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Perioperative

(Abstracts and Case Report/Series)

Contents

Anesthesia for Laparoscopic Bilateral Adrenalectomy in a Post-Pneumonectomy Patient

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Introduction:

There is very limited literature that could help identify the challenges that anesthesiologists might face while managing postpneumonectomy patients undergoing laparoscopic surgery. We report a 72-year-old post-left-pneumonectomy male patient for laparoscopic bilateral adrenal resection of metastatic masses.
Pneumonectomy is associated with anatomic and functional pulmonary changes (Kopec et al., 1998). Overtime, postpneumonectomy space decreases in size, together with elevation of the hemidiaphragm, hyperinflation of the remaining lung and shifting of the mediastinum to the postpneumonectomy space. There is ongoing resorption of the air in the postpneumonectomy space, and it is replaced with fluid.
Laparoscopic surgeries usually present with multiple challenges and have remarkable impact upon many systems, including the respiratory system. For laparoscopic bilateral adrenalectomy, the patient is placed in either the left or the right lateral decubitus position for the first adrenalectomy and then changed to the contralateral decubitus position for the second procedure (Castillo et al., 2007).

Case Presentation:

A 72-year-old male patient underwent left pneumonectomy in April 2020 for left synovial lung sarcoma. A left adrenal mass was detected on CT scan in February 2021. Patient reported early satiety as the only symptom. In September 2021, 2 more right adrenal nodules were detected. Therefore, bilateral adrenalectomy was planned.

After uneventful induction of general anesthesia, the patient was initially placed in left lateral position to resect the right Adrenal gland. Post insufflation, the peak airway pressure stayed stable near 27 cm H2O, maintaining hemodynamic stability. However, when the surgery advanced to resect the left adrenal gland, with the patient now in right lateral position, the peak airway pressures dramatically increased to >37 cmH2O, needing regular recruitment maneuvers to maintain ventilation. This was largely owing to the dependent right lung being compressed by the fluid filled left hemithorax and mediastinum. The patient was able to maintain minute ventilation with expired tidal volumes of 450 ml.
Hyperkalemia (K+ 6.4 with no ECG changes) was noted on arterial blood gas analysis, perhaps reflective of acute kidney injury. This was immediately treated with Insulin 4 units, Sodium bicarbonate 20 mmol, Calcium gluconate 1g and Salbutamol puff 10 mcg endotracheally, which corrected the potassium to 4.4 mmol/l.

The patient was extubated uneventfully. The patient's hospital stay was complicated by acute kidney injury with a creatinine of 137 mmol/l, on postoperative day 2, was managed conservatively, and resolved the next day. The patient was discharged after 3 days with prescribed replacement therapy for adrenal insufficiency.

Conclusion:

To our knowledge, this is the first case to describe the anesthetic management for laparoscopic bilateral adrenalectomy in a post-pneumonectomy patient. A review of literature revealed only one case report that mentioned a laparoscopic left adrenalectomy in a patient who underwent a right pneumonectomy (Nair et al., 2015). It is crucial to consider the physiologic changes in the postpneumonectomy patient while managing their anesthetics. Close monitoring of the respiratory and hemodynamic changes and tailoring the anesthetics delivery to meet such variations are necessary to avoid complications. Further studies are required to delineate the optimal management of these patients.

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ASA-Physical Status Classification: Perioperative Clinician's Overconfidence and the Use of ASA Approved Examples to Improve Decision Making

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Introduction:
The American Society of Anesthesiologists Physical Status (ASA-PS) Classification System has long served as an important tool for anesthesiologists and non-anesthesiologists in areas such as resource allocation, billing, and perioperative risk assessment. Despite wide adoption worldwide, an important inconsistency of the ASA-PS classification system is the high scoring variability among healthcare professionals.[1] Possible contributing factors for such variability include (i) the inherent subjectivity of the system; (ii) educational factors; (iii) professional experience, and (iv) institutional characteristics.[2] To test the hypothesis that the ASA-PS is often applied with overconfidence, potentially leading to misguided decision-making and perpetuation of misconceptions,[1] we aimed to evaluate clinicians' accuracy and self-reported confidence on the ASA-PS Classification System at two different time points: (1) while assigning ASA-PS according to their baseline knowledge/judgment; and (2) after a single exposure to the ASA-PS definitions and examples published by the ASA or written by the investigators.

