



## HEALTH TECHNOLOGY WALES (HTW) GUIDANCE 016 (July 2020)

### Cardiopulmonary exercise testing (CPET) to inform decision-making prior to major intra-abdominal surgery

#### HTW Guidance:

Cardiopulmonary exercise testing (CPET) shows promise when used to inform decision-making prior to major intra-abdominal surgery. The evidence shows that the use of CPET in addition to standard risk assessment improves the identification of patients at increased risk of surgery-related morbidity and mortality and facilitates the planning of peri-operative care. The evidence therefore partially supports the adoption of CPET for people undergoing major intra-abdominal surgery.

Further research is recommended to define the impact of CPET on clinical outcomes, patient experience and cost effectiveness as compared with standard risk assessment alone in people undergoing major intra-abdominal surgery.

#### Why did Health Technology Wales (HTW) appraise this topic?

In people undergoing major intra-abdominal surgery, it is important to identify those that are at greatest risk of developing complications so that correct decisions about treatment can be made and management over the time of surgery optimized. Standard risk assessment includes the use of clinical information and simple testing information. Cardiopulmonary exercise testing (CPET) can be added to standard risk assessment to measure cardio-pulmonary fitness and reserve and thereby refine the decision-making process. Evidence supports the use of CPET to identify patients at greatest risk of death or serious complications when undergoing major intra-abdominal surgery and the additional information from CPET allows for the planning of care over the time of surgery. There is less evidence available that defines the impact of using CPET on clinical outcomes, patient experience or the cost of surgery so further studies are recommended to clarify these issues.

The use of CPET before major abdominal surgery is increasing in NHS Wales, and Health Technology Wales appraised this topic to help inform the evidence-based use of this technology. This topic was submitted to Health Technology Wales by Dr Anthony Funnel, Consultant Anaesthetist, Cwm Taf Morgannwg University Health Board.

**The status of HTW guidance is that NHS Wales should adopt this guidance or justify why it has not been followed. HTW will evaluate the impact of its guidance.**

## Evidence Summary

Refer to Evidence Appraisal Report 016 (EAR016) for a full report of the evidence supporting this Guidance.

A systematic literature review was undertaken to identify evidence that could be used to answer two review questions:

1. In people undergoing major intra-abdominal surgery, how accurately do factors measured by pre-operative cardiopulmonary exercise testing (CPET) predict post-operative outcomes?
2. In people undergoing major intra-abdominal surgery, what is the effect of adding pre-operative CPET to standard pre-operative assessment on post-operative outcomes?

The evidence review identified a large body of evidence on the use of different cardio-pulmonary parameters measured by CPET to predict post-operative outcomes after major intra-abdominal surgery. The evidence suggests that CPET parameters can be used to predict post-operative outcomes including death and major complications. The predictive ability of CPET varies according to the type of surgery, CPET parameters and clinical outcomes considered. The parameters most consistently shown to be predictive of important clinical outcomes include the anaerobic threshold, peak oxygen consumption and the ventilatory equivalent for CO<sub>2</sub> production ratio.

Evidence on how adding pre-operative CPET to standard pre-operative risk assessment influences post-operative outcomes is limited, and the reliability of the evidence found was considered to be low due to the potential for bias and the relatively small quantity of evidence available. One non-randomized study was reported in patients undergoing abdominal aortic aneurysm (AAA) repair and the results suggested that the addition of CPET to standard risk assessment improved survival and shortened critical care unit length of hospital stay. A second non-randomized study was reported in patients having colorectal surgery and showed that the selected use of CPET in addition to standard risk assessment led to overall equivalent clinical outcomes as compared with lower risk patients who were not offered CPET. In this study, the proportion of patients who needed critical care after surgery was higher in the group receiving pre-operative CPET, but this is likely to be because patients who were referred for CPET were clinically determined to be at higher risk from surgery.

