

# Society for Translational Medicine Expert Consensus on the preoperative assessment of circulatory and cardiac functions and criteria for the assessment of risk factors in patients with lung cancer

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## Part I: basic contents of the project

Project name: methods for the preoperative assessment of cardiovascular functions and criteria for the assessment of risk factors in patients with lung cancer.

Research purpose and contents: the purpose of the study is to investigate the impact of preoperative cardiovascular evaluation on the perioperative cardiovascular risk of patients undergoing surgery for lung cancer. The main aspects of the study incorporate cardiovascular-related assessments on the safety and outcomes of lung cancer surgery.

Main research questions: preoperative assessments of coronary heart disease, heart failure, cardiomyopathy, cardiac valvular disease, cardiac rhythm and conduction disorders, pulmonary vascular disease, and congenital heart disease.

## Part II: background and current status of the project

Current research status of the project: perioperative cardiovascular events are one of major complications following lung cancer surgery. Myocardial infarction is the second most common cause of perioperative death after pulmonary resections. Because lung cancer surgery carries a significant hemodynamic burden, preoperative assessment of cardiac function is a critical issue. However, current preoperative examinations of lung cancer focused on pulmonary functions, and research on cardiac function requires further extensive investigation. The preoperative specification and inspection indicators are mainly derived from general findings of non-cardiac surgery but are not specific to lung cancer surgery.

Main research significance of the project: the project aims to better assess perioperative cardiovascular risks in patients with undergoing lung cancer surgery and to provide a reliable reference for perioperative safety.

## Part III: main conclusions of the project and recommended approaches

### Preoperative cardiac function tests

- (I) A routine 12-lead electrocardiogram should be performed prior to lung cancer surgery irrespective of the presence of known cardiovascular disease (1-4). (Level of evidence: B).
- (II) Patients with unexplained dyspnea or suspected to have heart failure should be screened by echocardiography; echocardiography should also be performed in patients with a history of heart failure who are currently in a stable condition and who have not had an assessment within the last 12 months (5). (Level of evidence: C).
- (III) Exercise stress testing is not routinely required. However, patients with risk factors for myocardial ischemia with poor functional capacity (<4 metabolic equivalents (METs)) or lack of functional capacity assessment should undergo exercise stress testing (6). (Level of evidence: C).
- (IV) Patients with risk factors but asymptomatic should undergo cardiopulmonary exercise testing, such as the six-minute walk test or stair climb test (7-12). (Level of evidence: B).
- (V) Preoperative coronary angiography is not routinely required (13). However, a coronary angiography should be performed in patients with known coronary heart disease. (Level of evidence: C).

### Risk factors

- (I) Unstable angina pectoris can substantially increase postoperative morbidity and mortality in patients with cardiovascular disease (14). Therefore, patients with coronary heart disease should undergo coronary angiography. If indications for an intervention are established, coronary stents or heart bypass surgery

should be taken into consideration. (Level of evidence: C).

- (II) Patients with a myocardial infarction within two months from surgery are not suitable for lung cancer surgery. One study (15) has showed that the interval length between surgery and preoperative myocardial infarction is directly proportional to the probability of postoperative myocardial infarction (0 to 30 days =32.8%, 31 to 60 days =18.7%, 61 to 90 days =8.4%, and 91 to 180 days =5.9%) and postoperative mortality (0 to 30 days =14.2%, 31 to 60 days =11.5%, 61 to 90 days =10.5%, and 91 to 180 days =9.9%). (Level of evidence: B).
- (III) The degree of attention paid to the preoperative assessment and control of heart failure should be improved to the same level as such for coronary artery disease. One study (16) showed that patients with non-ischemic heart failure, ischemic heart failure, and atrial fibrillation exhibited significantly higher postoperative 30-day mortality than those with coronary heart disease (99.3% vs. 9.2% vs. 6.4% vs. 2.9%). This finding indicates that although sufficient attention is paid to coronary artery disease such is not evident in patients with heart failure prior to surgery. Therefore, an echocardiography should be performed in patients with heart failure to assess their cardiac functions. Patients with a left ventricular ejection fraction below 40% deserve careful consideration for surgery due to significantly increased risk of death (17). (Level of evidence: B).
- (IV) Cardiomyopathy can increase the incidence of perioperative cardiovascular events. There is a need to assess preoperative cardiac functions in detail and to pay attention to perioperative management (18,19). (Level of evidence: C).
- (V) Moderate to severe aortic stenosis can increase the 30-day mortality and incidence of 90-day cardiovascular events. Hemodynamic monitoring is required even for asymptomatic patients (20) (Level of evidence: B). Percutaneous valve implantation may improve cardiac functions and achieve effects similar to valve surgery (21,22). However, there is lack of data confirming whether subsequent non-cardiovascular surgery is safe following this approach. (Level of evidence: C).
- (VI) Patients with surgical indications for mitral stenosis should undergo relevant preoperative therapy (23). Intraoperative and perioperative hemodynamic

monitoring should be performed in patients with mitral stenosis and patients who have undergone mitral valve surgery. (Level of evidence: C).

- (VII) Aortic and mitral regurgitation can increase the risk of cardiovascular complications (24,25). Hemodynamic monitoring should be performed for patients with severe aortic or mitral regurgitation. (Level of evidence: C).
- (VIII) Patients with stable atrial fibrillation prior to surgery require only routine anticoagulation and have no need of additional medication or special interventions prior to lung cancer surgery. Although ventricular arrhythmia is a risk factor of postoperative and intraoperative arrhythmia, it does not increase the risk of myocardial infarction and cardiac death. Therefore, cardiology experts should be consulted to jointly assess whether the cardiac function requires further examination (26,27). (Level of evidence: C).

#### Part IV: problems still open

- (I) What is the optimal operation time interval in patients with myocardial infarction?
- (II) What is the acceptable lower left ventricular ejection fraction?
- (III) Can non-cardiac surgery research findings completely guide lung cancer surgery?

#### Part V: main protocol of future research

- (I) To study risks associated with surgery for lung cancer in patients who have undergone surgery for myocardial infarction;
- (II) To study the risks associated with lung cancer surgery in patients with heart failure and the importance of pre-operative volume status assessment and perioperative fluid management in these patients;
- (III) To study the effects of surgical approaches to major lung resection surgery on perioperative cardiovascular outcomes.

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## Footnote

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

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