Trends in Anaesthesia and Critical Care 6 (2016) 11–19

Contents lists available at ScienceDirect

Trends in Anaesthesia and Critical Care

journal homepage: www.elsevier.com/locate/tacc

Review

Individualised prediction of postoperative cardiorespiratory complications after upper abdominal surgery

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ARTICLE INFO

Article history:
Received 23 October 2015
Received in revised form
24 February 2016
Accepted 29 February 2016

Keywords:
CPET
6MWT
Preoperative evaluation
Cardiac risk
Pulmonary failure

ABSTRACT

Risk evaluation for the development of postoperative complications is essential to select the patients that are able to face major abdominal surgery, to strengthen the process of informed consent and to optimize perioperative diagnostic strategies in patients at higher risk. The estimation of functional reserve is particularly important, since a poor cardiopulmonary reserve determines the inability to cope with the stress induced by surgery and thus contributes to the development of postoperative complications. Cardiopulmonary exercise testing (CPET) derived variables are helpful for patients' stratification; 6 min walk test (6MWT) could also be of use, by itself or in association with other risk predictors (clinical scores and biomarkers). A hierarchy of tests may be used to describe risk: simple clinical risk scores may be used to screen out low risk patients, whereas patients at high or uncertain risk could be evaluated by a more complex battery of tests including CPET and biomarkers.

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1. Introduction

Several factors might influence patient perioperative outcome. The prediction of postoperative complications [1–4] is based primarily on the identification of preoperative risk factors represented by:

- patient-related risk factors: comorbidities as chronic obstructive pulmonary disease (COPD), bronchial asthma not controlled by medication, active cardiac conditions and/or chronic ischemic heart failure, diabetes, obesity, American Society of Anesthesiologists (ASA) class, advanced age, functional status (partially or totally dependent), impaired sensorium, weight loss, smoking habits, alcohol use.

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http://dx.doi.org/10.1016/j.tacc.2016.02.003
2210-8440/

- intervention related risk factors: type and duration of surgery, urgency/emergency surgery, general anesthesia, perioperative transfusion, surgery-specific factors (e.g. fluid shifts, stress levels, blood loss).
- laboratory tests: low serum albumin, blood urea levels, chest radiography.

ASA (American Society of Anesthesiologists) classification [5], the classification system in six categories, widely and universally used during preoperative evaluation, correlates with perioperative mortality but is not intended as a measure to predict post-operative complications risk.

The ACC/AHA Guidelines 2007 [6], among the most important factors involved in the development of postoperative cardiac complications, include:

- Active cardiac conditions (previously defined as "major risk factors"): recent myocardial infarction, unstable angina, decompensated heart failure, significant arrhythmias and severe aortic or mitral stenosis.
- Poor functional status of the patient, expressed "metabolic equivalent tasks" (METs).
- Clinical risk factors: chronic ischemic heart disease, chronic heart failure, cerebrovascular disease, diabetes mellitus, renal failure.
- Minor predictors (markers of cardiovascular disease that might lead to a higher suspicion of Coronary Heart Disease): advanced age, abnormal ECG (left ventricular hypertrophy, left bundle branch block, ST-T abnormalities), rhythm other than sinus and uncontrolled systemic hypertension.

ESC/ESA Guidelines [4] confirm that the risk of perioperative complications depends on the preoperative patient's condition and comorbidities (diabetes, significant cardiac, pulmonary and renal disease), and on surgical factors like urgency, magnitude, type and duration of the procedure. More specifically, cardiac complications

Table 1
Comparison among independent predictors of postoperative pulmonary complications included in the major scores.

		RFI	PPRI	ARISCAT	SLIP	SLIP2	UEPI	SPORC	PRF calculator	PRI calculator
Intervention related risk factors	Type of surgery	+	+	+			Cardiac surgery excluded		+	+
	High risk surgery				+	+		+		
	General anesthesia		+							
	Medium to very high risk surgery						+			
	Duration of surgery			+	Only surgery >3 h					
	Emergency	+	+	+	excluded	+		+	+	
Patient-related risk factors	Age	+	+	+						+
	Respiratory infection in the last month			+						
	Diabetes				+		+			
	Preoperative SpO2			+		+				
	Preoperative anemia			+						
	Functional status	+	+						+	+
	Weight loss >10% in past 6 months		+				+			
	Impaired sensorium		+							
	History of stroke		+							
	Blood urea nitrogen	+	+							
	Preoperative transfusion >4 units		+							
	Corticosteroids use		+							
	Smoking		+				+			+
	Alcohol use		+		+		+			
	COPD	+	+		+		+	+ Chronic pulmonary disease		+
	GERD				+					
	Albumin <30 g/l	+								
	Dyspnea						+			
	Congestive heart failure						+	+		
	Hypertension						+			
	Liver disease					+ Only cirrhosis	+			
	Cancer						+			
	Prolonged hospitalization						+			
	Preoperative sepsis					+	+		+	+
	ASA class							+	+	+
	Admission location other than home					+				
	Increased respiratory rate					+				
	FiO2 > 35%					+				
	BMI						+			

RFI: Respiratory Failure Risk Index; PPRI: Postoperative Pneumonia Risk Index; ARISCAT: Respiratory Assess Risk in Surgical Patients in Catalonia; SLIP: Surgical Lung Injury Predicting score; UEPI: Unanticipated Early Postoperative Intubation; SPORC: Score for Prediction of Postoperative Respiratory Complications; PRF: Postoperative respiratory failure; PRI: Pneumonia risk index; SpO_2: Peripheral capillary oxygen saturation; COPD: Chronic Obstructive Pulmonary Disease; GERD: Gastroesophageal Reflux Disease; ASA: American Society of Anesthesiologists; FiO_2: Fraction of inspired oxygen; BMI: Body Mass Index.