One of the non-randomised retrospective cohort studies reported that the addition of CPET to pre-operative testing saved £4,408 per patient compared with not using CPET, in people undergoing open AAA repair only. The study did incorporate clinical decision-making that diverted patients away from open surgery to either endovascular aneurysm repair or conservative management but the cost impact for these patients was not reported. Overall, the cost effectiveness of CPET remains uncertain due to the limitations of the available evidence.

The appropriate mechanism for patient engagement was determined and the patient perspective was considered where possible.

## Appraisal Panel considerations

- The Appraisal Panel were informed that cancer outcomes in Wales are poorer than in other UK nations. It is considered that this is due to a combination of factors that relate to cancer screening, population health, and the delivery of cancer treatment. The Appraisal Panel therefore recognized the importance of identifying interventions that might have a beneficial impact on clinical outcome in patients undergoing treatment for cancer. In this regard, the Panel noted from the evidence that patients undergoing colorectal cancer resection comprise the majority of patients undergoing major intra-abdominal surgery in Wales.

- In addition to considering the published evidence, the Appraisal Panel were advised by a clinical expert from Aneurin Bevan University Health Board and a clinical expert from Cwm Taf Morgannwg University Health Board. The Panel were informed that CPET is available to all major colorectal cancer patients in Cwm Taf Morgannwg University Health Board, but that the CPET service has only recently been established in Aneurin Bevan University Health Board.
- The clinical experts outlined to the Panel the current clinical pathway for pre-operative risk assessment and explained that CPET is offered in addition to standard clinical risk assessment in a 'high-risk' surgical clinic. They explained that the results are used to inform shared decision-making in patients who are being considered for surgery and that the range of decisions include whether or not surgery should proceed, whether patients should be offered alternative treatments, and the way in which anaesthesia and post-operative care is delivered. In addition, the experts explained the value of CPET in providing objective information on which to base conversations with patients about the risks of surgery and the possible benefits that may result from pre-habilitation including improving nutrition and physical fitness prior to surgery. In addition to refining risk stratification, the experts noted that CPET allows the identification of pathologies such as arrhythmia, which might not otherwise have been detected. For these reasons, the clinical experts reported that the use of CPET for risk stratification is increasingly seen as good practice and that CPET (and pre-habilitation) is integral to delivering individualised care. The experts noted the importance of referring patients for CPET as soon as surgery is being contemplated so that decisions can be arrived at well in advance of treatment. The experts explained that the way in which CPET is integrated into the clinical pathway varies between hospitals and that in some cases, additional appointments may be necessary when CPET can be done, while in other cases, CPET may be delivered at the time of an existing pre-operative assessment appointment. Experts report that in their experience, only approximately 5% of people are unable to do a CPET test, and that once the test is recommended, only approximately 1% are unable to complete it.
- The clinical experts reported to the Panel that they have observed a slight decrease in the number of patients undergoing surgical management since CPET has been offered. In cases where predicted surgical mortality is greater than 10%, patients may be directed towards non-surgical management where appropriate. The experts also commented that patients have provided favourable feedback on the use of CPET and seem to value the additional time that they are able to spend with a consultant anaesthetist (up to an hour) prior to surgery since this also provides the opportunity for further discussion and questioning of a professional expert.
- The experts described to the Appraisal Panel what standard pre-operative risk assessment comprises. They explained that pre-operative surgical assessment clinics are often nurse-led but may include the input of a consultant anaesthetist. Clinical information is supported by non-invasive testing that may include an electrocardiogram (ECG), a chest X-Ray (CXR), an echocardiogram or lung function testing. The experts explained that the use of CPET provides additional dynamic and functional testing about cardio-pulmonary fitness and reserve that is valuable in anticipating the likelihood of high peri-operative risk.
- Having considered the published evidence and expert opinions, the Appraisal Panel concluded that the addition of CPET to standard risk assessment improves the prediction of increased peri-operative morbidity and mortality in people undergoing major intra-abdominal surgery. Furthermore, they considered that the use of CPET improves clinical decision-making and the planning of peri-operative care.
- The Appraisal Panel concluded, however, that the evidence on the impact of CPET on clinical outcomes after surgery is limited in both quantity and quality and recommend that further research be undertaken to elucidate this as well as the impact of CPET on patient experience. Given the paucity of evidence of the impact of CPET on clinical and economic outcomes, the Appraisal Panel concluded that it is difficult to draw any definitive conclusions about the cost