Methods:
Between January and April 2021, physicians were contacted by email and invited to voluntarily participate in a web-based questionnaire consisting of 10 hypothetical cases. Participants were divided in 2 groups: anesthesiologists and non-anesthesiologists. Non-anesthesiologists included (any) surgical as well as clinical (i.e., cardiology, nephrology, and respirology) specialties that commonly utilize the ASA-PS when evaluating patients perioperatively. Participants were initially asked to assign an ASA-PS score and rate their perceived self-confidence level (20-100%) on the accuracy of their assigned score for each case. Subsequently, participants reviewed a table containing the ASA-approved definitions and examples for each ASA-PS class. Finally, the cases were once again presented in random order and participants were asked to re-assign the ASA-PS score and confidence level for each case. The percentage of correct answers and confidence levels indicated by participants throughout the questionnaire were recorded. The correct ASA-PS (i.e., ASA I, II, III, IV, and V) for each hypothetical case was previously determined by consensus among investigators based on objective interpretation of the ASA-PS Classification System definitions and ASA-approved examples. Participants' accuracy, self-reported confidence, and calibration of confidence on the application of ASA-PS Classification System were measured. Agreement between measures was tested using kappa coefficient.

Results:
A total of 386 physicians (272 anesthesiologists and 114 non-anesthesiologists) completed the questionnaire. There was a significant decrease in accuracy among participants >60 years-old and those with >10 years of clinical experience (p=0.001). For non-anesthesiologists, there was no difference in accuracy between medical specialists and surgeons (p>0.05). Anesthesiologists had better accuracy than non-anesthesiologists both on

initial [6(5-7) vs. 4(3-5) out of 10; p<0.001] as well as subsequent [7(6-8) vs. 6(4-7); p<0.001] ASA-PS score assignments (Fig. 1). Participants' self-reported confidence was significantly greater than their accuracy for assigned ASA-PS scores (p<0.001), indicating overconfidence (Fig. 1). ASA-PS agreement between anesthesiologists and non-anesthesiologists was poor (κ<0.20), demonstrating significant inter-observer variability – even after participants had reviewed the ASA-PS definitions/examples. Participants' accuracy for hypothetical cases of ASA-PS I, II, and III involving adult patients was greater than for ASA-PS IV, V, and III (the latter involving a neonate) for both anesthesiologists and non-anesthesiologists (p<0.001).

Discussion:

Overconfidence is common among healthcare professionals[3] which was demonstrated/confirmed by our results. Anesthesiologists had better accuracy than non-anesthesiologists despite the latter often disagreeing with (and downgrading) the ASA-PS classification in comparison with the former.[4] Nevertheless, exposure to the ASA-PS definitions/examples proved effective at improving accuracy, especially for non-anesthesiologists. The lower accuracy observed for ASA-PS IV, V and III (neonate patient) can be partially explained by participant's lack of familiarity with neonatal anesthesia/physiology and/or failure to understand the (less commonly used) ASA-PS (IV-V) definitions. Finally, time since graduation impacts physicians' knowledge[5] and may explain the lower accuracy of older/more experienced participants.

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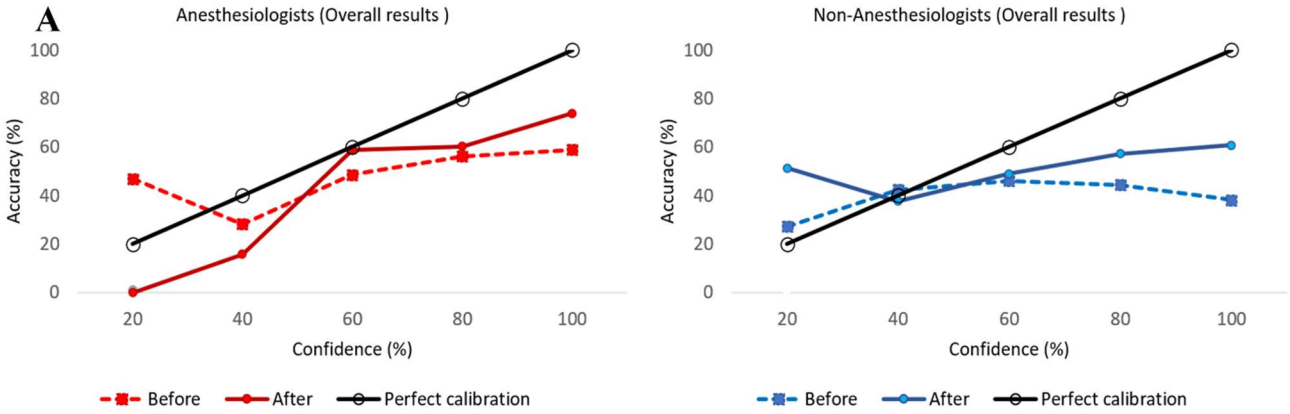
Figure 1:



Calibration curves for anesthesiologists and non-anesthesiologists before and after reviewing the ASA-PS definitions and examples. The black lines represent perfect calibration where accuracy values perfectly match confidence values (open circles). The red and blue lines represent participants' accuracy in comparison to their self-reported confidence levels in a 5-point scale, i.e., from 20–100% in 20% increments/intervals (filled circles/squares). The degree of agreement between the two measures was evaluated by the Kappa coefficient: Before (Kappa=0.06, p=0.07); After (Kappa=0.11, p=0.04).

