex does not shorten Pacu length of stay: A prospective double-blinded randomized controlled trial. Perioperative Care and Operating Room Management. Volume 24, 2021, 100199, ISSN 2405-6030,

# Intraoperative Hypotension in Patients Having Major Non-Cardiac Surgery Under General Anesthesia: A Systematic Review of Blood Pressure Optimization Strategies


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## INTRODUCTION

Intraoperative hypotension is associated with increased risks of postoperative complications, with evidence suggesting that the duration and severity of hypotension influences the magnitude of end-organ injury (1). Preliminary evidence suggests that strict intraoperative blood pressure control may be associated with reduced risks of adverse postoperative events (2). Consequently, a variety of blood pressure optimization strategies have been tested to prevent or promptly treat intraoperative hypotension. Despite a rapidly growing relevant literature, these strategies have yet to be systematically examined to assess their impact on blood pressure control and outcomes. We therefore conducted a systematic review to evaluate the efficacy of blood pressure optimization interventions in reducing risks of intraoperative hypotension and postoperative complications.

## METHODS

Electronic databases (Medline, Embase, PubMed, and Cochrane Controlled Register of Trials) were searched from database inception to May 24th, 2022, for randomized controlled trials that evaluated the impact of a blood pressure optimization intervention on intraoperative blood pressure and/or postoperative outcomes. A blood pressure optimization intervention was defined as any intervention used during the perioperative period to reduce the incidence, severity, or duration of intraoperative hypotension. There were no restrictions placed for the type of comparator used or the language of the study. Only adults receiving general anesthesia for inpatient non-cardiac surgical procedures were included. Obstetric and transplant surgeries were excluded. Two independent reviewers screened all citations and abstracted relevant study data onto standardized data abstraction forms. Disagreements were resolved through involvement of a third reviewer.

## RESULTS

40 studies (42,110 participants) were included. Ten classes of blood pressure optimization interventions were identified. In seven studies (n=761) of hemodynamic protocols using arterial waveform analysis, protocols were associated with reduced risks of hypotension compared to usual care (6%-48% vs. 13%-77% incidence; 2.8%-3.1% vs. 7.8%-10.3% time in hypotension). In five studies (n=7,902) that withheld antihypertensives the night before surgery, risks of hypotension were reduced (20%-67%) compared to continuing antihypertensives (50%-100% incidence). Other interventions include continuous versus oscillometric blood pressure monitoring (n=862), adjuvant agents (vasopressors,

anticholinergics) (n=471), and pre-specified blood pressure targets (n=1,914), all of which reported reduced risks of hypotension. Blood pressure alarms (n=29,826) had an inconsistent impact on hypotensive time. Three studies (n=1,088) of pre-specified blood pressure targets found higher thresholds to be associated with reduced risks of complications. Otherwise, there was limited evidence suggesting that these interventions prevented postoperative complications. Heterogeneity in interventions and outcomes precluded meta-analysis.

## DISCUSSION

Several different blood pressure optimization interventions have shown promise in reducing the incidence or duration of hypotension, including hemodynamic protocols, withholding of antihypertensives, adjuvant agents and pre-specified blood pressure targets (but not supplementary alarms for low blood pressure). Nonetheless, evidence that these interventions impact clinical outcomes remains unclear, with the most promise being shown by interventions based on pre-specified blood pressure targets. Future trials should assess promising intervention types in samples sufficiently large to assess for clinically plausible treatment effects on important postoperative outcomes.

## REFERENCES


1. Wesselink EM, Kappen TH, Torn HM, Slooter AJC, van Klei WA. Intraoperative hypotension and the risk of postoperative adverse outcomes: a systematic review. Br J Anaesth. 2018;121(4):706-21.
2. Futier E, Lefrant JY, Guinot PG, Godet T, Lorne E, Cuvillon P, et al. Effect of Individualized vs Standard Blood Pressure Management Strategies on Postoperative Organ Dysfunction Among High-Risk Patients Undergoing Major Surgery: A Randomized Clinical Trial. JAMA. 2017;318(14):1346-57.

# Iron Deficiency Modifies Risk of Perioperative Transfusion


## AUTHORS

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## INTRODUCTION

Preoperative anemia is common, affecting up to 76% of patients in some surgical populations. Affected patients experience increased risks of major perioperative complications, longer duration intensive care stays, and in-hospital mortality.[1] Importantly, anemia is a strong determinant of perioperative blood transfusion, which comes with significant risks.[2] The most common cause of perioperative anemia is iron deficiency; although intravenous (IV) iron supplementation is available, systemic barriers to its implementation and limited evidence hinder its use for preoperative hemoglobin optimization.[3] The recent PREVENTT trial reported no difference in red cell (RBC) transfusion between patients receiving a single preoperative IV iron dose versus placebo.[4] However, the failure to separate iron deficient and non-iron deficient patients was an important limitation of their study and may explain these results.[5] We hypothesize that iron deficient and non-iron deficient patients represent two unique populations. We sought to evaluate how iron deficiency affected the likelihood of perioperative transfusion.

## METHODS

We performed a retrospective cohort study of adult surgical patients who underwent non-cardiac, non-transplant surgery at a large, urban, tertiary-care hospital between 1 October 2020 and 31 December 2021 using institutional administrative data. This study received institutional research ethics board approval (REB#22-5007). We excluded patients with known coagulopathy, blood dyscrasia, preoperative transfusion dependence, or documented refusal of blood products. We compared patients with iron deficiency flagged in the pre-anesthetic clinic versus non-iron deficient patients. Descriptive analyses were performed using t-test and chi-square tests for continuous and categorical variables, respectively. The likelihood of RBC transfusion during the first postoperative week was regressed against age, sex, weight, preoperative hemoglobin concentration, patient comorbidities, procedure duration, anesthetic type, estimated blood loss (EBL), and treatment with tranexamic acid or vasopressors using a logistic model. Iron deficiency was treated as an effect modifier. Assessment of model diagnostics for reliability and discrimination revealed a c-index of 0.926, Somer's Dxy of 0.845, $R^2$ of 0.525, Brier's score of 0.041, and optimism-corrected calibration slope of 0.924, overall indicating good model fit with low risk of overfitting.

