

<p><b>Institution: Liverpool Hope University</b></p>
<p><b>Unit of Assessment: 26 - Sport and Exercise Sciences, Leisure and Tourism</b></p>
<p><b>Title of case study: Change in practice for surgical teams- Major surgery for cancerous tumour removal</b></p>
<p><b>1. Summary of the impact</b></p> <p>This case study refers to a change in practice for surgical teams when considering major surgery for the removal cancerous tumours. Such procedures carry significant risk of death within 30-days and reliance on intensive care in the post-operation period. Our research demonstrated that a significant predictor of mortality was physical fitness prior to undertaking chemotherapy. Hence exercise testing is now used in a systematic manner in order to objectively assess risk prior to chemotherapy and surgery</p> <p><b>2. Underpinning research</b></p> <p>Across the world, stomach cancer is the fourth most common cancer and the second most common cause of cancer death. Similarly, oesophageal cancer is the eighth most common cancer and the sixth most common cause of cancer-death. In England and Wales, approximately 13,500 patients are diagnosed annually, of which 22% undergo planned curative resection (removal of the tumour by surgical procedure). Surgical resection for these upper-gastrointestinal (upper GI) cancers does however have significant mortality (death), a recent national audit data reported 30 day mortality as 4%, and 90 day mortality as 6% (4% &amp; 6% of patients undergoing surgical resection with 1-year survival rates between 76.1% and 78.0% depending on the site of tumour.</p> <p>The clinical service of almost any treatment differs between NHS trusts. At University Hospital Aintree NHS Trust, it has been routine for patients due to undergo major abdominal surgery to undertake cardio-pulmonary exercise testing (CPET) in order to determine physical fitness and provide an objective means with which to stratify patients in terms of risk for surgery and outcome. This has been based on previously published data demonstrating that physical fitness measured via CPET is a predictor of risk in the peri- and post-operative period in patients undergoing major intra-abdominal (lower torso) surgery.</p> <p>However, prior to our undertaking research in this area, whether risk during and following major upper GI (upper torso) surgery is also related to physical fitness was not known. Furthermore, patients undergoing treatment for upper GI cancer undergo chemotherapy in order to reduce tumour size and thus improve operability. However, whether this results in detrimental effects on physical fitness, and thus an increase in surgical risk, was also unknown.</p> <p>In collaboration with the clinical team at University Hospital Aintree, we undertook a study in which 39 patients with upper GI cancer who completed their prescribed chemotherapy regime undertook CPET before and after chemotherapy and prior to surgery. We demonstrated that there was a reduction in physical fitness as measured by <math>VO_2</math>max and LT during incremental cycle exercise following a course of chemotherapy. Of these patients, those who had low physical fitness prior to chemotherapy had reduced survival following surgery as compared to those with high physical fitness. By comparison, physical fitness had no impact on survival for a second group of 50 patients who did not undergo chemotherapy.</p> <p>This research therefore demonstrates that chemotherapy can adversely affect survival in those with low physical fitness, an effect probably due to a chemotherapy-induced reduction in physical fitness beyond minimum threshold required for best outcome</p>
<p><b>3. References to the research</b></p> <p>The underpinning research was the basis for a successful grant application (“The effect of neo-adjuvant chemotherapy on exercise capacity and outcome following upper gastrointestinal cancer</p>

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surgery”) awarded to Professor Michael Grocott (PB-PG-0609-18262) from the National Institute of Health Research (NIHR) Research for Patient Benefit. The period of the grant was for 28 months, and was of the value £249,652. The contribution of the Unit member Dr Simon Marwood can be noted by reference to an article “in submission” in section 23 of this application form. It is available from the HEI.

**4. Details of the impact**

The research was conducted on-site at University Hospital Aintree in collaborations with members of the surgical and multi-disciplinary team. That physical fitness had an impact on survival in this group of patients was therefore rapidly disseminated to all members of the surgical and inter-disciplinary team at University Hospital Aintree.

As a consequence of this research, a business case was presented by the surgical and multidisciplinary team to the local NHS Trust to expand the pre-operative service of CPET to incorporate such testing pre- and post-chemotherapy. The business case noted that:

“It is now clear that although chemotherapy may reduce tumour size and improve operability, this may actually worsen cardiorespiratory fitness. It is therefore necessary to perform pre-operative CPX testing twice on these patients. Once before the chemotherapy to ensure they are suitable candidates for surgery and chemotherapy, and then again after chemotherapy to ensure they are still fit for surgery.”

This would result in a doubling of the volume of such testing completed during each year. Based upon the research, the objectives of the proposal were

“To identify those patients undergoing major elective colorectal surgery at highest risk of post-operative complications and to plan elective post-operative admission to the critical care unit

To identify lower risk patients that can be transferred directly to the ward post-operatively

To identify patients who are at particularly high risk, and for whom non-surgical treatment options may be more appropriate

To provide capacity for referral of patients from other surgical specialties considered to be at high risk for CPX testing in order to aid assessment of peri-operative risk”

The benefits (impact) of the proposal were considered to be:

“...predominantly clinical quality benefits, but there may be some cost benefits associated with reductions in morbidity and overall length of stay (critical care and hospital stay) and reductions in unplanned critical care admissions in this group of patients.”

The business case was successful; as a result all patients now undergoing chemotherapy for UGI cancer will undertake pre- and post- chemotherapy exercise testing for the determination of lactate threshold and maximal oxygen uptake. This represents a change from previous policy at this hospital where patients were tested for physical fitness (though not routinely) only after chemotherapy. This change has been introduced as the underpinning research has indicated that those with low physical fitness prior to chemotherapy have significantly reduced survival in the post-surgery period. Hence, if pre-chemotherapy exercise testing indicates low physical fitness then such patients will not undergo chemotherapy, but will still undergo surgery unless physical fitness is severely impaired.

All patients now undergo exercise testing prior to surgery, whereas previously only those perceived “at risk” (normally based on age) were tested. This provides an objective indicator of outcome such that the surgical team can both choose whether or not to operate, but also can consider

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potential alternative methods of operation.

The beneficiaries of the impact of this research are therefore the patients and the NHS trust within which University Hospital Aintree resides. Patients are benefitted as they may be placed at a lower risk of death following surgery by not undergoing chemotherapy if physical fitness is low. Alternatively, unnecessarily risky operations may not be undertaken. The NHS trust is benefitted as by identifying those individuals most at risk, and thus avoiding unnecessarily risky operations, this policy should bring about a reduction in mortality and morbidity. Furthermore, an understanding of the risk to each individual patient should bring about an improvement in the planning of the post-operative period (i.e. critical care bed or to the ward). Each of these factors bring about significant reductions in costs due to fewer bed-days in intensive care.

**5. Sources to corroborate the impact**

Testimonial from surgical team (Peri-operative CardioPulmonary Exercise Testing Clinical Lead and NIHR Clinical Research Fellow, Aintree University Hospitals NHS Foundation Trust.

Internal business case to expand pre-operative service of CPET at University Hospital Aintree (confidential internal document)

Successful grant application to the National Institute of Health Research (PB-PG-0609-18262)

<http://www.bbc.co.uk/news/health-21627235>