B

ASA-PS Class	Groups					
	Anesthesiologists			Non-Anesthesiologists		
	Before†	After†	P-value (B)	Before†	After†	P-value (B)
Accuracy*	6 (5-7)	7 (6-8)	0.005	4 (3-5)	6 (4-7)	0.001
Confidence*	8 (7.3-8.5)	9 (8-9.5)	0.001	6.65 (5.46-7.28)	9.8 (9.2-10)	0.001
P-value (A)	<0.001	<0.001		<0.001	<0.001	

Anesthesiologists' and non-anesthesiologists' accuracy and self-reported confidence levels while assigning American Society of Anesthesiologists Physical Status (ASA-PS) to 10 hypothetical cases before and after reviewing the ASA-PS definitions and examples. *Values expressed as median (percentile 25-75%). †Before and after reviewing the ASA-PS definitions and examples. (A) Accuracy and self-reported confidence – Mann-Whitney U test; (B) Analysis between values observed for anesthesiologists and non-anesthesiologists before and after participants had reviewed the ASA-PS definitions and examples – Wilcoxon matched-pairs signed-rank test.

Comparing the Predictive Accuracy of Frailty Instruments Applied to Preoperative Electronic Health Data for Adult Patients Undergoing Non-Cardiac Surgery: A Retrospective Cohort Study

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Introduction:

Frailty before surgery is associated with an increased risk of post-operative mortality, complications, and healthcare resource utilization.[1,2] Despite multiple guideline recommendations, routine preoperative frailty assessment is under-performed.[3-5] Automation of preoperative frailty assessment using electronic health data could improve adherence to guideline-based care if an accurate instrument is identified. Our aim was to measure and compare the predictive accuracy of frailty instruments operationalizable in electronic data for prognosticating outcomes and resource use in older adults undergoing surgery.

Methods:

We conducted a retrospective cohort study utilizing linked healthcare administration data for adults >65 undergoing elective, non-cardiac surgery between 2012-2018. Four frailty instruments were compared: the Frailty Index (FI), Hospital Frailty Risk Score (HFRS), Risk Analysis Index-Administrative (RAI), and ACG Frailty-defining diagnoses indicator (ACG). We estimated and compared the added predictive performance of each instrument beyond the baseline model (age, sex, American Society of Anesthesiologists' score, procedural risk) using discrimination, calibration, explained variance, net reclassification index (NRI) and Brier score for binary outcomes, and using explained variance, root mean squared error and mean absolute prediction error for continuous outcomes. The primary outcome was 30-day mortality. Secondary outcomes included 365-day mortality, non-home discharge, days alive at home, hospital length of stay, and 30- and 365-day health systems cost.

Results:

We identified 171,576 elective surgery patients who met inclusion criteria, of which 1,370 (0.8%) died at 30-days. Compared to the baseline model predicting mortality at 30-days (area under curve [AUC], 0.85; R^2, 0.08), addition of HFRS lead to greater improvement in discrimination (AUC, 0.87), explained variance (R^2, 0.09), and net reclassification (NRI, 0.65) than the FI, RAI or ACG. Brier scores and calibration curves did not differ appreciably between models.

Discussion:

All four electronic clinical frailty assessments, when combined with typically assessed preoperative risk factors, demonstrated strong predictive performance in prognosticating postoperative outcomes that are important to older surgical patients. The HFRS showed the largest statistical improvement among all measures of predictive

performance for 30-day mortality. These findings support the development and implementation of electronic, automated preoperative frailty assessments for older surgical patients. This may help overcome existing barriers to routine preoperative frailty assessment and may ultimately help guide and inform shared decision making in the perioperative period.

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Delayed Graft Function after Kidney Transplantation: Quantifying the role of Intraoperative Hypotension (The DeGift Study)

Authors:

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Introduction:

Delayed Graft Function (DGF) occurs in 20 to 30% of deceased donor kidney transplant (KT) recipients and is associated with both short- and long-term consequences for patients and their allografts. DGF is commonly defined as the need for dialysis within the first week after KT (DGF-D). However, other measures of early graft function, such as the Creatinine Reduction Ratio or CRR (i.e., the ratio of creatinine on postoperative day 1 to postoperative day 2) may provide greater precision and can be applied to both deceased and living donor KT. A CRR of < 30% is considered poor early graft function (DGF-CRR). As hypotension is associated with acute kidney injury (AKI) in the non-transplant population, we postulated that hypotension might be a modifiable risk factor for DGF in the KT population. The objective of this work is to determine the association between intraoperative hypotension (IOH) and DGF-D/DGF-CRR in KT recipients.

