Research Article

REVISED CARDIAC RISK INDEX AS PREDICTOR OF CARDIAC COMPLICATIONS IN PATIENTS UNDERGOING UNIPORTAL VATS LUNG RESECTIONS

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ABSTRACT

Background Revised Cardiac Risk Index (RCRI), or Lee Score, is a multivariable predictive index for perioperative cardiac complications and it seems to discriminate moderately well between patients at high versus low risk for perioperative cardiac events. Aim of this study was to evaluate the sensibility of RCRI in patients undergoing Uniportal Vats (U-VATS) interventions.

Methods A retrospective observational study involving 324 patients who underwent U-VATS interventions was performed. Data extracted from an anonymous database concerned demographic information, diagnosis, type of surgery, tobacco habit, American Society of Anesthesiologists (ASA) classification, comorbidity, duration of anesthesia, duration of surgery, type of operation, duration of eventual admission to intensive care, duration of postoperative hospitalization, cardiovascular and non-cardiovascular postoperative complications, 30-days mortality. For each patient, the RCRI was calculated retrospectively.

Results Records from 324 patients, 165 (50.9%) of which were male, were considered. The mean age of the population was 61.4 years. The most frequent diagnosis at admission was "lung cancer", followed by "lung metastasis". The most frequent type of surgery performed was the "atypical resection", followed by "lobectomy". The most frequent ASA index was level "2", found in 209 patients (64.5%). Cardiac complications had been experienced by 3 patients (0.9%). The sensibility of the RCRI was 33.3%, its specificity 97.8%, with a Positive Predictive Value of 12.5% and a Negative Predictive Value of 99.3%.

Conclusions U-Vats represents a new frontier in thoracic surgery. The mean age of the general population is increasing, and so is the mean age of patients entering the operating room for U-VATS lung surgery. The presence of a preoperative score could help the anesthesiologist to identify patients at risk of developing postoperative cardiac complications and choose the appropriate anesthesiologic approach. RCRI could be a useful prognostic score in VATS, but further studies are needed to support this statement.

INTRODUCTION

The Revised Cardiac Risk Index (RCRI), or Lee Score (1,2), is a multivariable predictive index for major perioperative cardiac complications. It consists of 6 equally weighted components: history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, diabetes mellitus requiring insulin therapy, renal insufficiency (serum creatinine >176.8 mol/L [2 mg/dL]) and high-risk non-cardiac surgery (suprainguinal, vascular, intrathoracic, or intraperitoneal procedures). The RCRI seems to discriminate moderately well between patients at high versus low risk for perioperative cardiac events (3)

Non-cardiac surgery is associated with several postoperative complications, most of them regarding cardiac issues. In particular laparoscopicsurgery causes less tissue trauma, resulting in less postoperative pain, better recovery of the respiratory function after surgery and an earlier hospital discharge.

Laparoscopic surgery proved to have more advantages in elderly patients. These patients are, in fact, more at risk of developing clinical complications such as respiratory failure, cardiac problems and onset of infections, particularly when a history of diabetes and kidney function failure is present.

Laparoscopic surgery has typically been used for abdominal surgery. In the two last decades, though, Video-Assisted Thoracic Surgery (VATS) has made its way in the operating rooms. Unfortunately, still only few data are available about postoperative complications in VATS surgery.

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The first ever U-VATS lobectomy was reported by Gonzalez-Rivas *et al*. in 2011. Uniportal technique minimizes surgical trauma by performing a surgical incision of less than 5 cm. Indications for U-VATS surgery have been implemented and can be addressed to a larger number of patients; it is now a good option for the treatment of a variety of benign and malignant lung diseases. (4,5,6,7)

Aim of the Study

Aim of this study was to evaluate the sensibility and the predictive power of RCRI in patients undergoing U-VATS interventions and to identify possible risk factors that can cause post-operative cardiovascular complications such as myocardial ischemia, pulmonary edema, ventricular and supraventricular arrhythmias.

MATERIAL AND METHODS

In this retrospective observational study, data from 324 patients who underwent U-VATS surgery between 2015 and 2018 in our Thoracic Surgical Center were analyzed. The departments involved were the Thoracic Surgery Department and, for some of the patients, the Postoperative Intensive Care Unit (PICU). The operating sessions were held in the operating rooms of the Department of General Surgery and Transplant Anesthesia of the "A. Gemelli" Hospital. No exclusion criteria were applied.