## RESULTS

We included 7751 patients (511 iron deficient). More iron deficient patients were female (280 [55%] versus 3560 [50%]; p=0.024), had cancer (217 [43%] versus 1798 [25%]; p<0.001), renal disease (59 [12%] versus 251 [4%]; p<0.001), diabetes (101 [20%] versus 1022 [14%]; p<0.001), lower preoperative hemoglobin (120±16g/L versus 139±15g/L; p<0.001), and transfusion (121 [24%] versus 520 [7%]; p<0.001). In multivariable regression, iron deficiency was a significant effect modifier (p=0.024 for interaction). Among iron deficient patients, transfusion was associated with procedure duration (adjusted odds ratio [aOR] 1.2 [1.1–1.3] per 30min; p<0.001), preoperative hemoglobin (aOR 3.5 [2.6–4.9] per 10g/L; p<0.001), and blood loss (aOR 2.0 [1.6–2.6] per 200mL; p<0.001). In non-iron deficient patients, transfusion was associated with procedure duration, preoperative hemoglobin, and blood loss, plus tranexamic acid (aOR 2.1 [1.5–3.1]; p<0.001), vasopressor/inotrope infusion (aOR 2.1 [1.5–3.0]; p<0.001), regional/neuraxial anesthetic (OR 0.13 [0.05–0.33]; p<0.001), and body weight (aOR 0.9 [0.84–0.96]; p=0.008).

## DISCUSSION

This study has demonstrated that iron deficiency significantly modifies the relationship between patient and procedural characteristics with the likelihood of transfusion: iron deficient and non-iron deficient patients do represent two unique populations. We have additionally identified important predictors of transfusion for iron deficient and non-iron deficient patients. While treatment with tranexamic acid and vasopressor/inotrope infusion were associated with higher likelihood of transfusion in non-iron deficient patients, this relationship is not likely causal; rather, these may be markers of unexpected bleeding and hemodynamic instability. Future analyses of perioperative transfusion risk should stratify according to iron deficiency.

## REFERENCES


1. Shander, A., Knight, K., Thurer, R., Adamson, J. and Spence, R., 2004. Prevalence and outcomes of anemia in surgery: a systematic review of the literature. *The American journal of medicine*, *116*(7), pp.58-69.
2. Glance, L.G., Dick, A.W., Mukamel, D.B., Fleming, F.J., Zollo, R.A., Wissler, R., Salloum, R., Meredith, U.W. and Osler, T.M., 2011. Association between intraoperative blood transfusion and mortality and morbidity in patients undergoing noncardiac surgery. *The Journal of the American Society of Anesthesiologists*, *114*(2), pp.283-292.
3. Ontracprogram.com. 2021. [online] Available at: <https://www.ontracprogram.com/ckupload/files/103/Revised%20PBM%20algorithm%202021(5).pdf> [Accessed 10 June 2021].
4. Richards, T., Baikady, R.R., Clevenger, B., Butcher, A., Abeysiri, S., Chau, M., Macdougall, I.C., Murphy, G., Swinson, R., Collier, T. and Van Dyck, L., 2020. Preoperative intravenous iron to treat anaemia before major abdominal surgery (PREVENTT): a randomised, double-blind, controlled trial. *The Lancet*, *396*(10259), pp.1353-1361.
5. Hardy, J.F., Farmer, S.L., Auerbach, M., Frank, S.M., Javidroozi, M., Leahy, M.F., Meier, J., Ozawa, S. and Shander, A., 2021. Preoperative Intravenous Iron in Anemic Patients Undergoing Major Abdominal Surgery May Not PREVENTT Blood Transfusions But Still Contribute to the Objectives of Patient Blood Management. *Anesthesia & Analgesia*, *132*(4), pp.1174-1177.

**Table: Multivariable Logistic Regression Predicting RBC Transfusion**

| | Iron Deficiency (Odds Ratio) | | p-value |
|---|---|---|---|
| | **Not Iron Deficient** | **Iron Deficient** | 0.024 (for interaction) |
| Age (year) | 1.02 (1.01 - 1.03) | 1.02 (0.99 - 1.05) | 0.001 |
| Female | 0.8 (0.58 - 1.11) | 1.01 (0.34 - 3.01) | 0.421 |
| Weight (5kg) | 0.9 (0.84 - 0.96) | 0.99 (0.76 - 1.28) | 0.008 |
| Preop Hgb (-10g/L) | 1.69 (1.54 - 1.85) | 3.53 (2.55 - 4.91) | <0.001 |
| Procedure Duration (30 min) | 1.12 (1.1 - 1.15) | 1.2 (1.1 - 1.3) | <0.001 |
| General Anesthetic | Reference | Reference | - |
| Regional/Neuraxial | 0.13 (0.05 - 0.33) | 0.32 (0.05 - 2.16) | <0.001 |
| Coronary Artery Disease | 1.22 (0.72 - 2.06) | 0.91 (0.18 - 4.58) | 0.751 |
| Chronic Kidney Disease | 1.47 (0.84 - 2.57) | 0.66 (0.19 - 2.28) | 0.332 |
| Diabetes | 0.89 (0.62 - 1.27) | 0.65 (0.25 - 1.68) | 0.542 |
| Cancer | 1.28 (0.96 - 1.71) | 0.51 (0.22 - 1.16) | 0.066 |
| Estimated Blood Loss (200 mL) | 1.43 (1.36 - 1.5) | 2.01 (1.58 - 2.56) | <0.001 |
| Tranexamic Acid | 2.12 (1.46 - 3.07) | 0.69 (0.18 - 2.73) | <0.001 |
| Vasopressor / Inotrope Infusion | 2.09 (1.47 - 2.96) | 2.2 (0.84 - 5.74) | <0.001 |
| C-index = 0.926. Somer's Dxy = 0.845. R-squared = 0.525. Slope (Overfitting) = 0.924. Brier's score = 0.041 | | | |

# Post-operative Epidural Catheter Management in the Post Hepatectomy Patient: Does it Warrant Special Consideration?


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## INTRODUCTION

At our tertiary liver transplant and hepatobiliary referral centre, the standard of care is to place a thoracic epidural for analgesia in all open liver resections unless contraindicated. Patients are followed daily by an anaesthesiologist and catheters typically removed within 5 days of insertion. Hemostatic abnormalities associated with liver resection can be unpredictable. Standard guidelines do not reflect the unique rebalanced hemostasis often seen in this cohort, with guidance for safe removal of neuraxial catheters lacking[1]. The use of viscoelastic testing (e.g. ROTEM) in this cohort suggests evidence of hypercoagulability in opposition to standard laboratory measures of INR, PTT and platelet count[2]. Ambiguity of evidence and imperfect tests have led to a heterogeneity of practice for post-operative epidural management. We hypothesized that post-operative hepatectomy patients may be receiving unnecessary blood products or experience unnecessary delays in epidural catheter removal as a result of “coagulopathic” laboratory testing.

## METHODS

We conducted a retrospective single-centre observational study by patient chart review at our institution of all major hepatectomies between January 1$^{st}$ 2017 to June 30$^{th}$ 2022.