effectiveness of adding CPET to standard risk assessment and recommends that further research be undertaken to clarify this. The Appraisal Panel noted that the establishment of a CPET service requires significant financial investment and the Panel were informed by the clinical expert from the Aneurin Bevan University Health Board that there is an up-front cost for purchasing equipment of approximately £60,000 and there are recurring costs of £7,000 per year for maintenance of equipment.

- Overall, the Panel considered that it is plausible that the additional cost of adding CPET to standard risk assessment, which is estimated to be £255 per test, may be off-set by cost savings that result from improved clinical outcomes, but the evidence to support this is currently lacking and needs to be derived from carefully planned prospective clinical studies.
- The Appraisal Panel considered the patient perspective on the use of CPET through the receipt of questionnaires that had been completed by individual patients and by the PPI Lead and Head of Research from Bowel Cancer UK. This feedback identified that there is a lack of awareness of CPET and little research is available about patient experience with this technology. Individual patients reported that physical fitness was not a priority to them, but that the emotional stress of the operation was more of a concern. The Panel concluded that patient information and education should be an important element in the delivery of a CPET service and that additional information about the impact of CPET on patient attitudes towards the risks of surgery should be explored further in future research.
- The Appraisal Panel concluded that CPET, in addition to standard pre-operative assessment, should be considered in people undergoing major intra-abdominal surgery, to inform decision making and to facilitate shared decision making. Since there is uncertainty about the impact of CPET on clinical outcomes after surgery as well as its cost effectiveness, the Appraisal Panel recommends that further research is undertaken to address these.

## Responsibilities for consideration of this Guidance

Health Technology Wales (HTW) was established by Ministerial recommendation<sup>1,2</sup> to support a strategic, national approach to the identification, appraisal and adoption of non-medicine health technologies into health and care settings. The HTW Appraisal Panel comprises senior representation from all Welsh boards with delegated authority to produce guidance 'from NHS Wales, for NHS Wales'. The status of HTW guidance is 'adopt or justify'. There is an expectation from Welsh Government that HTW guidance is implemented with adoption regularly audited by HTW.<sup>3</sup>

The guidance in this document is intended to assist Welsh care system decision makers to make evidence-informed decisions when determining the place of health technologies and thereby improve the quality of care services.

The content of this HTW guidance was based upon the evidence and factors available at the time of publication. An international evidence base was reviewed and external topic experts and HTW committee members consulted to contextualise available evidence to Wales. Readers are asked to consider the generalisability of the evidence reviewed to NHS Wales and that new trials and technologies may have emerged since first publication and the evidence presented may no longer be current. It is acknowledged that evidence constitutes only one of the sources needed for decision making and planning.

This guidance does not override the individual responsibility of health professionals to make decisions in the exercise of their clinical judgment in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

No part of this guidance may be used without the whole of the guidance being quoted in full. This guidance represents the view of HTW at the date noted. HTW guidance is not routinely updated. It may, however, be considered for review if requested by stakeholders, based upon the availability of new published evidence which is likely to materially change the guidance given.

Standard operating procedures outlining HTWs evidence review methods and framework for producing its guidance are available from the HTW website.

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Declarations of interest were sought from all reviewers. All contributions from reviewers were considered by HTWs Assessment Group. However, reviewers had no role in authorship or editorial control and the views expressed are those of Health Technology Wales.

Chair, Health Technology Wales Appraisal Panel

1. National Assembly for Wales, Health and Social Care Committee. Access to medical technologies in Wales. December 2014.
2. Response to Recommendations from the Health & Social Care Committee: Inquiry into Access to Medical Technologies in Wales. February 2015.
3. Gething, V. Letter to all Health Board Chairs re Funding for Sacral Nerve Stimulation in Wales. VG\_01655\_17. September 2017.



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