Data were extracted from an anonymized database. Data collected concerned demographic information, diagnosis, type of surgery, tobacco habit, ASA classification, comorbidities, duration of anesthesia, duration of surgery, type of operation, duration of the eventual admission to intensive care, duration of postoperative hospitalization, cardiovascular and non-cardiovascular postoperative complications, 30-days mortality. All patients underwent preoperative anesthesiologic evaluation that included collection of a complete medical history and cardiological objective examination. For each patient, the RCRI was calculated retrospectively. on the basis of what was reported in the medical records; it was then dichotomized as follows:

low risk = total score (0 - 2);
high risk = total score (3 - 6).

Information on the onset of cardiovascular complications were also extrapolated from the medical records and the following measures were calculated: true positive rate, true negative rate, false positive rate, false negative rate and, consequently, sensitivity, specificity and of the positive and negative predictive power of the RCRI index.

RESULTS

Medical records from N=324 patients were considered. 159 (49.1%) were females and 165 (50.9%) were males. The mean age of the population was 61.4 years (minimum=14, maximum=87).

The most frequent diagnosis at admission was "lung cancer" in 149 patients (46%), followed by "lung metastasis" in 76 patients (23.5%). The most frequent type of surgery performed was the "atypical resection" (n=192, 59.3%), followed by "lobectomy" (n=81, 25%). The most frequent ASA index recorded was level "2" in 209 patients (64.5%), followed by level "3" in 64 patients (19.8%). Cardiac complications were experienced by 3 patients (0.9%).

Revised Cardiac Risk Index distribution is displayed in the following Table 1:

Tab 1

Lee Score	Freq	%
1	264	81.5
2	52	16
3	7	2.2
4	1	0.3

Contingency table of the Revised Cardiac Risk Index and Presence/absence of postsurgical complications is displayed in the following Table 2:

Tab 2

	Presence of complications	No complications
HIGH Lee score	1	7
LOW Lee score	2	314

The sensitivity of the Revised Cardiac Risk Index, calculated on the recorded data, resulted being 33.3%. The specificity, instead, 97.8%. The Positive Predictive Value was 12.5% and the Negative Predictive Value 99.3%. Accuracy was equal to 97.2%.

According to our sample's results, the Revised Cardiac Risk Index sensitivity does not reflect the real amount of complications occurred as it correctly predicted only 33% of the total complications. It is however necessary to highlight that the total number of complications recorded was extremely low, consisting of only 3 events (0.9%). Moreover, only 1 of them was classified as belonging to a high-risk patient by the Revised Cardiac Risk Index. All three patients with complications were males and all of them had a "lung cancer" diagnosis at admission.

In order to detect any risk factors that could cause post-operative cardiovascular complications, a binary logistic regression was performed and the results highlighted that:

- the probability of developing a cardiac complication in patients with a HIGH level of Revised Cardiac Risk Index is 22.43 times higher than the probability for patients with a LOW level of Revised Cardiac Risk Index (Odds Ratio - OR, 22.43).
- the OR calculated on the ASA score was = 6.918

DISCUSSION

Risk models are a tool used to better plan the treatment pathway for patients who are candidates for surgery. Over the years, various risk models and calculators have been developed to identify the risk of cardiovascular complications after non-cardiac surgery, therefore also thoracic surgery; one of these is the Revised Cardiac Risk Index (RCRI), otherwise known as the "Lee score".

It is a multivariable predictive index for major perioperative cardiac complications, consisting of 6 components: history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, diabetes mellitus requiring insulin therapy, renal insufficiency (serum creatinine >176.8 mol/L [2 mg/dL]) and high-risk non-cardiac surgery (suprainguinal, vascular, intrathoracic, or intraperitoneal procedures). It seems to discriminate moderately well between patients at high versus low risk for perioperative cardiac events.

Furthermore, U-Vats represents a new frontier in thoracic surgery. Minimally invasive video-assisted thoracoscopic surgery(VATS) is rapidly becoming the commonest

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approaches for a majority of pulmonary resections. There is a general consensus that patients have fewer complications and less postoperative pain when comparable resections are performed by VATS than by open thoracotomy.

The mean age of the general population is increasing as much as the mean age of people entering the operating room for lung surgery, increasing the likelihood of intra-and postoperative complications. The presence of a preoperative score could help anesthesiologists to identify patients at risk of developing postoperative cardiac complications and choose the appropriate anesthesiologic approach.

In this study we analyzed the use of the lee index as a prognostic factor for cardiac complications in patients undergoing thoracic surgery.

Few patients have developed post-operative cardiac complications, so it is not possible to give statistically significant results. We believe it is necessary to increase the number of patients in order to have a larger reference sample.

CONCLUSION

U-Vats is destined to have more and more space in our operating rooms. A stratification system of potential postoperative cardiovascular risks in UVATS surgery could be very helpful for anesthesiologists.

Declaration of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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