

Patient selection for operation: the complex balance between information and intuition

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Functional operability has been the object of many investigations and different organizations have published clinical guidelines to assist the practicing thoracic surgeon in stratifying the risk of lung resection.

However, the objective approach used so far may have important limitations, which question its real clinical value.

One of the main problems is the inability to properly define surgical risk.

The patient, their family, the surgeon, and the hospital administrator may all perceive surgical risk in entirely different ways.

Clinicians for instance are mostly focused on objective endpoints such as mortality and morbidity, whilst patients may be more concerned about residual quality of life.

The use of objective endpoints is appealing because they are easily measured. Furthermore, ad hoc risk models have been developed to account for baseline and clinical confounders.

However, the main concern for candidates to lung resection is not much immediate mortality or complications, but permanent disability and loss of independence (1).

These concepts are far more difficult to estimate and risk-stratify since they involve a certain level of subjectivity.

Residual quality of life is difficult to predict. Objective factors traditionally used to estimate mortality or morbidity failed to show an association with physical or mental domains of quality of life (2).

Patient perception about surgical risk

The perception of health status remains the most important

endpoint for the patient during the decision to proceed to surgery and it is driven more by the balance between chance of cure and residual quality of life rather than by the estimated risk of early morbidity or mortality (3). This aspect is even more critical in patients presenting with advanced age, cardiopulmonary co-morbidities and limited functional reserve, insomuch as some preoperative guidelines have started to include patient opinions in their algorithms (4).

Unfortunately there is scant evidence in the literature that can help the physician to counsel the patient about prediction of residual quality of life. The way this information is provided is not without consequence and may even contribute to swing the patient attitude concerning the decision to proceed to surgery (5).

In the attempt to clarify the relationship between preoperative functional status and residual quality of life, we recently compared the perioperative changes of quality of life in patients with preoperative VO_2max lower than 15 mL/kg/min with those of patients with higher values of VO_2max (6).

Compared to patients with higher aerobic capacity, those with preoperative reduced VO_2max had lower postoperative scores of Physical Functioning, General Health, Vitality and Mental Health (Table 1). Nevertheless, the proportions of patients with postoperative values of Physical (PCS) and Mental Component Summary (MCS) scores below norms of general population were similar between the two groups (PCS: low- VO_2 55% vs. high- VO_2 49%, $P=0.5$; MCS: low- VO_2 53% vs. high- VO_2 44%, $P=0.2$). The most important finding however was that the perioperative standardized differences of each individual quality of life scale were similar between patients with lower and higher VO_2max . The effect sizes of all domains (mean change of the variable divided by its baseline standard deviation) were smaller than 0.8, indicating clinically meaningless perioperative changes. Furthermore, the proportions of patients experiencing large postoperative declines of PCS and MCS were similar in both groups (PCS: $\text{VO}_2\text{max} >15$, 17% vs. $\text{VO}_2\text{max} <15$, 14%, $P=0.6$; MCS: $\text{VO}_2\text{max} >15$, 32% vs. $\text{VO}_2\text{max} <15$, 27%, $P=0.6$).

Finally, logistic regression analysis was not able to identify any objective factor associated with large declines of PCS or MCS. In particular, a preoperative VO_2max value lower than 15 mL/kg/min

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Table 1. Results of the comparison of postoperative QoL scales between patients with VO₂max greater and lower than 15 mL/kg/min submitted to major anatomic pulmonary resections.

Postop QoL scale	VO ₂ max > 15 mL/kg/min [155]	VO ₂ max < 15 mL/kg/min [66]	P-value
PCS	49.7 [7.6]	47.7 [8.1]	0.1
MCS	49.1 [10.4]	46.3 [12.3]	0.2
PF	50 [7.6]	44.5 [9.7]	<0.0001
RP	45 [11.4]	44 [12.5]	0.6
BP	51.1 [10.5]	52.6 [9.9]	0.3
GH	49.1 [8.6]	46.5 [9.7]	0.09
VT	56.1 [8.9]	52.1 [10.7]	0.006
SF	48.6 [10]	46.6 [10.3]	0.2
RE	46.5 [12.7]	45.1 [13.2]	0.4
MH	48 [10.2]	43.9 [13.5]	0.04

Results are expressed as means (SD). PCS-physical component summary, MCS- mental component summary, PF-physical functioning, RP-role limitation caused by physical problems, BP-bodily pain, GH-general health perception, VT-vitality, SF-social functioning, RE-role limitation caused by emotional problems, MH-mental health.

was not associated with large declines of PCS or MCS.

Why objective data are not associated with patient-reported health status?

Self-rated health is an active cognitive process in which numerous aspects of health, both subjective and objective, are summarized within the perceptual framework of the individual (social, cultural, demographic, reference groups, health expectations, previous experience with health, mental disposition etc.) (7). For this reason, individual objective components of health (such as PFT values or VO₂max), when they are extrapolated from the patient contextual framework, can constitute only the basis of self-rating, which are subsequently modified by the context of evaluation.

Surgeon perception and intuition about surgical risk

In addition to using objective parameters of preoperative testing, surgeons strongly rely on observation and experience to assess risk in an individual patient. Physician estimates of risk, however, are only moderately accurate and poorly reproducible (8-10).

In general, surgeons tend to overestimate the risk of complications in healthy patients and underestimate risks in sicker ones. They also tend to use objective data selectively and somewhat inconsistently.

Clinical reasoning skills are altered by experience, exposure, and internal biases and most of all they are driven by clinical gestalt.

