CPET in Clinical Practice

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Cardio Pulmonary Exercise Testing (CPET)

CPET variables are associated with surgical outcome;
- VO2 at LS
- VO2 Peak and
- V̇E/V̇CO2

CPET has the capacity to identify high risk surgical patients
CPET outperforms other methods that estimate functional capacity

Risk Assessment

- Cardio-pulmonary (CPX) testing is an established tool for risk assessment of patient undergoing major surgery.
- An lactate threshold of <11 ml/kg/min is considered to be associated with increased risk
- Perioperative management has to be planned accordingly.
  Older et al 2004

Assessment of risk for major surgery

- Major surgery shown to place severe stress on patients cardiopulmonary reserve.
- Requiring increased oxygen demand of around 40%.
- High risk patients been assessed using tests such as transthoracic echocardiography and spirometry etc.

Simple Walk Tests

- Subjective measurement of exercise tolerance using patient’s walking distance or ability to climb stairs.
- Questionnaire
- 6 minute walk test
- Flights of stairs
- Incremental Shuttle walk test

Simple tests

- ALL effort dependent, limited by patient’s desire to continue.
- Patients who perform poorly may or may not be fit.
- Many patients cannot perform walk tests.
- No supplementary information as in CPET
  - E.g. ischaemia (early or late)
  - O2 pulse (O2 delivery mls/beat)- cardiac function

Older et al 2004
“...the ability of either simple test to determine risk in a heterogeneous surgical population is poor.”


The Role of CPET in Risk evaluation for Major Surgery

Western Hospital Melbourne

Surgical Stress and Oxygen Consumption

A patient undergoing a major operation has to increase oxygen delivery to meet the oxygen requirements (consumption) associated with the increased metabolic work required to survive and recover from surgery.....

mean increase in VO2 - 44%

Older and Smith. Anaesth Intens Care (1988), 16, 389-395

REVIEW ARTICLE
Cardiopulmonary exercise testing as a risk assessment method in non cardio-pulmonary surgery: a systematic review

T. B. Smith,1 C. Stanef2, L. Punsawattha3 and P. Paraskevas4
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Systematic Review of Periop CPET

- 9 studies identified (1290 patients)
- No meta-analysis
- 6/7 with data found VO2 Peak to be predictive
- 4/6 with data found AT to be predictive

“We conclude that peak oxygen consumption and possibly anaerobic threshold are valid predictors of peri-operative morbidity and mortality in non-cardiopulmonary thoraco-abdominal surgery.”

Smith Anesthesia 2009

NSQIP reported complications

- Cardiac 2.0%
- Neuro 1.2%
- Infection 8.1%
- Pulmonary 5.4%
- Renal 1.2%
- Vascular/thrombotic 1.7%

3.1% mortality / n=105,951

Khuri Annals of Surgery 2005

Major Intra-abdominal Surgery
Upper GI Surgery

Vascular and Liver Transplant Surgery

Cardiovascular mortality in patients >60yrs undergoing major intrathoracic or intra-abdominal surgery

Cardiovascular mortality and anaerobic threshold

![Graph]

Chest 1993 104: 701-04

Prognostic studies of perioperative risk: robust methodology is needed

* A. R. M. Scott and P. R. A. F. A. M.

[Graph]
"Confounding by indication"

Predicting complications

- Plasma biomarkers (BNP/NT-proBNP/hsCRP)
- CPET (AT/VO2peak)
- Risk scores (Goldman/Lee)

- Cardiac/cardio-respiratory outcomes
- Not great predictors (individual patients)
- Even less good for "non-selected outcomes"

3-week cycle:
- Epirubicin IV bolus on day 1
- Cisplatin IV bolus on day 1
- Fluorouracil daily

Cunningham NEJM 2006

Cunningham NEJM 2006