Methods:

Following institutional ethics approval (REB no. 20-6098), data were retrieved on consecutive deceased and living donor KT recipients between January 1, 2009 and June 30, 2020. Data were obtained from the Drug Reconciliation Electronic Anesthesia Management (DREAM) dataset and the Comprehensive Renal Transplant Research Information System (CoReTRIS)4 . Hemodynamic data were retrieved from the DREAM dataset for each patient in 1-minute intervals. The duration in minutes and area (time x pressure) under pre-selected mean arterial blood pressure (MAP) levels (80, 70, 60, 50 and 40 mmHg) were ascertained. The two primary outcomes were DGF-dialysis (DGF-D) and DGF-CRR.
To examine baseline differences between groups, Student-t test was used for normally distributed continuous variables and Wilcoxon rank-sum test was used for non-normally distributed continuous variables. The Chi-squared or Fisher exact tests were used for categorical variables. Logistic regression models were fitted to examine the association between the study exposures (i.e., IOH duration and AUC) and outcomes (DGF-D and DGF-CRR). A two-sided P value less than 0.05 was considered as statistically significant.

Results:

The cohort included 1596 KT recipients. DGF-CRR occurred in 525 (32.9%) of the entire population and DGF-D occurred in 327 (34%) of the 939 deceased donor KT. By univariable analysis, both DGF definitions were strongly associated with hypotension, as defined by duration of time and AUC under a MAP of < 80, 70, 60 and 50 mmHg, with OR's ranging from 1.003 [95% CI, 1.001, 1.005] to 1.015 [95% CI, 1.002, 1.029] per min. However, following risk adjustment, this association was only found with a MAP of < 70 and < 60 mmHg OR of 1.002 [95% CI, 1.000, 1.005] and 1.01 [95% CI, 1.00, 1.03] per min). The duration of hypotension with a MAP of < 60 showed a time-dependent association in the DGF-CRR and DGF-D groups, but the latter was not statistically significant. Higher MAP cutoffs were associated with a reduced risk of DGF-D.

Discussion:

In this observational cohort study of KT recipients, we demonstrate an association with IOH and early KT function following surgery, although statistical power may have been insufficient to provide definitive inferences. Future research could include a randomized controlled trial assessing whether maintaining MAP > 70 improves graft function. This could be accomplished with fluids or vasoactive agents titrated with advanced hemodynamic monitoring to avoid fluid overload or excessive vasoconstriction, both of which might be detrimental for transplanted kidneys.

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Evaluation of the Effect of one Session of Hypnotherapy Administered prior to General Anesthesia Induction on Intraoperative Nociception Measured by the NOL Index: The HYPNOSTIMNOL Study

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Introduction:
Previous studies showed hypno-anesthesia resulted in lower levels of pain, anxiety, and post-operative side effects, as well as shorter procedure times (1). However, hypnotherapy studies are mainly done in non-anesthetized patients (2) and are not based on objective measures of nociception. During general anesthesia (GA), multivariate physiological indices were developed to determine intraoperative depth of anesthesia (BIS index) and responsiveness to noxious stimuli (NOL index). Based on our expertise in monitoring intraoperative depth of anesthesia and nociception (3), we aimed to explore the variations of the NOL index (0-100), heart rate (HR), mean arterial pressure (MAP) and BIS index to assess the impact of one session of hypnotherapy (just before the anesthesia induction) on the nociception induced by an experimental tetanic stimulus applied after intubation under sevoflurane anesthesia with minimal doses of opioids. We hypothesized that medical hypnotherapy has relevant analgesic effect using an objective measure of nociception during GA.

Methods:
A prospective randomized double-blind, single-center trial was conducted to meet our objectives. Patients scheduled for laparoscopic surgery under GA were included. REB approval was obtained and the study registered on clinicaltrial.gov. The pre-induction hypnotherapy session was based on the procedure classically used and included the safe place technique and wellness/pain management suggestions. The control condition included neutral, non-hypnotic language. The anesthesia protocol was similar in both groups for induction and maintenance of anesthesia (guided by BIS index) and analgesia (guided by NOL index). All parameters were recorded electronically every 5 seconds and for 5 minutes (HR, MAP, BIS, NOL). Delta NOL, the difference between post and pre-tetanic stimulation (forearm level, stimulation done at least 10 minutes after tracheal intubation and the last bolus dose of remifentanil) was the primary endpoint; NOL area under the curve (AUC) as well as BIS, HR and MAP changes were secondary endpoints. We expected this delta NOL in the hypnotherapy group to be 30% lower than without hypnotherapy (18.2±9 for hypnotherapy, vs 26±9 for control). With alpha of 0.05 and beta of 0.2 and bilateral test, we estimated that we needed 22 patients per group. Fifty patients were recruited to account for potential patient losses.