Clinical gestalt is the theory that healthcare practitioners actively organize clinical perceptions into coherent constructs (11). It is the ability of pattern recognition, which allows to making clinical decisions in the absence of complete information or

in the presence an overwhelming amount of data that need to be elaborated. In essence, clinical gestalt is characterized as a heuristic approach to problem-solving and clinical decision-making (12). At present, the literature suggests that experience does positively influence decision-making accuracy as experienced clinicians have better pattern recognition skills (12).

In a recent investigation, Ferguson and coll. (13) confirmed that experienced practicing surgeons were more accurate than trainees in estimating the surgical risk.

The paper from Rocco and coll. published in this issue of the *Journal of Thoracic Disease* (14) is a demonstration of clinical gestalt applied to patient selection. Objective information resulting from routine clinical testing such as pulmonary function test, carbon monoxide lung diffusion capacity and cardiopulmonary exercise test (CPET) were used along with “eyeball” impression of patient health status to make the intuitive judgment whether to proceed to surgery and which extent of resection to select for each individual patient. In this series, even patients with very reduced levels of VO₂max had a favorable immediate outcome, showing that the interpretation of objective data based on previous experience and clinical instinct can add to the rigid application of guidelines based on numeric cut offs.

In his book “Blink”, Malcolm Gladwell describes the ability to make snap judgments about complex problems relying on instinct and rapid pattern recognition. Our unconscious is able to find patterns in situations and behavior based on very narrow slices of experience, the so-called “thin-slicing”. In a recent study, Dijksterhuis and coll. (15) showed that it is not always advantageous to engage in thorough conscious deliberation before choosing. Simple choices produce better results after conscious thought, but choices in complex matters (when many different variables need to be taken into consideration) should

be left to unconscious thought. They were able to confirm this hypothesis in a study on consumer choice. Purchases of complex products were viewed more favorably when decisions had been made in the absence of attentive deliberation.

The same concept was proposed by Sigmund Freud, the father of unconscious. He found advantageous to consider all pros and cons when making a decision of minor importance. In vital matters, however, he was convinced that the decision should come from the unconscious.

Clinical decision, such as patient selection for operation, is a complex process, where multiple factors both objective and subjective need to be taken in to account. How can we balance information and understanding, data and intuition? The best we can do is to find out the right mix of conscious and unconscious analysis for each patient.

Experience and knowledge (information) are able to improve our gestalt or snap judgment ability. This was demonstrated in a recent study where experts and non-experts were asked to predict the results of soccer matches after conscious thought or after unconscious thought. Experts who thought unconsciously outperformed participants in all other conditions. In addition, experts who thought unconsciously were better at applying diagnostic information than experts who thought consciously (16).

We can use the results of data analysis and computer-aided risk modeling to increase our knowledge and find statistical patterns. In other words, we can take advantage of statistical risk analysis to increase our level of experience. A better level of experience will then allow us to perform a more accurate rapid cognition analysis on an individual basis.

In the study of Dr. Rocco and coll. objective information (i.e., VO_2max and other clinical testing) was used by their unconscious to formulate a clinical judgment about a specific patient (14).

The future of cardiopulmonary exercise test: beyond VO_2max

Dr. Rocco and coll. (14) educated clinical judgment acted as a surrogate for their visionary concept of a patient-specific VO_2max . Indeed, although VO_2max is certainly the most used parameter in the clinical practice, CPET yields a wealth of additional direct and indirect measures, which can precisely identify the nature of the deficit of the oxygen transport system.

Oxygen pulse reflects for instance the cardiac function, whereas the alveolar ventilation to carbon dioxide output ratio slope (VE/VCO_2 slope) is an expression of ventilatory efficiency. These are only few examples among many other parameters, which if interpreted alone or in combination can explain in details the reason of a reduced VO_2max .

In fact, VO_2max should be interpreted as a global measure,

which can be influenced by multiple factors (cardiovascular, pulmonary vascular, neuromuscular, pulmonary, hematological, motivational, biochemical, peripheral vascular, physical deconditioning, etc.). As such, the same reduced level of VO_2max may have different prognostic values depending on the type of deficit in the oxygen transport system.

For instance, cardiopulmonary exercise testing (CPET) has been recently proposed as the most accurate non-invasive test to detect and quantify myocardial perfusion defects in patients at increased risk for coronary artery disease with a diagnostic accuracy similar to single photon emission computed tomographic myocardial perfusion study (17).

Furthermore, several other authors have published about CPET-derived parameters (i.e., efficiency slope, oxygen pulse, VE/VCO_2 slope), which turn out to be predictive of cardiac and pulmonary complications (18-20).

In essence, a patient with a $\text{VO}_2\text{max} < 10 \text{ mL/kg/min}$ due to physical deconditioning may have a very different surgical risk compared to another one with the same VO_2max level due to chronic heart failure or severe ventilatory inefficiency.

Although a proper interpretation of all CPET parameters would be able to clarify the reason of a reduced VO_2max it may be impractical to add all these measures in a functional algorithm. Therefore, as suggested by Rocco and coll. (14) these other parameters need to be taken into consideration on an individual basis when VO_2max indicate a prohibitive risk (i.e., $\text{VO}_2\text{max} < 10\text{-}12 \text{ mL/kg/min}$).

In this regard, patient selection becomes skill of conscious and unconscious clinical reasoning, where a balanced mix of objective information, clinical instinct and patient perspectives is applied to find a solution on an individual basis.

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