Editorial

Preoperative resting heart rate: a novel risk factor for cardiopulmonary complications after lung resection

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Non-small cell lung cancer (NSCLC) is the leading cause of cancer-related deaths and ranks as the second most common malignancy in the world. Nowadays, surgical resection still remains the optimal therapeutic option for early-stage operable NSCLC and also plays a key role in multidisciplinary treatment for locally advanced NSCLC. Despite advances in surgical techniques, the morbidity rate still remains as high as 25–35% after elective pulmonary resections, and the cardiopulmonary complications (CPCs) occupy the largest percentage of all postoperative outcomes (1). Abundant evidence indicates that a variety of co-existing invasive clinic pathological parameters, such as the presence of chronic obstructive pulmonary disease (COPD), tuberculosis, neoadjuvant therapy and extended resection, have a potent predictive value for risk of CPCs. Thoracic surgeons are particularly attentive in identifying the patients who are at a high surgical risk and prepare a series of preventive strategies in advance to decrease the incidences of fatal complications. Due to these required preparations, an effective risk stratification tool is urgently needed for the early recognition of high-risk patients.

Most recently, the effects of hemodynamic changes on postoperative complications have become a hotly-discussed topic (2-4), and preoperative heart rate is of great concern and criticism. Resting heart rate has long been recognized as a vital indicator to reflect sympathetic excitability and catecholamine levels, and an elevated resting heart rate was believed to be one of the risk factors for increasing cardiovascular diseases and mortality (5). An updated analysis of randomized controlled trials demonstrated that the effective control of heart rate could reduce the incidence of postoperative myocardial infarction and eventually achieve the goal of heart protection for patients undergoing non-cardiac surgery (6).

Dr. Fu and his colleagues prospectively reviewed the clinical data of patients undergoing lung resection surgery for NSCLC in their institution between May 2010 and July 2015 to investigate the relationship between preoperative heart rate and the occurrence of CPCs during the postoperative period (7). A total of 180 eligible patients with operable NSCLC were ultimately enrolled. During the study period, the enrolled patients were initially divided into the CPC group and the non-CPC group, and the authors then utilized a logistic regression analysis to determine the independent risk factors for CPCs.

Dr. Fu finally found that the elevated preoperative resting heart rate was an independent risk factor for postoperative CPCs (odds ratio: 4.48; 95% confidence interval: 1.17–18.42, P<0.05). Meanwhile, the optimal cut-off value of heart rate for the prediction of CPCs derived by receiver operating characteristic (ROC) curve analysis was 86 beats/min.

To the best of our knowledge, this is the first study that attempts to explore the potential relationship between

preoperative heart rate level and postoperative CPCs after pulmonary resection. In general, electrocardiogram, pulmonary function, computerized tomography scan, ultrasound and other inspection methods are the most common means of assessing the cardiopulmonary system in preoperative patients with NSCLC. However, all of these examinations are limited by high cost, long appointment/inspection time, and scattered inspection results. Thus, in order to predict the risk of CPCs, it is critical to identify a suitable examination along with a strong indicator, which can better reflect the overall cardiopulmonary function of surgical patients with NSCLC. Despite this crucial need, the academic community has yet to reach a consensus. The current prospective study conducted by Dr. Fu with his colleagues demonstrated that an elevated resting heart rate could serve as an independent predictive risk factor for postoperative CPCs, although the relevant mechanisms still remain unclear. Their findings may provide initial evidence to support surgeons and anesthetists in managing patients according to their preoperative heart rate.

Of course, the limitations in this study cannot be ignored. First of all, a variety of selection biases still exist and may have a certain impact. For instance, the overall sample size is small and the researchers do not clarify the sample-size calculations, thus the reliability of the outcomes can be doubted. Secondly, some complications might be missed both because of a lack of long-term follow-up and because of the low coverage of comprehensive tests and examinations due to research conditions and the financial status of enrolled patients. Thirdly, preoperative resting heart rate itself is affected by both age and underlying heart diseases. People who have cardiovascular comorbidities or poor cardiopulmonary reserve often suffer from a state of metabolic acidosis, resulting in vast differences in oxygen supply and lung function. As for age, elderly people and younger people may vary in morbidity risk levels even if they have similar heart rates. Therefore, it is necessary to stratify the patients by age category and analyze the cut-off values between different age groups. In addition, different CPCs are at different levels of risk; some are life-threatening with high mortality, while others are not life-threatening. This being the case, different types of CPCs should also be stratified in future studies.

Notwithstanding these limitations, Fu *et al.*'s study is a promising piece of pilot research, both highly innovative and rich with exploratory meaning. Large, high quality, randomized controlled trials are needed in the future to further clarify the relationship between preoperative resting heart rate and prognosis.

In summary, resting heart rate measurement is easy to perform, does not greatly burden the patient financially, and has high patient compliance. If Dr. Fu's findings could be further validated and extended, this measurement might justifiably be considered for routine preoperative examination and evaluation of lung cancer patients. Accurate screening of suitable surgical patients is critically important in deciding the lung cancer treatment strategy. For patients with abnormal resting heart rate, thoracic surgeons should pay adequate attention to improving their preoperative cardiopulmonary function and preparation. It is recommended that this be accompanied by other functional examinations, such as pulmonary function and echocardiography, to determine the overall cardiopulmonary reserve and tolerance to surgery. After all, the goal of lung cancer therapy is not only radical resection, but also the significant improvement of the overall prognosis and quality of life.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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