Results:
Data from forty-seven patients were analyzed. A material problem was encountered for one participant and two patients were excluded because they were practicing meditation already. Demographic data and anesthesia drugs administered at induction were similar between groups. Baseline values of the four study parameters (NOL, HR, MAP, BIS) were similar between groups prior to the noxious stimulation under GA. The variations of the NOL index (delta NOL) were similar between the two groups after the tetanic stimulation (47±12) for hypnotic group versus 45±12 for control group; P=0.7). NOL AUC during 5 minutes after the

stimulus did not show any statistically significant difference (4904±1732) for hypnotic group versus 4989±2464) for control group; P=0.89; see figure 1). Other secondary outcomes parameters (HR, MAP, BIS) showed similar variations between the two groups after the tetanic stimulation (delta of each parameter). No difference in the peak nor in the AUCs of each parameter could be noted.

Discussion:

The present results fill an existing gap on hypnotherapy effects in anesthetized patients. The expected reduction by 30% of NOL reactivity was not reached in this study. Also, the alterations of others studied parameters (HR, MAP, BIS) after noxious stimulation in the hypnotherapy group seemed to be exactly similar to those in the group who was exposed to normal conversation. Previous studies demonstrated that hypnotherapy has an impact on perceived pain in an awake patient. It seems this effect disappears in patients under GA. Expectations regarding a significant effect of hypnotherapy on intraoperative nociception might be reconsidered.

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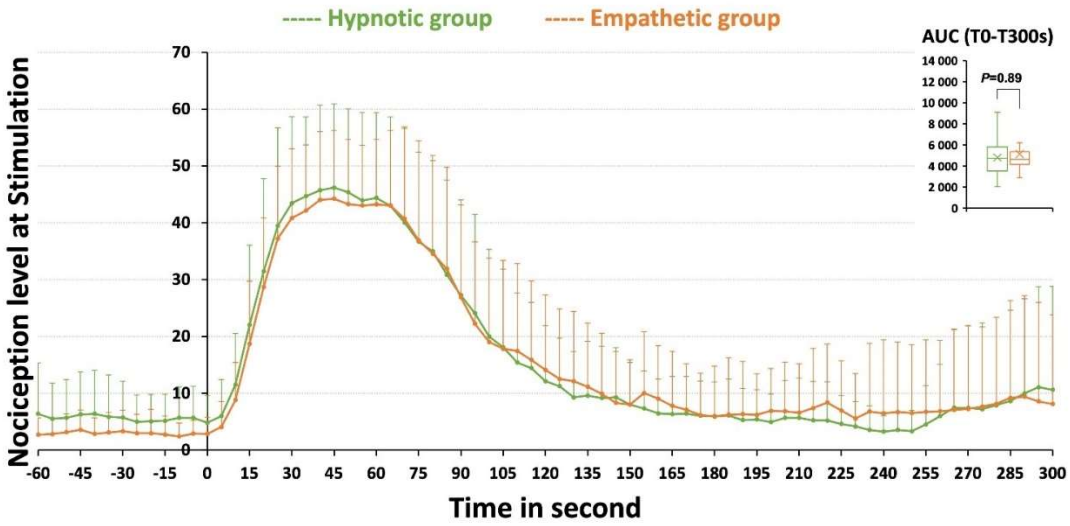
Figure 1:



Impact of Advanced Hemodynamic Monitoring on Intra-Operative Hypotension Following Head and Neck Free Flap Reconstructive Surgery: A Before–After Study

Authors:

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Introduction:

Goal-directed hemodynamic therapy (GDHT) based on advanced cardiac output monitoring has been explored in several surgical specialties to optimize intraoperative fluid management and minimize hypotension to improve postoperative outcomes[1,2]. In January of 2021 we implemented a GDHT algorithm during anesthesia for head and neck cancer excision with Free Tissue Transfer (FTT). Despite significant advances in perioperative care, this complex surgical procedure remains associated with significant complications[3]. Of critical importance to the mitigation of this morbidity is the maintenance of both vital organ and free flap perfusion. Intraoperative fluids and vasoactive agents must be carefully titrated to manage intraoperative hypotension (IOH) without promoting edema and/or vasoconstriction at the graft, inadvertently contributing to flap failure and postoperative organ dysfunction[4,5]. The goal of this study was to determine whether GDHT driven by advanced cardiac output monitors during head and neck FTT surgery reduced the duration of intraoperative hypotension (IOH).

