tracheal intubation using a GlideScope® for anaesthetists with expertise in Macintosh laryngoscopy: an in-vivo longitudinal study. *Anaesthesia* 2015; **70**: 290–5
13. Cook TM, Boniface NJ, Seller C, et al. Universal videolaryngoscopy: a structured approach to conversion to videolaryngoscopy for all intubations in an anaesthetic and intensive care department. *Br J Anaesth* 2018; **120**: 173–80
14. Cook TM, Kelly FE. A national survey of videolaryngoscopy in the United Kingdom. *Br J Anaesth* 2017; **118**: 593–600
15. Howard-Quijano KJ, Huang YM, Matevosian R, Kaplan MB, Steadman RH. Video-assisted instruction improves the success rate for tracheal intubation by novices. *Br J Anaesth* 2008; **101**: 568–72
16. Zaouter C, Calderon J, Hemmerling TM. Videolaryngoscopy as a new standard of care. *Br J Anaesth* 2015; **114**: 181–3
17. Marewski JN, Gigerenzer G. Heuristic decision making in medicine. *Dialogues Clin Neurosci* 2012; **14**: 77–89
18. Scheibehenne B, Greifeneder R, Todd P, et al. Can there ever be too many options? A Meta-analytic review of choice overload. *J Consum Res* 2010; **37**: 409–25
19. Jessup RK, Ritchie LE, Homer J. Hurry up and decide: empirical tests of the choice overload effect using cognitive process models. *Decision* 2020; **7**: 137–52
20. Cook TM, Kelly FE. Time to abandon the 'vintage' laryngeal mask airway and adopt second-generation supraglottic airway devices as first choice. *Br J Anaesth* 2015; **115**: 497–9
21. Higgs A, McGrath BA, Goddard C, et al. Guidelines for the management of tracheal intubation in critically ill adults. *Br J Anaesth* 2018; **120**: 323–52
22. Care Quality Commission. Supporting note: standardisation. Available from: https://www.cqc.org.uk/sites/default/files/documents/20110506_supporting_note_-_standardisation_updated_for_external_publication.pdf (accessed 25 February 2020).
23. McNarry A, Cook TM, O'Sullivan EP, Baker PA. The airway lead – opportunities to improve institutional and personal preparedness for airway management. *Br J Anaesth* 2020; **125**: e22–4
24. Pracy JP, Brennan L, Cook TM, et al. Surgical intervention during a can't intubate can't oxygenate (CICO) event: emergency front-of-neck airway (FONA)? *Br J Anaesth* 2016; **117**: 426–8
25. Mendonca C, Ahmad I, Sajayan A, et al. Front of neck access: a survey among anesthetists and surgeons. *J Anaesthesiol Clin Pharmacol* 2017; **33**: 462–6
26. Rehak A, Watterson L. Institutional preparedness to prevent and manage anaesthesia-related 'can't intubate, can't oxygenate' events in Australian and New Zealand teaching hospitals. *Anaesthesia* 2019; **75**: 767–74
27. Saunders TG, Gibbins ML, Seller CA, Kelly FE, Cook TM. Videolaryngoscope assisted fibreoptic intubation for tracheal tube exchange in a difficult airway. *Anaesth Rep* 2019; **7**: 22–5
28. Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19. Guidelines from the difficult airway society, the association of anaesthetists the intensive care society, the faculty of intensive care medicine and the royal College of anaesthetists. *Anaesthesia* 2020; **75**: 785–99
29. Sorbello M, El-Boghdadly K, Di Giacinto I, et al. The Italian coronavirus disease 2019 outbreak: recommendations from clinical practice. *Anaesthesia* 2020; **75**: 724–32
30. Brewster DJ, Chrimes N, Do TB, et al. Consensus statement: safe Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group. *Med J Aust* 2020; **212**: 472–81
31. Yao W, Wang T, Jiang B, et al. Emergency tracheal intubation in 202 patients with COVID-19 in Wuhan, China: lessons learnt and international expert recommendations. *Br J Anaesth* 2020; **125**: e28–37

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Preoperative evaluation in 2020: does exercise capacity fit into decision-making?