Major hepatectomy was defined as open right (rH) or extended right hepatectomy (erH), as large resections (>3 liver segments) are more likely to show post-operative derangement in standard laboratory testing.

We sought to (1) understand the natural history of laboratory-diagnosed coagulopathy in the first 5 post-operative days by recording platelet count, INR and PTT; (2) identify if blood products were used to correct coagulopathy in the absence of bleeding to facilitate epidural removal; and (3) interrogate whether ROTEM was used to aid decision making.

We defined laboratory-based coagulopathy as an INR ≥ 1.5, as defined by ASRA guidelines for safe epidural removal[1], and platelet count <70,000/µl as endorsed by ASRA[3], which, although described within the obstetric population, represents the main available guidance of lower threshold of platelet count for epidural removal.

Patients were excluded if no epidural catheter was sited or if they developed post- operative multi-organ failure.

All patient data was anonymised and complied with local standards. Statistical tests were two-tailed and a $p<0.05$ was considered statistically significant.

## RESULTS

Seventy-five erH and 107 rH were included; 95% had underlying cancer. All pre-operative coagulation parameters were normal except one isolated elevated PTT.

By POD5, 83% (62/75) and 47% (50/107) of eRH and rH demonstrated standard laboratory evidence of coagulopathy. INR elevation (≥ 1.5) was seen in 69% (123/182. Excluding those that received clotting products (13/123), 97% (107/110) resolved spontaneously by POD5. Only 13% (23/182) developed thrombocytopenia (< 70 000/µl), and all spontaneously recovered by POD5. To facilitate epidural removal, 8% received blood products (10/75 eRH, 4/107 rH).

INR peak and platelet nadir were reached at POD2 in both groups. INR and platelet count (mean±SD) from pre-operative to POD2 were 1.0±0.1 to 1.6±0.3 ($p<.00001$) and 242±96 to 133±53 ($p<.00001$), respectively.

ROTEM was used in 8% (14/182); transfusion was not indicated in 10/14 cases (71%) despite laboratory-demonstrated coagulopathy.

There were no epidural haematomas. Six patients (6/182, 3%) developed pulmonary emboli by POD5.

## DISCUSSION

This study adds to the sparse literature describing laboratory parameters following major hepatectomy and appears consistent with other centres[4].

A procoagulant effect following hepatectomy has been seen with viscoelastic testing[5]. In this cohort, six patients developed pulmonary emboli, underscoring the increased thrombotic risk in patients with underlying malignancy undergoing major surgery. Over-zealous transfusion may worsen the hemostatic balance following liver-resection. ROTEM may help delineate the coagulation status and transfusion requirement in this unique population where an acute temporary liver failure exists. This study will inform design of our prospective trial using ROTEM post-hepatectomy to guide epidural management.

## REFERENCES


1. Horlocker TT, Vandermeuelen E, Kopp SL, Gogarten W, Leffert LR, Benzon HT. Regional Anesthesia in the Patient Receiving Antithrombotic or Thrombolytic Therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (Fourth Edition). Reg Anesth Pain Med. 2018 Apr;43(3):263-309. doi: 10.1097/AAP.0000000000000763
2. Barton JS, Riha GM, Differding JA, Underwood SJ, Curren JL, Sheppard BC, Pommier RF, Orloff SL, Schreiber MA, Billingsley KG. Coagulopathy after a liver

resection: is it over diagnosed and over treated? HPB (Oxford). 2013 Nov;15(11):865-71. doi: 10.1111/hpb.12051
3. Bauer ME, Arendt K, Beilin Y, Gernsheimer T, Perez Botero J, James AH, Yaghmour E, Toledano RD, Turrentine M, Houle T, MacEachern M, Madden H, Rajasekhar A, Segal S, Wu C, Cooper JP, Landau R, Leffert L. The Society for Obstetric Anesthesia and Perinatology Interdisciplinary Consensus Statement on Neuraxial Procedures in Obstetric Patients With Thrombocytopenia. Anesth Analg. 2021 Jun 1;132(6):1531-1544. doi: 10.1213/ANE.0000000000005355
4. Matot I, Scheinin O, Eid A, Jurim O. Epidural anesthesia and analgesia in liver resection. Anesthesia & Analgesia. 2002 Nov;95(5):1179-81. doi: 10.1097/00000539-200211000-00009
5. Mallett SV, Sugavanam A, Krzanicki DA, Patel S, Broomhead RH, Davidson BR, Riddell A, Gatt A, Chowdary P. Alterations in coagulation following major liver resection. Anaesthesia. 2016 Jun;71(6):657-68. doi: 10.1111/anae.13459

# Postoperative Nausea and Vomiting in the Post-Anesthetic Care Unit not Affected by Guideline Adherence or Educational Intervention


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## INTRODUCTION

Post-operative nausea and vomiting (PONV) affects approximately 30% of patients within 24 hours of surgery.[1] Preventing PONV has been shown to increase patient satisfaction, reduce stay in the post-anesthetic care unit (PACU), and reduce costs.[2-4] The American Society of Enhanced Recovery and Society for Ambulatory Anesthesia published the fourth iteration of their consensus guidelines on management of PONV in August 2020 with the recommendation that the number of antiemetics administered for PONV prevention be determined by risk stratification.[5] We performed a chart review to determine if adherence with these guideline recommendations was associated with a lower rate of PONV in PACU. We also provided anesthesiologists with data on their individual PONV management with the goal of improving the use of PONV prophylaxis and therefore reducing the rate of PONV.

## METHODS

After obtaining approval from our institution's Research Ethics Board, a retrospective review of anesthetic records of adult patients undergoing general anesthesia at a single tertiary care center was performed. Recorded data included PONV risk factors, prophylactic antiemetics given intra-operatively, rescue antiemetics given in PACU, and documented PONV in PACU. PONV prophylaxis was determined to be sufficient if the number of prophylactic measures for PONV was in keeping with the risk stratification recommended in the guidelines. PONV was defined as administration of antiemetics and/or documentation or nausea or vomiting in PACU. Statistical analysis was performed to evaluate if the rate of PONV was influenced by guideline adherence. An initial review of 500 charts was performed from January 1, 2021 to February 18, 2021 and a second chart review of 502 charts was performed from March 2, 2022 to April 4, 2022. 1 month prior to the second chart review, anesthesiologists were provided with the collective results of the initial chart review, their individual data from any cases in the study period, and additional information on the recommendations in the PONV guidelines.

## RESULTS

Antiemetic administration met the guideline recommendations in 374/1002 (37.3%) cases. 181/1002 (18.1%) patients experienced PONV during the PACU period. There was no significant difference in the rate of PONV when antiemetic administration met the guideline recommendations. There was no significant change in adherence to the guidelines or in the rate of PONV after providing anesthesiologists with the data from the initial chart review.