Methods:

Following research ethics approval (REB no, 21-5664) perioperative data were collected retrospectively on consecutive FFT from Jan 1, 2017, to May 1, 2021. The use of an arterial waveform based cardiac output monitor (FloTrac™ and EV1000™ monitor, Edwards Lifesciences) was introduced into clinical practice on Jan 1, 2020, and instructions on the use of this device were provided on a printed algorithm attached to the device. Patient data was retrieved from the electronic medical records and the Drug Reconciliation Electronic Anesthesia Management (DREAM) data collection system. Patients with the advanced hemodynamic monitoring were compared to historical controls using patient demographics, comorbidities (age-adjusted Charlson Comorbidity Index), and intraoperative fluid and hemodynamic data. The primary outcome was the number of IOH episodes, defined as > 5 minutes with a Mean Arterial Pressure (MAP) < 65 mmHg. A secondary objective was the total time with an MAP < 65 mmHg. Continuous and categorical variables were expressed respectively as median (IQR) and proportions and were compared with the Fisher exact test or the X^2 test as appropriate (Two-sided, $p \leq 0.05$). Adjusted incidence rate ratios (IRRs) and 95% confidence intervals were calculated for the number of episodes of IOH using a Poisson regression model.

Results:

A total of 414 patients were included in the study cohort, 346 before and 68 after with advanced hemodynamic monitoring. The two groups were similar with respect to age, ASA score, comorbidities, and duration of anesthesia. The number of episodes of IOH and the total duration of IOH did not significantly change with the introduction of the advanced hemodynamic monitoring (respectively 6 (2-12) vs. 8 (3-14) p=0.15; and 93 (33-173) vs. 109 (47-180) min, p=0.21). Advanced monitoring was not associated with the number of IOH events

when adjusting for confounders (adjusted IRR 0.94 (0.86-1.03), p=0.24). Intraoperative fluid balance (2250 (1607-3050) ml vs. 2210 (1700-2807) ml, p=0.99) was comparable in both groups. The use of norepinephrine and dobutamine increased from 1.2% to 5.9% (p=0.01) and 2.4% to 30.9% (p<0.001) respectively. The total dose of phenylephrine increased from 480 (160-1344) mcg to 640 (240-2156) mcg (p=0.05) in the monitored group.

Discussion:

The implementation of advanced hemodynamic monitoring was not associated with a reduction in the number of episodes of IOH or the total duration of IOH. The administration of vasopressors and inotropic agents increased with the introduction of GDHT. The association of this change in practice with medical or surgical outcomes e.g. organ injury, infections or free flap complications, has yet to be determined.

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Measuring the Predictive Performance of Preoperative Clinical Frailty Tools Applied to Electronic Health Data for Adult Patients Having Emergency General Surgery

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Introduction:

The number of older patients presenting for emergency general surgery (EGS) continues to rise at a rapid rate.[1] Patients undergoing EGS experience higher rates of postoperative complications and mortality compared to elective surgery.[1-3] Preoperative frailty has been identified as a key perioperative risk factor among older patients undergoing EGS.[3,4] However, routine preoperative frailty assessment remains underperformed in practice.[5] Development of automated, electronic preoperative frailty assessment may help overcome existing barriers to routine implementation. The objective of this study was to identify a prognostically accurate clinical frailty instrument that can be applied to electronic health data to prognosticate adverse perioperative outcomes in older adults undergoing EGS.

Methods:

This was a retrospective cohort study using linked administrative healthcare data. We included adults >65 years of age undergoing EGS from 2012-2018. We compared four distinct clinical frailty instruments: the Frailty Index (FI), Hospital Frailty Risk Score (HFRS), Risk Analysis Index-Administrative (RAI), and ACG Frailty-defining diagnoses indicator (ACG). We measured the predictive accuracy of each instrument when added to a baseline risk model (age, sex, American Society of Anesthesiologists' score, procedural risk). The predictive accuracy of each instrument was measured using discrimination, calibration, explained variance, net reclassification index (NRI) and Brier score for binary outcomes, and using explained variance, root mean squared error and mean absolute prediction error for continuous outcomes. Our primary outcome was postoperative 30-day mortality. Our secondary outcomes included postoperative 365-day mortality, non-home discharge, days alive at home, hospital length of stay, and 30- and 365-day health systems cost.