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For the past 50 yr, preoperative evaluation for the patient with cardiac disease undergoing noncardiac surgery has included a functional assessment as part of the decision process with respect to optimal perioperative care. In a *British Journal of Anaesthesia* article in 1988, Goldman[1] suggested that 'patients should be asked if they can perform common activities that might imply that their functional status is Class II or better, such as carrying grocery bags or any 10–15 kg object up a flight of stairs without developing appreciable symptoms or having to stop'. The first and all subsequent versions of the American College of Cardiology/American Heart Association (ACC/AHA) guidelines on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery included exercise capacity as a key discriminatory point in the decision to undergo further testing, with a key discriminative point of 4 metabolic equivalents despite a lack of direct evidence.[2–5] The original recommendation was based upon a series of observational studies of exercise stress testing and a study of 600 selected patients who self-reported the number of blocks walked and stairs climbed with respect to predicting both cardiac and overall complications.[6]

The METS study was therefore designed to address the value of subjective assessment of exercise capacity, the objective Duke Activity Status Index (DASI) questionnaire and a biomarker (N-terminal pro-B-type natriuretic peptide) to predict death or complications after major elective noncardiac surgery.[7] The investigators documented the poor subjective discriminative ability of anaesthesiologists to predict functional capacity; however, the DASI was predictive of myocardial injury and death. Although cardiopulmonary exercise testing (CPET) did not have significantly increased predictive ability for cardiac events, some of the measured variables were predictive of complications after surgery. In a follow-up study from the METS investigators recently published in the *British Journal of Anaesthesia*, the authors assessed the predictive ability of different values of the DASI score and showed that a score <34 was highly predictive of myocardial infarction, death, and serious complications.[8]

Whilst the ACC/AHA guidelines have incorporated exercise capacity into the algorithm, the specific cut-offs for distinguishing good and excellent exercise tolerance were mapped onto the DASI questionnaire without using the original scoring system. Specifically, the original DASI publication did not have a gradation of questions with a simple cut-off but rather had a weighting of each of the questions and an overall score.[9] Wijeysundera and colleagues[8] utilised the original weighting scores and defined a specific numeric cut-off of 34 for identifying patients at risk for the primary study outcome of myocardial injury and death. It was also predictive of myocardial infarction, moderate-or-severe complications, and new disability. Although a recent letter to the editor questioned the method the authors used to define an absolute cut-off, the authors did an excellent job justifying their approach.[10]

The key question is: what is the value of preoperative information, including diagnostic testing, in the care of the patient undergoing noncardiac surgery? Preoperative evaluation has undergone a marked evolution over the past 40 yr. Beginning with the publication of the cardiac risk index by Goldman and colleagues,[11] the authors suggested that calculation of risk should be used to determine when only truly lifesaving procedures be performed (e.g. cardiac risk index IV) or to identify patients in whom the information can be used to delay the operation until the patient is more stable (e.g. recent myocardial infarction of active congestive heart failure). During the last 2 decades of the 20th century, there was an inherent assumption by many that identifying occult disease was critical and that intervening on those with significant coronary artery disease would lead to better outcomes. In 1994, the ACC/AHA convened a task force on Perioperative Cardiovascular Guidelines. There was an overt decision to focus the guidelines on defining the role of the perioperative evaluation and recommended testing on the premise that testing should be reserved for those situations in which the results would change management. With the publication of a number of randomised trials evaluating both interventional studies (e.g. Coronary Artery Revascularization Prophylaxis) and prophylactic drugs that have not shown benefit, more recent guidelines have moved away extensive preoperative work-ups except in the presence of overt disease.[5,12–15] Additionally, there has been a steady decrease in the rate of major cardiac events over the past 4 decades, although there continues to be a significant incidence of myocardial injury after noncardiac surgery (MINS).[16] This led the Canadian Cardiovascular Society and several authors to suggest that preoperative cardiovascular imaging is rarely needed before noncardiac surgery in stable patients.[17]

Therefore, how should we utilise exercise tolerance as part of the preoperative evaluation, and what are the implications of both the overall findings of the METS trial and the recent publication[8] of the follow-up study? In the 2014 ACC/AHA guidelines, exercise capacity continued to be an important discriminatory variable in deciding which patients should be considered for testing if the results will impact care. The algorithm step regarding exercise testing is supported by the strongest level of evidence when utilised to determine who does not need further testing. Based upon the METS trial, subjective exercise tolerance should not be used in this step, but a DASI score >34 (approximately 7 METS) is appropriate and does denote very low risk. The harder question is the care of those with a DASI $\leq$34 since the key question is how would the information be used as part of the decision process to determine if surgery is the best option for the patient. If a 50% increased rate of events is considered clinically as opposed to statistically significant, then a DASI of <25 points (approximately 4 METS) would be a second cut-off to identify the subgroup in whom testing should be considered if it would change management.