## DISCUSSION

PONV in PACU remains common, affecting almost 1/5 patients in our retrospective review. While the recent guideline recommendations for prophylaxis were not met in the majority of cases, our study did not find evidence to support the risk stratification strategy recommended in the guidelines as there was no significant reduction in the rate of PONV in PACU with guideline adherence. Anesthesiologists at our institution were not influenced to change their clinical practice after being informed of their guideline adherence and of the rate of PONV among their patients.

## REFERENCES


1. Franck M, Radtke FM, Apfel CC, Kuhly R, Baumeyer A, Brandt C, Wernecke KD, Spies CD. Documentation of post-operative nausea and vomiting in routine clinical practice. J Int Med Res. 2010 May-Jun;38(3):1034-41.
2. Hill RP, Lubarsky DA, Phillips-Bute B, Fortney JT, Creed MR, Glass PS, Gan TJ. Cost-effectiveness of prophylactic antiemetic therapy with ondansetron, droperidol, or placebo. Anesthesiology. 2000 Apr;92(4):958-67.
3. Ganter MT, Blumenthal S, Dübendorfer S, Brunnschweiler S, Hofer T, Klaghofer R, Zollinger A, Hofer CK. The length of stay in the post-anaesthesia care unit correlates with pain intensity, nausea and vomiting on arrival. Perioper Med (Lond). 2014 Nov 26;3(1):10.
4. Parra-Sanchez I, Abdallah R, You J, Fu AZ, Grady M, Cummings K 3rd, Apfel C, Sessler DI. A time-motion economic analysis of postoperative nausea and vomiting in ambulatory surgery. Can J Anaesth. 2012 Apr;59(4):366-75.
5. Gan TJ, Belani KG, Bergese S, Chung F, Diemunsch P, Habib AS, Jin Z, Kovac AL, Meyer TA, Urman RD, Apfel CC, Ayad S, Beagley L, Candiotti K, Englesakis M, Hedrick TL, Kranke P, Lee S, Lipman D, Minkowitz HS, Morton J, Philip BK. Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2020 Aug;131(2):411-448. doi: 10.1213/ANE.0000000000004833. Erratum in: Anesth Analg. 2020 Nov;131(5):e241.

# Preoperative Carbohydrate Drinks for Adults to Prevent Preoperative Complications. A Systematic Review and Meta-Analysis


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## INTRODUCTION

Preoperative fasting is responsible for reducing the risk of aspiration during and after surgery.(1) However, gastric emptying can be delayed in patients with certain medical conditions including those patients suffering from gastroesophageal reflux disease, diabetes mellitus, and gastroparesis. (2,3) Evidence also suggests that depending on the types of food and liquids taken, gastric emptying rate is different.(4) Carbohydrates are more likely to get digested and emptied from stomach compared to protein or fat rich foods. Carbohydrate liquids might decrease insulin resistance, delayed gastric emptying, and an increase in gastric acidity. Also, some trials show carbohydrate drinks may reduce the length of hospital stay or pre-operative discomforts.(5)
However, the effects of drinking carbohydrate liquids before surgery on hospital stay and patient discomforts are controversial.(5)
Given the uncertain benefits and harms associated with various preoperative fasting regimens and given variations in preoperative fasting practices a synthesisand appraisal of the evidence is warranted.

## METHODS

Randomized controlled trials (RCTs) were included in this review. We included studies without consideration of publication status and language of publication.
Studies with adults (>18 years old) undergoing general anesthesia for emergency or elective surgeries were included in this systematic review. We included participants regardless of pregnancy status or whether they have any co-morbidities.
We included trials that compared getting carbohydrate liquids 2-4 hours prior to surgery with standard fasting. We excluded studies in which the intervention is a special regimen such as immune-nutrition regimens or a special diet for a specific surgery, recovery after surgery and early rehabilitation after surgery , chewing gum or intravenous fluid therapy.
The outcomes of interests are

1. Aspiration-related preoperative complications
2. All-cause mortality during or after surgery until hospital discharge
3. Duration of hospital stay
4. Preoperative thirst.

5. Preoperative hunger.

We searched MEDLINE, Embase, CINHAL, and Cochrane CENTRAL until Jan 2021, with no restriction on language of publication. Additionally, we searched Web of science without any language limitation or publication status.

Two reviewers were working independently and together in screening, data extraction, and risk of bias and certainty of evidence (GRADE) assessment. Data were pooled using random effect model.

## RESULTS

This review includes 24 studies. These included approximately 20119 individuals. Overall risk of bias was judged as some concern in several studies.

The incidence of aspiration related to preoperative complications and all-cause mortality during or after surgery until hospital discharge was reported zero in the included studies.

Pooling data from the 14 studies (1288 participants) shows low-quality evidence in the reduction of length of hospital stay towards using carbohydrate drinks (mean difference -0.74 [-1.20 , -0.28])

12 parallel randomised studies measured pre-operative thirst in 1047 participants. The pooled analysis indicated a very low quality evidence in the reduction of thirst in favour of carbohydrate liquid intake ( -15.80 [-21.46 , -10.13]).

There was very low-quality evidence in 13 studies that drinking carbohydrate rich liquids around 2-4 hours before surgery can reduce feeling of hunger prior to the administration of anaesthesia. The mean difference is -12.84 [-18.53 , -7.15].

## DISCUSSION

The evidence suggests preoperative carbohydrate liquid intake results in a reduction of duration of hospital stay. Carbohydrate liquid regimes 2-4 hours prior to elective surgeries may reduce little or no effect on pre-operative thirst and hunger but the evidence is very uncertain.

Studies which assessed aspiration and all-cause mortality, reported zero incidence of these events.

Future systematic reviews should appraise the carbohydrate regimes with placebo and other pre-operative regimes. Conducting a network meta-analysis is suggested to compare the variety of pre-operative regimes to make better evidence-based decision in clinical practice.

## REFERENCES


1. Brady MC, Kinn S, Stuart P, Ness V. Preoperative fasting for adults to prevent perioperative complications. Cochrane database of systematic reviews. 2003(4).
2. Shanley S. Preoperative carbohydrate loading: a review of the current evidence. Journal of Human Nutrition and Dietetics. 2009;22(3):261-2.
3. Crenshaw JT. Preoperative fasting: will the evidence ever be put into practice? AJN The American Journal of Nursing. 2011;111(10):38-43.
4. Ljungqvist O, Nygren J, Thorell A, Brodin U, Efendic S. Preoperative nutrition—elective surgery in the fed or the overnight fasted state. Clinical Nutrition. 2001;20:167-71.
5. Bilku D, Dennison A, Hall T, Metcalfe M, Garcea G. Role of preoperative carbohydrate loading: a systematic review. The Annals of The Royal College of Surgeons of England. 2014;96(1):15-22.