Results:

There were 121,095 EGS patients who met inclusion criteria. Of these, 11,422 (9.4%) experienced death within 30 days of surgery. Compared to the baseline model predicting death at 30-days (AUC, 0.68, R^2, 0.08), addition of the RAI showed greater improvement in discrimination (AUC, 0.74), explained variance (R^2, 0.10), and net reclassification index (NRI, 0.53) than the FI, RAI, or ACG. Brier scores and calibration curves were comparable across all outcomes.

Discussion:

The addition of each clinical frailty instrument to typically assessed preoperative risk factors demonstrated strong predictive accuracy when prognosticating perioperative outcomes in older EGS patients. For 30-day mortality, the RAI showed the greatest statistical improvement across all metrics of predictive accuracy. Clinicians and health systems planners can use these findings to guide the development of automated preoperative frailty assessment systems, which may help save clinicians' time, inform perioperative risk stratification, and ultimately strengthen patient-centred care before emergency general surgery.

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Point-of-Care LUng and CAdiac ultraSound (LUCAS) in Hip Fractured Patients: A Prospective Single-Centre Cohort Study

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Introduction:

Early and accelerated surgery (within 48 hours and 8 hours from admission) in hip fractured patients has showed to improve survival and reduce the risk of delirium.[1-2] One key contributor to surgical delay is the wait for formal echocardiography or medical consultation to clarify cardiopulmonary status.[3] This often presents the dilemma of proceeding with surgery without a complete evaluation or delaying surgery.

Point-of-care LUng and Cardiac ultraSound (LUCAS) at bed-side allows for a timely comprehensive evaluation of the cardiopulmonary status of hip fractured patients. Previous studies[4-5] suggested that focused echocardiography could diagnosed occult pathologies and results in marked changes of anesthetic management in patients with suspected symptoms. However, the roles of LUCAS scans as part of routine preoperative assessment to address the need for a timely comprehensive cardiopulmonary assessment are unclear. The LUCAS study aimed to assess the impact of LUCAS scans on the anesthetic management of fractured hip patients.

Methods:

After obtaining ethics approval and trial registration, we recruited 225 consecutive adult patients booked for urgent hip arthroplasty surgery. All included patients were first evaluated by the attending anesthesiologists preoperatively. A LUCAS scan was then performed by an independent investigator. The attending anesthesiologists were asked to review their anesthetic management plans before and after acknowledging the results of the LUCAS scans.

The primary endpoint was a composite outcome of changes of the following 10 aspects of anesthetic management: surgical postponement, disposal plan, mode of anesthesia, 5-lead electrocardiogram, use of arterial line, use of central venous catheter, fluid bolus, liberal fluid therapy, restrictive fluid therapy, use of inotropic/vasopressor. Secondary outcomes included hospital and intensive care unit length of stay, perioperative cardiac and respiratory events, stroke, and death, and anesthesiologist's opinion of the LUCAS scans.

We summarized baseline demographics. The McNemar's test was used to assess the effect that the LUCAS scans had on changing the patients' anesthetic plans. The Chi-square test was used to assess the differences in secondary outcomes between patients with or without changes of anesthetic management. The anesthesiologists' opinions regarding the use of LUCAS scans as part of the perioperative management of fractured hip patients were also summarized.

Results:

Of 225 patients recruited between May 2018 and Nov 2021, 198 patients were included for final analysis. The majority of LUCAS scans were either normal, or revealed non-severe findings. The most common abnormal findings were hypovolemia (31%), followed by valvular heart lesions (24%). New cardiopulmonary conditions were identified in 50 patients (Fig. 1A), in which 28% were mild-moderate mitral or aortic regurgitation. One-

hundred-and-six anesthetic management decisions were changed in 67 patients (Fig. 1B), in which 59 changes were related to escalation of the anesthetic plan and 47 changes were related to de-escalation of the anesthetic plan. Only the decision to give fluid boluses had a statistically significantly difference (p=0.03). The secondary outcomes showed no differences between the groups with or without changes of anesthetic management. 161 of 194 anesthesiologists agreed that LUCAS re-confirmed their anesthetic plans, and that LUCAS should be an integral part of perioperative assessment.

Discussion:

This study found that using LUCAS scans as part of routine preoperative assessment did not significantly alter anesthetic management in hip fractured patients. However, LUCAS scans provide reassuring information to rule out severe cardiopulmonary conditions, allow for the de-escalation of unnecessary intervention, and provide a more accurate volume assessment to guide fluid management. In an experienced hand, a point-of-care LUCAS scans usually takes 10 minutes to perform. In the setting of early or accelerated surgery, an integrated preoperative assessment involving LUCAS scans represents a viable solution to address the unmet competitive need for both timely surgery and comprehensive preoperative evaluation.

