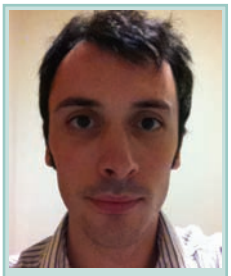
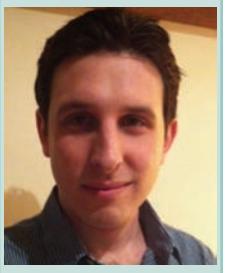
Use the Stairs: Fitness Optimisation Before GI Cancer Surgery



Alistair Connell,
Foundation Year 1,
Upper GI Surgery,
Department of General Surgery, GI Division,
University College London Hospitals NHS Foundation Trust.



Gavin Schaller,
Foundation Year 2,
Upper GI Surgery,
Department of General Surgery, GI Division,
University College London Hospitals NHS Foundation Trust.

Khaled Dawas,
Senior Lecturer and Honorary Consultant Upper GI Surgeon,
Department of General Surgery, GI Division,
University College London Hospitals NHS Foundation Trust.

Correspondence to:
Khaled Dawas
khaled.dawas@uclh.nhs.uk

Malignancy involving the gastrointestinal (GI) tract is common. In western populations, colorectal cancers are more prevalent than oesophageal and gastric tumours. The latter two represent the fifth most common cancers diagnosed each year. Typically, they are found in an elderly population, and because their presentation is often late, they account for almost 10% of deaths attributable to cancer. GI cancers are seen most often in men, and increase in incidence with age [1]. As it is more common in the elderly, many patients will have multiple medical co-morbidities, which may increase the risks of surgery. For elective colorectal cancer resections, 30 day mortality may reach 5%; for oesophagectomy and gastrectomy patients, it can be as high as 15% [2].

Historically, our ability to predict which patients will require higher levels of peri-operative care is poor, with recent studies describing a significant number of deaths occurring in patients where transfer to a critical care setting was delayed [3]. GI cancer surgery patients represent one such 'high risk' group. Deciding which patients are at the highest risk could improve outcomes at surgery, and ensure hospital resources are used effectively.

This review seeks to highlight different methods in stratifying risk in GI cancer surgery patients. The effects of both neoadjuvant therapy and surgery on patient fitness will then be discussed.

Means of assessing fitness for surgery

Surgery is a major challenge to the body's physiological systems. Any inability to meet these demands will put an individual at increased risk of morbidity and mortality. Pre-operative assessment aims to ensure that those at high risk receive an appropriate level of peri-operative care [4].

Pre-operative measurements of fitness can take several forms. Questionnaires such as the Duke Activity Status Index (DASI) use questions about the patient's activities of daily living. However, this questionnaire was developed for use in cardiac patients, and it's usefulness in the context of other major surgeries is less well understood. Risk stratification scores are also used, from simple methods (such as ASA grading), to more complex systems (such as the POSSUM index). Interestingly, patients assessed as being high risk in the opinion of their operative surgeon were found to have worse outcomes [5].

More objective assessments of exercise tolerance can take a number of forms; stratifications of risk using an incremental 'shuttle walk' test have been found to correlate with more high-tech exercise tests.

The fitness of high-risk patients may be assessed using echocardiography and spirometry. However, such tests do not reflect the body's ability to deal with the physiological stress that surgery mandates. Stress echocardiography and treadmill exercise tolerance tests have been found to be poor at predicting post-operative ischaemic cardiac events, but they are able to establish which patients are at low risk [6].

In cardiopulmonary exercise testing (CPEX), patients are exercised using a bicycle or treadmill. The intensity of exercise is gradually increased until maximal exertion is reached. Breath-by-breath analysers allow the total oxygen used and carbon dioxide produced by the patient to be calculated. ECG monitoring is typically performed at the same time.