With the shift to value-based care and the development of Enhanced Recovery After Surgery (ERAS) protocols, increasing attention is now focused on the decision to undergo surgery. Does the benefit of surgery outweigh the risk of surgery and anaesthesia? Some would argue we are back to the original question asked by Goldman and colleagues.[11] In the current era, this question is not focused on cardiac risk but overall risk. In the supplemental tables in the METS article, the authors presented data of the DASI score and 1-yr new disability or death, and found a threshold of $\leq$34 points had an odds ratio of 3.00, although 35 points had a similar odds ratio of 2.87. Cardiopulmonary exercise testing has been utilised by many groups to help decide on fitness for surgery. Using a DASI cut-off of 34 points, a group at high risk of complications including cardiac events can be identified. This study and overall METS trial should be used to help patients, anaesthesiologists, and surgeons make informed decisions regarding the value of the planned surgical procedure.

Declarations of interest

The author declares that they have no conflict of interest.

References

1. Goldman L. Assessment of the patient with known or suspected ischaemic heart disease for non-cardiac surgery. *Br J Anaesth* 1988; **61**: 38–43
2. Eagle K, Brundage B, Chaitman B, et al. Guidelines for perioperative cardiovascular evaluation of the noncardiac surgery. A report of the American Heart Association/American College of Cardiology Task Force on Assessment of Diagnostic and Therapeutic Cardiovascular Procedures. *Circulation* 1996; **93**: 1278–317
3. Eagle KA, Berger PB, Calkins H, et al. ACC/AHA guideline update for perioperative cardiovascular evaluation for noncardiac surgery–executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *J Am Coll Cardiol* 2002; **39**: 542–53
4. Fleisher LA, Beckman JA, Brown KA, et al. ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: Executive Summary: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery): Developed in collaboration with the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery. *Circulation* 2007; **116**: 1971–96
5. Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 2014; **64**: e77–137
6. Reilly DF, McNeely MJ, Doerner D, et al. Self-reported exercise tolerance and the risk of serious perioperative complications. *Arch Intern Med* 1999; **159**: 2185–92
7. Wijeysundera DN, Pearse RM, Shulman MA, et al. Assessment of functional capacity before major non-cardiac surgery: an international, prospective cohort study. *Lancet* 2018; **391**: 2631–40
8. Wijeysundera DN, Beattie WS, Hillis GS, et al. Integration of the Duke Activity Status Index into preoperative risk evaluation: a multicentre prospective cohort study. *Br J Anaesth* 2020; **124**: 261–70
9. Hlatky MA, Boineau RE, Higginbotham MB, et al. A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). *Am J Cardiol* 1989; **64**: 651–4
10. Yonekura H, Kamei M. Clinical utility of Duke Activity Status Index for preoperative risk assessment. Comment on *Br J Anaesth* 2020. *Br J Anaesth* 2020; **124**: 261–70
11. Goldman L, Caldera DL, Nussbaum SR, et al. Multifactorial index of cardiac risk in noncardiac surgical procedures. *N Engl J Med* 1977; **297**: 845–50
12. Devereaux PJ, Mrkobrada M, Sessler DI, et al. Aspirin in patients undergoing noncardiac surgery. *N Engl J Med* 2014; **370**: 1494–503
13. Devereaux PJ, Sessler DI, Leslie K, et al. Clonidine in patients undergoing noncardiac surgery. *N Engl J Med* 2014; **370**: 1504–13
14. Devereaux PJ, Yang H, Yusuf S, et al. Effects of extended-release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial): a randomised controlled trial. *Lancet* 2008; **371**: 1839–47
15. McFalls EO, Ward HB, Moritz TE, et al. Coronary-artery revascularization before elective major vascular surgery. *N Engl J Med* 2004; **351**: 2795–804
16. Sanaiha Y, Juo YY, Aguayo E, et al. Incidence and trends of cardiac complications in major abdominal surgery. *Surgery* 2018; **164**: 539–45
17. Duceppe E, Parlow J, MacDonald P, et al. Canadian Cardiovascular Society Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Noncardiac Surgery. *Can J Cardiol* 2017; **33**: 17–32