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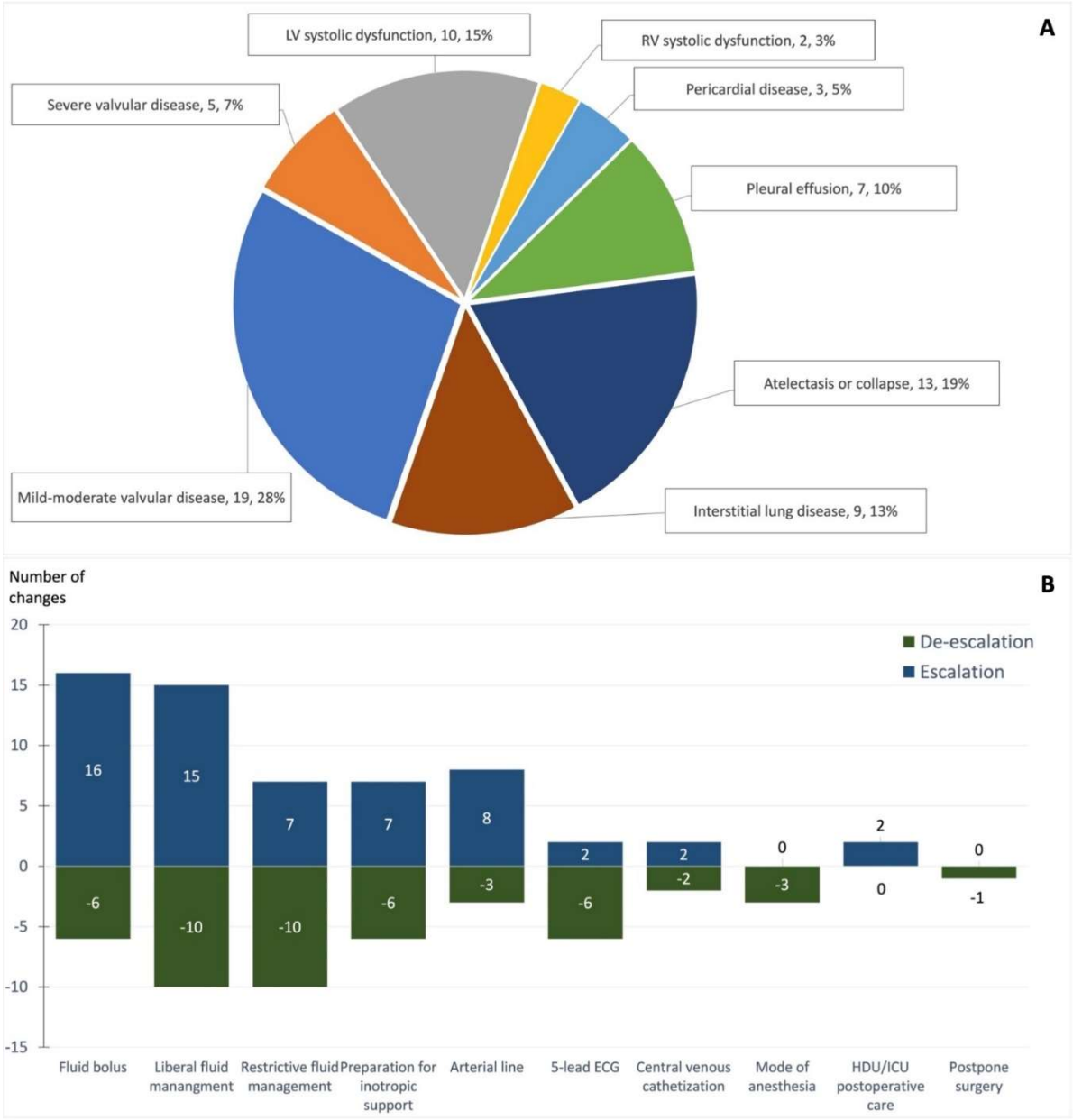
Figure 1:


A
LV systolic dysfunction, 10, 15%
RV systolic dysfunction, 2, 3%
Pericardial disease, 3, 5%
Severe valvular disease, 5, 7%
Pleural effusion, 7, 10%
Atelectasis or collapse, 13, 19%
Mild-moderate valvular disease, 19, 28%
Interstitial lung disease, 9, 13%
B
Number of changes
De-escalation
Escalation
20
15
10
5
0
-5
-10
-15
16
15
7
7
8
2
2
0
2
0
-6
-10
-10
-6
-3
-6
-2
-3
0
-1
Fluid bolus
Liberal fluid manangment
Restrictive fluid management
Preparation for inotropic support
Arterial line
5-lead ECG
Central venous cathetization
Mode of anesthesia
HDU/ICU postoperative care
Postpone surgery