**Author(s):**
**Question:** Carbohydrate drinks compared to fasting overnight for adults to prevent perioperative complications
**Setting:**
**Bibliography:** , preoperative fasting for adults to prevent perioperative complications. Cochrane Database of Systematic Reviews [Year], Issue [Issue].

| Certainty assessment | | | | | | | Nr of patients | | Effect | | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nr of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Carbohydrate drinks | fasting overnight | Relative (95% CI) | Absolute (95% CI) | | |
| **Length of hospital stay** | | | | | | | | | | | | |
| 14 | randomised trials | serious[a] | serious[b] | not serious | not serious[c] | none | 642 | 646 | - | MD **2.07 lower** (3.27 lower to 0.86 lower) | ⨁⨁◯◯ Low | IMPORTANT |
| **Thirst preoperation** | | | | | | | | | | | | |
| 12 | randomised trials | very serious[d] | serious[e] | not serious | not serious | none | 522 | 525 | - | MD **1.56 lower** (2.3 lower to 0.83 lower) | ⨁◯◯◯ Very low | IMPORTANT |
| **Hunger preoperation** | | | | | | | | | | | | |
| 13 | randomised trials | very serious[f] | serious[g] | not serious | not serious | none | 587 | 589 | - | MD **1.29 lower** (1.52 lower to 0.76 lower) | ⨁◯◯◯ Very low | IMPORTANT |

**CI:** confidence interval; **MD:** mean difference

**Explanations**

a. several risk of bias domains were judged as 'some concerns' or 'high risk' across most studies, including some of the studies with most weight in the analysis (Wang , Reis, Mohd , Oh), leading to an overall judgement of 'high risk' across the studies.
b. There is considerable inconsistency (I2=98%).
c. there are only 370 people in this analysis, which does not meet the rule of thumb of 400 people for continuous outcomes. However, the confidence interval includes the possibility that between 3.27 lower days and 0.86 lower days. Overall, I considered 1/2 rate down for this domain.
d. The overall risk of bias domains was judged as 'high risk' across all studies, due to non-blinding assessors for patients recorded outcomes. This leads to an overall judgement of 'high risk' across the studies and rate down 2 level for this domain.
e. There is considerable inconsistency (I2=98%).
f. The overall risk of bias domains was judged as 'high risk' across all studies, due to non-blinding assessors for patients recorded outcomes. This leads to an overall judgement of 'high risk' across the studies and rate down 2 level for this domain.
g. There is considerable inconsistency (I2=98%).

# Preoperative Risk Assessment of Postoperative Delirium: A Cross-sectional Study of Patients and Anesthesiologists in Canada


## AUTHORS

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## INTRODUCTION

Postoperative delirium (POD) after non-cardiac surgery is a common complication in older adults(1). The diagnosis of POD is often missed, and treatment options are limited(2,3). Preoperative risk identification and planning maybe an effective approach for the prevention and management of POD. Guidelines for perioperative care in geriatrics recommend that preoperative interviews include risk assessment for POD and encourage communicating such risks to patients and caregivers as a way of shared decision-making(4,5). However, there are no published data on the frequency of POD screening, or its communication to patients during preoperative anaesthesia meetings. The aim of the current study was to evaluate 1) patient- and anesthesiologist-reported rate of preoperative screening and discussion of the risk of POD during preoperative meetings in older adults (≥65 years) undergoing elective non-cardiac surgery, 2) patients' and anesthesiologists' rating of the importance of POD, and 3) predictors of patient-reported discussion of POD risk during preoperative meetings.

## METHODS

We conducted a multicentre two-part cross-sectional survey study of patients, in five Canadian hospitals, and anaesthesiologists, in four Canadian universities, to evaluate the patient-reported (primary outcome) and anaesthesiologist-reported frequency of the POD screening and discussion in preoperative visits, and the rating of POD importance as a postsurgical event from the perspectives of patients and anaesthesiologists (secondary outcomes). The study was approved by provincial and local research ethics boards. Eligible patients anonymously completed a 5-minute survey, in person or over the phone, after their preoperative anaesthesia consult either the same day or within the next 24 hours. The survey

included questions on patient demographics, medical history, their perception of the importance of POD, and specifically whether they were assessed for the POD risk along with a discussion about reducing such risk during the preoperative meeting. The anaesthesiologists' survey was circulated to anaesthesia staff, fellows and residents using institutional mailing lists to be self-administered using a link to REDCap survey tool. Anaesthesiologists were asked about the frequency of risk assessment and discussion of POD in older patients, the factors and tools used, and their perception of POD screening barriers.

## RESULTS

In this multicentre cross-sectional study, 412 patients (50% male, mean age=73.5) and 267 anesthesiologists (among 1205 email invitations) participated in the study from five Canadian hospitals and four Universities respectively. POD screening and discussion was reported by 88/412 (22%) patients and 229/267 (86%) anesthesiologists. POD was rated as "Somewhat-Extremely" important by 64% of patients. Previous history of delirium, higher education, higher number of daily medications and longer surgical duration were independently associated with POD discussion. On average, anesthesiologists rated the importance of POD at 8/10, and 42% ranked "patient risk factors" as the top reason prompting discussion. Anesthesiologist-reported barriers for rarely or never discussing the risk of POD included lack of time, forgetting despite importance, fear of increasing patients' anxiety, and not having seen senior staff discuss it in practice.

## DISCUSSION

The combined evaluation of patients' and anesthesiologists' perspectives provides valuable information about preoperative POD screening and risk-assessment, and highlights areas for improvement in the current practice. Our study confirmed that some recognized risk factors of POD were associated with higher odds of POD screening and discussion, at the same time only 22% of elderly patients reported a discussion of postoperative delirium (POD) during their preoperative meetings, highlighting the need for improved screening, which could allow for strategies to mitigate such risk. Anesthesiologist-identified barriers to POD screening highlight the need for training and standardizing POD screening process in clinical practice.

## REFERENCES


1. Dasgupta M, Dumbrell AC. Preoperative risk assessment for delirium after noncardiac surgery: a systematic review. J Am Geriatr Soc. 2006;54(10):1578-89.
2. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. Ann Intern Med. 1990;113(12):941-8.
3. Sanders RD, Pandharipande PP, Davidson AJ, Ma D, Maze M. Anticipating and managing postoperative delirium and cognitive decline in adults. BMJ. 2011;343:d4331.
4. Adults AGSEPoPDiO. American Geriatrics Society abstracted clinical practice guideline for postoperative delirium in older adults. J Am Geriatr Soc. 2015;63(1):142-50.
5. Griffiths R, Beech F, Brown A, Dhesi J, Foo I, Goodall J, et al. Peri-operative care of the elderly 2014: Association of Anaesthetists of Great Britain and Ireland. Anaesthesia. 2014;69 Suppl 1:81-98.