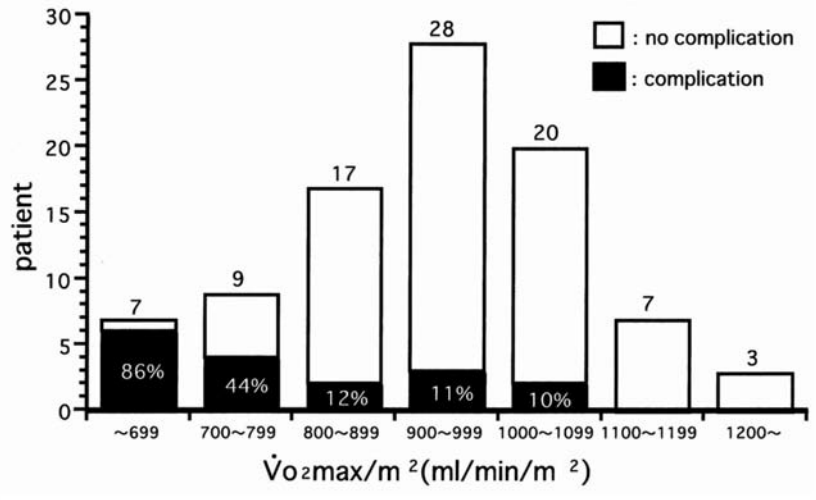


Figure 1: A graph showing cardiopulmonary complication rates following thoracic oesophagectomy as a function of VO_2max.[8]

In the initial aerobic phase of exercise, total expired carbon dioxide increases linearly with oxygen intake, reflecting the CO_2 that is produced aerobically in muscle tissue. As exercise intensity increases, oxygen demand begins to outstrip supply. The product of anaerobic metabolism – lactic acid – is buffered by bicarbonate in the bloodstream. This is seen as a disproportionate rise in exhaled CO_2 relative to oxygen consumption. The point at which this change happens is called the ventilation threshold (VT). An individual's maximum ability to extract oxygen from the air during exercise is termed the 'VO_2max'. Measuring such parameters in exercise is useful, as they act as a surrogate marker for the physiological processes that affect them: gas exchange in the lungs, the fitness of the cardiovascular system, and the performance of the muscles themselves. This point underlies the advantages of CPEX testing over other conventional pre-operative assessment tools; it aims to subjectively assess the body's physiological systems under stress, and in unison. Importantly, it may also be used to guide peri-operative management. For this reason, CPEX testing may be used pre-operatively to assess an individual's fitness for surgery, acting as a proxy for the 'metabolic insult' that surgery represents.

Whilst the utility of CPEX testing in the context of cardiac and major intra-abdominal surgery has been discussed at length, there are far fewer data regarding its usage in GI cancer patients. One study has found a correlation between VO_2max and the rate of cardiopulmonary complications in oesophagectomy patients [7]. This is seen in Figure 1.

However, others have found that CPEX testing was not a useful predictor of post-operative complications in oesophagectomy patients [8]. Similarly, the use of exercise testing in colorectal cancer is poorly understood.

Neoadjuvant treatments

Modern treatment regimes may be multimodal, involving pre-operative chemotherapy and radiotherapy. Whilst they improve survival, such regimes can impact dramatically on quality of life, often leaving side effects long after treatment has finished. They may also have direct effects on cardiovascular fitness; this can be explained in part by side affects such as anaemia and cardiac dysfunction. Indeed, fatigue affects a large proportion of patients undergoing chemoradiotherapy. Other side effects such as nausea may make exercise more difficult. For these reasons, physical 'de-conditioning' in the setting of adjuvant treatments may be expected. This decline in fitness might affect outcome following surgery. However, the detrimental effects of chemotherapy on physical performance can be reduced by structured programs of aerobic exercise during treatment [9].

In a study of colon cancer, an increase in physical activity following diagnosis led to fewer cancer-specific deaths. Exercise has also been found to improve patient-rated outcomes such as depression, anxiety, and quality of life [10].

The effects of surgery

For oesophageal cancer, resection surgery is associated with high rates of morbidity and mortality. Post-operative care may involve long stays in high dependency units, and a lengthy recovery. Techniques involving thoracotomies by necessity collapse a lung. Minimally invasive approaches may have the potential to improve morbidity and the length of hospital stay, and aim to reduce rates of respiratory complications such as pneumonia and atelectesis though this has yet to be proven. Recovery from such complications can be arduous; patients are often frail, and malnourished.

In colorectal cancer patients, 'fast track' post-operative recovery pathways involving the multidisciplinary team have been implemented with the aim of improving care and decreasing complication rates. Studies report a return to pre-morbid physical fitness within one year in colorectal surgery for cancer [11]. However, there is little information on recovery of physical fitness in oesophagogastric (OG) cancer patients.

