Cardiopulmonary Exercise Testing for Collaborative Decision Making Prior to Major Hepatobiliary Surgery

Presenting Author: Mark Edwards[1,2,3,4], BMedSci BMBS MRCP FRCA MD(Res)

Co-Authors: Thomas Sharp[2]; Sandy Jack[1,2,3] PhD; Tom Armstrong PhD FRCSEd[1]; John Primrose[1,5] MB ChB FRCS MD Michael Grocott[1,2,3,4] BSc MBBS MD FRCA FRCP FFICM; Denny Levett[1,2,3] BM BCh PhD MRCP FRCA FFICM

Affiliations: 1. University Hospital Southampton NHS Foundation Trust; 2. Integrative Physiology and Critical Illness Group, Clinical and Experimental Sciences, Faculty of Medicine, University of Southampton; 3. University of Southampton NIHR Respiratory Biomedical Research Unit; 4. Royal College of Anaesthetists Health Services Research Centre; 5. Department of Surgery, Cancer Sciences Unit, University of Southampton.

Background/Introduction: Cardiopulmonary exercise testing (CPET) is increasingly used for preoperative risk assessment. Evidence to date suggests utility for predicting risk of postoperative morbidity and mortality across a number of surgical specialties (1). It is commonly used to triage patients to postoperative critical care (2) and to inform preoperative risk discussions. We report its use for preoperative collaborative decision making in a large University hepatopancreatobiliary (HPB) surgical unit in which postoperative critical care admission is routine.

Methods: Patients undergoing assessment for liver resection and pancreaticoduodenectomy in 2014 and 2015 underwent symptom limited incremental exercise testing at the surgeons' discretion. Data collected included anaerobic threshold (AT), peak oxygen consumption (peakVO_2) and ventilatory equivalents for carbon dioxide at AT (VE/VCO_2), clinical plan made on the basis of CPET, intensive care and hospital length of stay (LOS) in operated patients. Based on prior literature, physiological risk was reported to the clinical team as "low risk" (AT > 10mlO_2.min^{-1}.kg^{-1}), "high risk" (AT 8-10mlO_2.min^{-1}.kg^{-1}) or "very high risk" (AT <8mlO_2.min^{-1}.kg^{-1}).

Results: 146 patients underwent CPET. Median (IQR) age was 69 (62-74), with mean (SD) AT 9.6 (2.6) mlO_2.min^{-1}.kg^{-1}. This is lower than previously published series of HPB patients (3) and may reflect selective referral of patients where the surgeon has concern about baseline physiological status. 31 patients did not ultimately have surgery. Of these 13 (8.9%) had disease that was assessed as non-resectable whereas 18 (12.3%) had very high physiological risk (mean AT 6.5 mlO_2.min^{-1}.kg^{-1}; $p<0.0001$ compared with operated group). Pursuing non-surgical treatment in these patients involved collaborative decision making between patient, surgeon, anesthesiologist and oncologist. Each potential treatment was explored in terms of benefits and risks, including the individualized risk level of postoperative morbidity / mortality suggested by CPET results. Alternative treatments included transarterial chemoembolization, chemotherapy, interval disease surveillance and palliative care.

Furthermore, in nine "high-/very high- risk" cases undergoing surgery (8% of operated group), perioperative care was significantly modified based on CPET findings. This included four cases of optimization of cardiac medication for exercise-induced ischemia / arrhythmia and two respiratory interventions. This preoperative optimization group proceeded to surgery in a timely fashion (median time from test to surgery 9 days, range 1-20) and had postoperative outcomes in line with the lower risk CPET group: critical care LOS 1 day (range 1-6 days), hospital LOS 8 days (range 2-9 days).

Conclusion: Even in centers and surgical specialties where postoperative critical care admission is routine, preoperative CPET in a higher risk subset of the overall patient group has utility in guiding shared decision making. This includes consideration of non-surgical options in patients at very high risk of postoperative morbidity and mortality, and timely optimization of cardio-respiratory limitations revealed during CPET.

References:

1. Hennis PJ, Meale PM, Grocott MPW. Cardiopulmonary exercise testing for the evaluation of perioperative risk in non-cardiopulmonary surgery. Postgrad Med J. 2011 Aug;87(1030):550–7.

2. Swart M, Carlisle JB. Case-controlled study of critical care or surgical ward care after elective open colorectal surgery. Br J Surg. 2012 Feb;99(2):295–9.

3. Snowden CP, Prentis J, Jacques B, Anderson H, Manas D, Jones D, et al. Cardiorespiratory Fitness Predicts Mortality and Hospital Length of Stay After Major Elective Surgery in Older People. Annals of Surgery. 2013 Jun;257(6):999–1004.