**Multivariable Analysis of predictors of patient-reported POD discussion**

| Variable | OR | 95% CI | p-value |
|---|---|---|---|
| **Age (years)** | 1.045 | 0.992-1.1 | 0.09 |
| **Sex (female vs. male)** | 1.23 | 0.67-2.26 | 0.49 |
| **Level of education** | 1.3 | 1.021-1.66 | 0.03* |
| **History of delirium** | 8.02 | 1.2-53.4 | 0.03* |
| **Comorbidities** | 0.652 | 0.479-0.89 | 0.006* |
| **Chronic pain** | 0.387 | 0.109-1.373 | 0.1418 |
| **Vision or hearing impairment** | 0.576 | 0.24-1.4 | 0.224 |
| **Number of daily medication intake** | 1.141 | 1.029-1.265 | 0.012* |
| **Type of anesthesia (general vs. regional)** | 2.5 | 0.86-7.26 | 0.09 |
| **Duration of surgery (hours)** | 1.395 | 1.094-1.779 | 0.007* |

*Statistically significant. POD, postoperative delirium.

Figure 1

# Proton Pump Inhibitors are not Linked to a Decrease in Serum Magnesium in Adults Awaiting Elective Surgery – MAGPPIES Study


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## INTRODUCTION

Hypomagnesemia has important multi-systemic effects relevant to the practice of anesthesia. Proton pump inhibitors (PPIs) are commonly prescribed blockers of gastric acid, but chronic use is associated with hypomagnesemia. In a 2019 meta-analysis, many patients in the studied population were hospitalized or on chronic hemodialysis. In patients undergoing elective surgery, this association remains uncertain but could be relevant to preoperative evaluation although interpretation of magnesium levels is itself controversial.

The primary objective of the *Magnesium and Proton Pump Inhibitors in Elective Surgery* (MAGPPIES) study was to compare serum magnesium (Mg) between patients PPI-users and the non-users. Secondary objectives were 1) to compare the proportion of patients with hypomagnesemia according to two different definitions (serum Mg <0.75 or <0.85mmol/L), and 2) to examine the utility of Fractional excretion of Mg (FeMg) as an additional test in evaluating magnesium levels as it has been suggested this could better reflect Mg bioavailability.

## METHODS

After local ethics committee approval was obtained, we recruited patients (ASA I–III) scheduled for elective surgery at our institution. Patients already at risk for hypomagnesemia were excluded. We collected demographic, medical, ASA Physical Status Class, and paraclinical data (prealbumin, serum and urine magnesium, serum and urine creatinine, serum ionized calcium). The participants were divided into two groups. PPI users had to be taking a PPI daily for at least one year. PPI non-users had not taken a PPI in the last year. A chi-square test was used for proportions and percentages. For continuous variables, a Student's t test or Mann-Whitney test was used depending on the distribution of the data. A multiple linear regression model with the following independent variables was used to eliminate the impact of predisposing factors: age, sex, ASA class, excessive alcohol consumption, diabetes, and diuretic use. A Spearman correlation was used to measure the correlation between magnesium and FeMg. Based on a reduction of 0.04 mmol/L in magnesium between the PPI group and the group without PPI, a power of 80% and a p-value of 0.05, 194 patients per group were recruited.

## RESULTS

388 patients were recruited between January 2019 and September 2021. One patient was excluded because his magnesium was not measured. Six patients were excluded due to poor renal function. In the PPI group, patients were older (64.4 vs 54.6 years, p<0.001), more often diabetic (18.4% vs. 7.3% p=0.001) and rated ASA Class III more frequently (41.6

vs 15.2%, p<0.001). After adjustment according to the multiple regression model described above, serum magnesium levels were not significantly different between PPI users and non-users (0.82±0.09 vs 0.82±0.08mmol/L, p=0.37). The proportion of hypomagnesemia (Mg <0.75mmol/L) was similar in both groups and was large overall (17%) regardless of PPI use. The correlation between magnesium and FeMg was not significant in both groups (PPI: r=0.024, p=0.746; Without PPI: r=0.017, p=0.818). However, we observed a median FeMg of 0.3% (1.58% vs 1.88%, p=0.003) lower in the group taking PPIs after adjustment for confounding factors.

## DISCUSSION

Taking PPIs does not reduce serum magnesium levels in patients awaiting elective surgery. However, as magnesium is a predominantly intracellular ion, many question whether serum magnesium is a good reflection of bioavailable magnesium. The decrease in FeMg in patients taking a PPI, although modest, can be interpreted as alteration in magnesium handling where renal excretion is reduced to compensate for decreased digestive absorption. FeMg testing does not correlate with low serum magnesium. The best test for identifying low bioavailability of magnesium requires attention. Finally, anesthetists should be aware of the large proportion of preoperative patients with hypomagnesemia.

## REFERENCES


1. Dent A, Selvaratnam R. Measuring magnesium – Physiological, clinical and analytical perspectives. Clinical Biochemistry. juill 2022;105-106:1-15.
2. DiNicolantonio JJ, O'Keefe JH, Wilson W. Subclinical magnesium deficiency: a principal driver of cardiovascular disease and a public health crisis. Open Heart. janv 2018;5(1):e000668.
3. Famularo G, Gasbarrone L, Minisola G. Hypomagnesemia and proton-pump inhibitors. Expert Opinion on Drug Safety. sept 2013;12(5):709-16.
4. Scarpati G, Baldassarre D, Oliva F, Pascale G, Piazza O. Ionized or Total Magnesium levels, what should we measure in critical ill patients? Transl Med UniSa. sept 2020;23:68-76.
5. Srinutta T, Chewcharat A, Takkavatakarn K, Praditpornsilpa K, Eiam-Ong S, Jaber BL, et al. Proton pump inhibitors and hypomagnesemia: A meta-analysis of observational studies. Medicine. nov 2019;98(44):e17788.

