



PREOPERATIVE RISK ASSESSMENT AND OPTIMIZATION IN PATIENTS UNDERGOING THORACIC SURGERY

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Over 230 million surgical procedures are performed worldwide each year. This number will continue to grow, in rich countries to cater an aging population and in emerging countries to match a growing need for invasive procedures with increasing health care capacities.¹ Complications arising following major surgery pose major healthcare challenges. They prolong the hospital length of stay, increasing medical costs and may decrease patients' quality of life and survival.²⁻⁶ Postoperative pulmonary complications (PPC) are the most common serious adverse events with a reported incidence of 2%– 50% that far outnumbers cardiovascular complications.⁵

Patients undergoing thoracic or abdominal surgery are prone to develop PPCs.^{8,9} Advanced age, the severity of cardiopulmonary diseases, complex and prolonged surgical procedures and mechanical ventilation, poor nutritional status as well as low aerobic capacity all have been identified as risk factors for PPCs. Weakness of the respiratory muscles is often associated with poor aerobic fitness and may also play a key role in the pathogenesis of PPCs.¹⁰⁻¹² Age-adjusted low aerobic fitness is largely reported in sedentary people and in patients suffering from chronic inflammatory diseases, heart failure (HF), chronic obstructive pulmonary disease (COPD, and/or neurological disorders.¹³⁻¹⁵ In the early postoperative period, the contractile performance of respiratory muscles is further impaired by the residual effects of anaesthetic agents, surgery-induced systemic inflammation, ventilator-associated respiratory muscle disuse and incisional pain.¹⁶ These weaker inspiratory muscles are less "fatigue resistant" when faced with increased inspiratory loading conditions that prevail following anaesthesia emergence as a result of reduced lung volumes and airflow limitations.^{17,18} Consequently, the inefficient pumping capacity of the respiratory muscles is the main factor leading to a fall in functional residual volume and in total lung capacity that promotes atelectasis and results in ventilation– perfusion mismatch and in turn, hypoxemia.

The American Society Anesthesiology Physical Status (ASA-PS) classification (from 1 to 5) reflects the patient's general health status. This simple global score is utilized worldwide and has a strong independent predictive value of postoperative mortality and any complications across a wide range of interventions.^{19,20} Historically, research efforts were initially focused on cardiovascular complications that were the leading causes of mortality following surgery. Since 1990, the Goldman Risk indice and later the Revised Cardiac Risk Index (RCRI) that entailed six items (high-risk surgery, ischemic heart disease, congestive heart failure, cerebrovascular

disease, diabetes mellitus requiring insulin, renal dysfunction [creatinine < 177 m/L]) have been largely adopted in combination with functional capacity based on metabolic equivalent tasks (MET) to stratify cardiovascular risk and guide further investigations and treatments.²¹

Among scoring systems to specifically predict PPCs, the Assess Respiratory Risk in Surgical Patients in Catalonia (ARISCAT) score, is the only dedicated tool with sufficient predictive power for PPCs.²² The ARISCAT score takes into account seven parameters (age, preoperative arterial oxygen saturation in room air, respiratory infection within the last month, preoperative anemia, upper abdominal or intrathoracic surgery, surgical duration, and emergency surgery). Given its simplicity and satisfactory external validation, the ARISCAT score is recommended to identify patients at risk of PPCs who could benefit from prophylactic interventions and surveillance in ICU or intermediate care units.

Given the large body of scientific knowledge recently accumulated on modifiable risk factors, there is a translational research opportunity to implement evidence-based scientific interventions from the experimental laboratory settings and chronic health disorders to the acute perioperative field.

Besides patient's risk assessment, the preoperative time period should be considered as a window of opportunity to optimise patient's physical status and to transform its phenotype towards healthier life styles. The term "prehabilitation" has been coined to describe a multimodal program involving physical exercises aiming to enhance aerobic fitness and muscular strength, nutritional advices to support lean body mass building, the introduction of coping strategies to deal with surgical anxiety as well a smoking and alcohol cessation.²³ Over the last two decades, physical preparation with endurance training and/or respiratory muscle training has been safely and efficiently applied within the short waiting period preceding surgery. Preoperative education on risk assessment and exercise training has been shown to provide beneficial effects if the patient adheres to the prescribed home-based training program and in specialized facilities supervised by physiotherapists.²⁴ The appropriate timing, location, content and duration of preoperative exercise training remain controversial given the paucity of strong scientific data.²⁵ The effect of physical training on PPCs and its continuation beyond the short postoperative hospital period remains largely unexplored although its routine use, including early ambulation, has been widespread.

The future of preoperative exercise training may encompasses protocols that allow a more individualized approach based on a greater understanding of the complex interplay between a genetic background, pathophysiological features and social environments of patients as well as the logistic constrains of surgical procedures.

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