Means of improving pre-operative fitness and reassessment

Regular exercise may decrease the incidence of colon cancer in population studies, but its effects following diagnosis are less well understood. One study found that increasing levels of exercise after diagnosis improved outcomes in colorectal cancer. High levels of physical activity prior to diagnosis did not appear to have the same effect [12]. The effects of pre-operative exercise regimes on fitness in patients with OG cancer are poorly understood and a study is in place to look at this aspect.

Conclusions

Whilst UK guidelines suggest that all patients diagnosed with GI malignancy should undergo a thorough assessment of fitness, how this should be attained is less clear. Furthermore, there is evidence to suggest that improving physical fitness following diagnosis may have beneficial effects on outcome. Exercise also has a role to play in rehabilitation, and may help limit the detrimental effects of treatment on function and quality of life.

Our knowledge of neoadjuvant therapy and surgical techniques is expanding. However, much of the work surrounding fitness optimisation in the context of malignant disease has focused on breast and lung cancer. In particular, there are few data on oesophageal and gastric cancer patients. Further studies are needed to clarify the best approach to peri-operative assessment and management. ■

References

1. Management of oesophageal and gastric cancer - a national clinical guideline. SIGN guideline 87. Accessed at http://www.sign.ac.uk/pdf/sign87.pdf on 01/03/11.
2. Davies SJ, Wilson RJ. Br J Anaesth. *Preoperative optimization of the high-risk surgical patient.* 2004;93(1):121-8.
3. Pearse RM, Harrison DA, James P, Watson D, Hinds C, Rhodes A, Grounds RM, Bennett ED. *Identification and characterisation of the high-risk surgical population in the United Kingdom.* Crit Care. 2006;10(3):R81.
4. Struthers R, Erasmus P, Holmes K, Warman P, Collingwood A, Sneyd JR. Br J Anaesth. *Assessing fitness for surgery: a comparison of questionnaire, incremental shuttle walk, and cardiopulmonary exercise testing in general surgical patients.* 2008;101(6):774-80.
5. McCulloch P, Ward J, Tekkis PP; ASCOT group of surgeons; British Oesophago-Gastric Cancer Group. *Mortality and morbidity in gastro-oesophageal cancer surgery: initial results of ASCOT multicentre prospective cohort study.* BMJ. 2003;327(7425):1192-7.
6. Davies SJ, Wilson R,. Br J Anaesth. *Preoperative optimization of the high-risk surgical patient.* 2004;93(1):121-8.
7. Nagamatsu Y, Shima I, Yamana H, Fujita H, Shirouzu K, Ishitake T. *Preoperative evaluation of cardiopulmonary reserve with the use of expired gas analysis during exercise testing in patients with squamous cell carcinoma of the thoracic esophagus.* J Thorac Cardiovasc Surg. 2001;121(6):1064-8.
8. Forshaw MJ, Strauss DC, Davies AR, Wilson D, Lams B, Pearce A, Botha AJ, Mason RC. *Is cardiopulmonary exercise testing a useful test before esophagectomy?* Ann Thorac Surg. 2008;85(1):294-9.
9. Dimeo F, Fetscher S, Lange W, Mertelsmann R, Keul J. *Effects of aerobic exercise on the physical performance and incidence of treatment-related complications after high-dose chemotherapy.* Blood. 1997;90(9):3390-4.
10. Spence RR, Heesch KC, Eakin EG, Brown WJ. *Randomised controlled trial of a supervised exercise rehabilitation program for colorectal cancer survivors immediately after chemotherapy: study protocol.* BMC Cancer. 2007;7:154.
11. Courneya KS, Segal RJ, Mackey JR, Gelmon K, Reid RD, Friedenreich CM, Ladha AB, Proulx C, Vallance JK, Lane K, Yasui Y, McKenzie DC. *Effects of aerobic and resistance exercise in breast cancer patients receiving adjuvant chemotherapy: a multicenter randomized controlled trial.* J Clin Oncol. 2007;25(28):4396-404.
12. Meyerhardt JA, Giovannucci EL, Holmes MD, Chan AT, Chan JA, Colditz GA, Fuchs CS. *Physical activity and survival after colorectal cancer diagnosis.* J Clin Oncol. 2006;24(22):3527-34.