**Comparison of magnesemia and FeMg in each group of patients according to their PPI intake**

| Outcomes | With PPI intake N = 190 | Without PPI intake N = 191 | Unadjusted Risk Difference (95% CI) N = 381 | Adjusted Risk Difference (95% CI) N = 381 |
|---|---|---|---|---|
| Magnesemia in mmol/L, *mean* (SD) | 0.82 (0.09) | 0.83 (0.08) | -0.01 (-0.03 to 0.01) p = 0.15 | -0.01 (-0.03 to 0.01) p = 0.37 |
| Number of patients with magnesemia <0.85 mmol/L, *n* (%) | 111 (58) | 108 (57) | p = 0.71 | |
| Proportion of patients with magnesemia <0.75 mmol/L, *n* (%) | 37 (20) | 26 (14) | p = 0.12 | |
| FeMg in %, *median* (1st quarter – 3rd quarter) | 1.58 (1.01 – 2.49) | 1.88 (1.32 – 2.53) | -14% (-23 to -3%) p = 0.01 | -18% (-28 to -7%) p = 0.003 |

Adjusted risk differences obtained from inverse probability of exposure weighting based on propensity scores. The propensity score was estimated using multivariable logistic regression with receipt of the intervention as the dependent variable and a vector of covariates decided upon a priori as the independent variables (age, sex, ASA class, excessive alcohol consumption, diabetes, and diuretics intake). Risk differences are for the intervention group relative to the control group. PPI = proton pump inhibitors, FeMg = fractional excretion of magnesium, SD = standard deviation, CI = confidence interval.

# Symptoms of Anxiety and Depression After Major Elective Non-Cardiac Surgery: A Secondary Analysis of the Measurements of Exercise Tolerance Before Surgery (METS) Multicenter Prospective Cohort Study


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## INTRODUCTION

Patients report that psychological well-being is an integral component of their recovery process following surgery.[1] Surgery is meant to be therapeutic, but it can also be emotionally burdensome, leading some patients to experience new onset or worsening psychological distress afterwards. Whether related to patient- or procedure-specific factors, anxiety and depression after surgery are known to be associated with other adverse outcomes and complications.[2,3] To better align perioperative care and psychosocial supports with patients' needs, better characterization of anxiety and depression after surgery is needed. Findings from previous studies have limited generalizability as most were single-center studies conducted in homogenous samples of patients undergoing a single procedure.[4] No studies have yet described changes in anxiety or depression in a large prospective cohort undergoing a broad case mix of surgeries.

## METHODS

We conducted a secondary analysis of Measurement of Exercise Tolerance before Surgery (METS), an international cohort study which evaluated measures of cardiopulmonary fitness before major elective non-cardiac surgery in adults.[5] This sub-study received local REB approval. The primary outcome in this study was the anxiety/depression item on the EQ-5D-3L, which asked respondents to describe their status as "none", "moderate", or "severe" at baseline before surgery, then at 30 days and 1 year after surgery.

The first study objective was to characterize the trajectory of anxiety/depression symptoms after surgery. A cumulative link model was fitted, with the 3-level (ordinal) anxiety/depression rating as the outcome and a random intercept for each participant. Time was modeled continuously after verifying non-linearity assumptions. Age, sex, procedure type, and an interaction between time and sex were included in the model as covariates.

The second objective was to identify patient- and procedure-specific risk factors for the

composite endpoint of severe or worsened anxiety/depression after surgery. A multivariable logistic regression model was fitted and included age, sex, smoking, cancer-related surgery, procedure type, and anesthetic technique as potential predictors.

Missing data was handled using Multivariate Imputation by Chained Equations. Statistical significance was defined as a two-tailed $p<0.05$.

## RESULTS

The analytic cohort included 1,546 patients (median age 65 years [IQR 57–72]; 40.7% female) undergoing a broad range of orthopedic, abdomino-pelvic, thoracic, peripheral vascular, and plastic procedures. Moderate-to-severe anxiety/depression was reported by 32.6% of participants at baseline, 27.3% at 30 days, and 26.2% at 1 year after surgery (Figure 1). In trajectory analyses, older patients were less likely to have greater symptoms (aOR 0.64, 95% CI: 0.57–0.73). Females had greater symptoms compared to men (aOR 1.69, 95% CI: 1.33–2.16); however, their symptoms were more likely to improve over time (aOR 1.19, 95% CI: 1.02–1.39). Of the patients who survived to 1-year follow-up, 326 (21.7%) experienced the composite outcome of severe or worsened anxiety/depression after surgery. In multivariable regression modelling, increasing age was associated with lower odds of the composite endpoint (aOR 0.98 per year, 95% CI: 0.97–1.00).

## DISCUSSION

One-third of patients reported moderate-to-severe anxiety/depression before major elective non-cardiac surgery. Female and younger patients were more likely to experience worse symptoms at any given time. Unlike males, females reported a downward trend in symptoms over time. Younger adults were more likely to experience worsened or severe anxiety/depression. To better understand the epidemiology and factors associated with psychological distress after surgery, future studies should use more comprehensive measurement tools at frequent time intervals. New knowledge about adverse psychologic outcomes in surgical patients can facilitate earlier identification of at-risk individuals and inform the development of timely, targeted psychosocial interventions.

## REFERENCES


1 Rajabiyazdi F, Alam R, Pal A, Montanez J, Law S, Pecorelli N, et al. Understanding the Meaning of Recovery to Patients Undergoing Abdominal Surgery. JAMA Surgery 2021;156(8):758–65.

2 Hinrichs-Rocker A, Schulz K, Järvinen I, Lefering R, Simanski C, Neugebauer EAM. Psychosocial predictors and correlates for chronic post-surgical pain (CPSP) - A systematic review. European Journal of Pain 2009;13:719–30.

3 Abrams TE, Vaughan-Sarrazin M, Rosenthal GE. Influence of psychiatric comorbidity on surgical mortality. Archives of Surgery 2010;145(10):947–53.

4 Strøm J, Bjerrum MB, Nielsen CV, Thisted CN, Nielsen TL, Laursen M, et al. Anxiety and depression in spine surgery—a systematic integrative review. Spine Journal 2018;18:1272–85.

5 Wijeysundera DN, Pearse RM, Shulman MA, Abbott TEF, Torres E, Ambosta A, et al. Assessment of functional capacity before major non-cardiac surgery: an international, prospective cohort study. Lancet 2018;391(10140):2631–40.

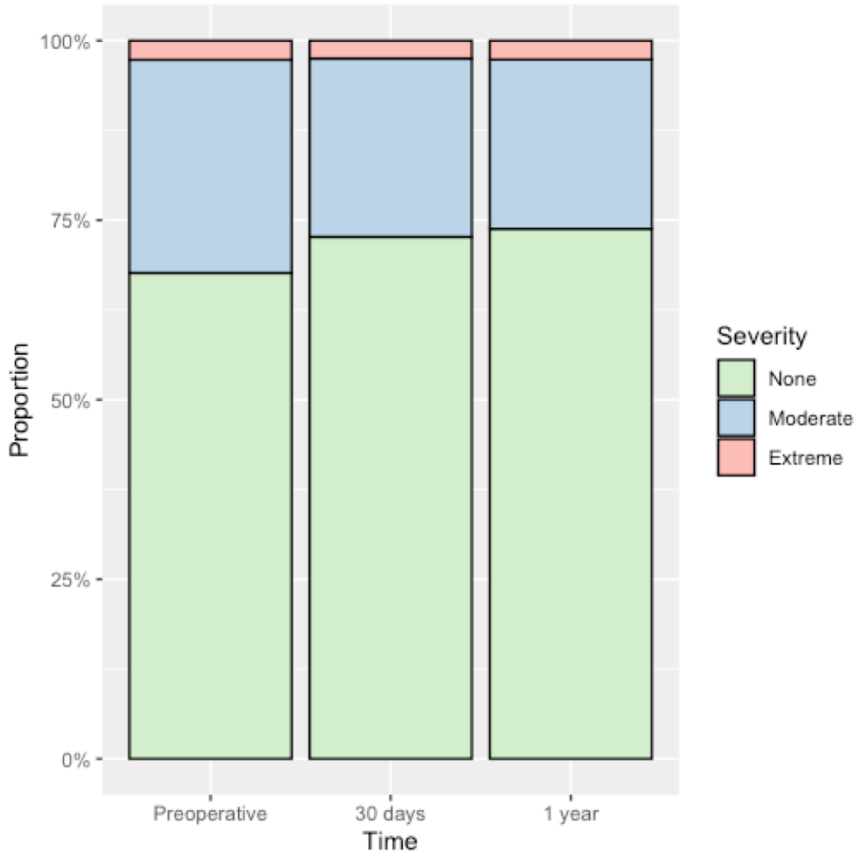


**Figure 1.** Stacked bar plot of participants' responses to the EQ-5D-3L item about their level of anxiety/depression at each timepoint during the study.

# The Impact of Prehabilitation During Neoadjuvant Therapy: A Case Report on Lung Cancer Surgery


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## INTRODUCTION

Growing evidence favours neoadjuvant chemo-immunotherapy over traditional adjuvant therapy for operable non-small cell lung cancer (NSCLC). Better tolerability, increased likeliness for completion and improved event free survival are defining a new standard of care for stage II and III NSCLC[1].
Lung cancer and chemo-immunotherapy are associated with loss of lean body mass and deteriorating functional capacity, impacting postoperative outcome[2,3].
We present the trajectory of one patient with diagnosis of stage IIb NSCLC throughout neoadjuvant therapy and surgery, who received multimodal prehabilitation. Supervised and home-based structured aerobic and resistance exercise training individualized for this patient, whey protein supplementation to target 1.5g/kg/day and psychosocial support were used to mitigate the effect of both systemic therapy and surgery.

## CASE PRESENTATION

A 70 year-old female with stage IIb squamous cell carcinoma was scheduled to receive three cycles of chemo-immunotherapy. Her medical history included type 2 diabetes, hypertension, stage 4 chronic kidney disease and neuropathic pain. She was referred to the Prehabilitation Clinic to initiate multimodal prehabilitation before chemo-immunotherapy and surgery.
At baseline, her body mass index (BMI) was 34.6, fat-free mass percentage (FFM%), 51% and she was at risk for malnutrition. The patient's 6-minute walk test (6MWT) was 260m (44% of predicted) and Duke Activity Status Index (DASI) was 19. Health care quality of life (EQ-5D) score was 70 and Hospital Anxiety and Depression Scale (HADS) score 11, showing high anxiety. Baseline hemoglobin was 89g/L.
Over 22 weeks, the patient received three cycles of chemo-immunotherapy and personalized, structured prehabilitation.
Her FFM% peaked at 53.3% and her BMI decreased to 30. 6MWT improved by 15m, her DASI improved to 24.4, EQ-5D improved to 75 and HADS decreased by 3 points, indicating borderline anxiety. Her preoperative hemoglobin increased to 125g/L after intravenous iron and erythropoietin.
Six weeks after surgery, our patient maintained her BMI at 31, her FFM% at 53.5%, and her 6MWT was 311m. Hemoglobin remained 105g/L after surgery without the need for perioperative blood transfusion. She was sent home 3 days after surgery with no complications and readmission during the first 30 postoperative days.

## CONCLUSION

This case demonstrated that multimodal prehabilitation during chemo-immunotherapy for lung cancer mitigated our patient's physical deterioration, maintained her lean body mass and enhanced her fitness prior to surgery. Such prehabilitation is feasible, effective and may enhance cancer patients' perceived quality of life[4,5].
Prehabilitation together with neoadjuvant chemo-immunotherapy may present a new opportunity to optimize function, mental health and modifiable medical comorbidities for lung cancer patients.

## REFERENCES


1. Burke, S. M., Brunet, J., Sabiston, C. M., Jack, S., Grocott, M. P., & West, M. A. (2013). Patients' perceptions of quality of life during active treatment for locally advanced rectal cancer: the importance of preoperative exercise. *Supportive care in cancer 21*(12), 3345–3353.
2. Huynh C, W. L., and Spicer J. (2021). Surgery after neoadjuvant immunotherapy in patients with resectable non-small cell lung cancer. *Translational Lung Cancer Research, 10*(1), 563-580. https://doi.org/ http://dx.doi.org/10.21037/tlcr-20-509
3. Loughney L, W. M., Kemp GJ, Grocott MPW and Jack S. (2016). Exercise intervention in people with cancer undergoing neoadjuvant cancer treatment and surgery: A systematic review. *European Journal of Surgical Oncology, 42*(1), 28-38. https://doi.org/https://doi.org/10.1016/j.ejso.2015.09.027
4. Minnella E, B. G., Quang ATL, Bessissow A, Spicer J & Carli F. (2021). Prehabilitation in Thoracic Cancer Surgery: From Research to Standard of Care. *Journal of cardiothoracic and vascular anesthesia, 35*(11), 3255-3264. https://doi.org/https://doi.org/10.1053/j.jvca.2021.02.049
5. Schmid, S., Minnella, E. M., Pilon, Y., Rokah, M., Rayes, R., Najmeh, S., Cools-Lartigue, J., Ferri, L., Mulder, D., Sirois, C., Owen, S., Shieh, B., Ofiara, L., Wong, A., Sud, S., Baldini, G., Carli, F., & Spicer, J. (2022). Neoadjuvant Prehabilitation Therapy for Locally Advanced Non-Small-Cell Lung Cancer: Optimizing Outcomes Throughout the Trajectory of Care. *Clinical Lung Cancer, 23*(7), 593-599.