Editorial

Pre-operative preparation for Da Vinci robotic surgery

Xueyu Chen, Su Yang, Wei Guo, Runsen Jin, Yajie Zhang, Xingshi Chen, Han Wu, Hailei Du, Dingpei Han, Kai Chen, Jie Xiang, Hecheng Li

Department of Thoracic Surgery, Ruijin Hospital, Shanghai Jiao Tong University, School of Medicine, Shanghai 200025, China

Correspondence to: Hecheng Li, MD, PhD. Department of Thoracic Surgery, Ruijin Hospital, Shanghai Jiao Tong University, School of Medicine, 197 Ruijin Er Road, Shanghai 200025, China. Email: lihecheng2000@hotmail.com.

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Psychological preparation

When patients are hospitalized, they are usually unhappy. Furthermore, patients in the thoracic surgery ward usually have malignant tumors. Therefore, in addition to dealing with a monotonous and unfamiliar environment, patients often feel depressed. Before the operation, most patients have some degree of anxiety, because they lack comprehensive knowledge about the operation, such as tissue trauma and postoperative conditions. If patients have any questions or worries, they can ask the physician or nurses. The doctors should answer these questions patiently and help patients feel positive about the operation.

Respiratory tract preparation

(I) For patients with a history of smoking, bronchial secretions will increase after the operation, which will exacerbate respiratory symptoms and related postoperative complications. These patients should quit smoking at least 2 weeks before the operation.

(II) Patients should take a deep breath and cough training consciously to inflate the lung after the surgery. Patients should practice abdominal deep breathing and effective expectoration drainage.

- ❖ Deep breathing training
  - ◆ Abdominal breathing: the patient should relax and stand upright (semi-reclining position or sitting position for sick patients) and put the left and right hand separately on the abdomen and chest. Relax the muscles and slow the breathing. Inhale deeply though the nose and try to expand the belly without moving the chest. Exhale though the mouth, compress the abdomen at the same time, and keep the thorax as still as possible, taking a slow and deep breath and increasing alveolar ventilation. Take 7–8 breaths per minute, for 10 to 20 minutes each training session, 2 times a day. After becoming skilled, gradually increase the frequency and duration to develop an unconscious breathing habit.
  - ◆ Pursed lip breathing: inhale though the nose and exhale though the mouth. While exhaling, purse the lips like as when whistling, exhale slowly and continuously, and compress the abdomen at the same time. The ratio between inhale and exhale time should be 1:2 or 1:3. The lip girdle degree and exhale flow should be selected such that a candle flame would flicker at a distance of 15–20 cm.
  - ◆ Yawn: Yawn once every 5–10 min by inhaling continuously for 5 s and then exhaling slowly.
  - ◆ Bilateral lower thoracic expansion and lateral lower thoracic expansion exercises.
- ❖ Coughing training: instruct the patient in the correct position and method for coughing.
  - ◆ When coughing in the sitting position, the body should be bend forward slightly with legs crossed.
  - ◆ When coughing in the side-lying position, bend the knees.
  - ◆ When coughing in the sitting position, sit on the chair or bed, bring the shoulders forward with the head downward, and hold a small pillow against the abdomen with two hands. Press against the abdomen with the hands when coughing.

- Using the abdominal or chest breathing method, relax the throat, open the mouth, and extend the tongue slightly to cough 2 or 3 times.

❖ Using the incentive spirometer

- The Incentive Spirometer is an instrument that is used to encourage sustained maximal inspiration and to judge the patient's inspiratory capacity by observing the position of the rising ball. Methods: After one normal deep breath, put the mouthpiece into the mouth, inhale, and then take out the mouthpiece, and exhale slowly with pursed lips, 5 times.

(III) Atomization inhalation: atomization inhalation begins 3 days before the operation and is performed two or three times each day, for 15 to 20 minutes for each time.

Diet

To enhance physical fitness, increase the tissue repair, and prevent infection, patients should eat digestible food high in heat, protein, fiber, vitamin, and rich fruit acid (except for patients who suffer from esophageal obstruction), such as lean meat and fish, eggs, fresh vegetables and fruits, and bean products, etc. For patients who have difficulty in eating and those who are not able to eat food because of digestive tract obstruction, intravenous nutrition can be provided. For patients with malignant anemia and hypoproteinemia, these conditions should be corrected before the operation.

Pre-operative examination

Examinations

General laboratory texts

Before the operation, patients should undergo blood, biochemical, and urine, and receive proper treatment. For example, low hemoglobin indicates anemia and poor nutrition, so small amounts of blood can be transfused frequently to bring the hemoglobin level back to normal in a short time. Patients who suffer from esophagus cancer often have difficulty eating, so most of them have hypoproteinemia. They should be given infusions of human albumin to correct this condition and in this way improve the safety of the operation. Coagulation function of patients should also be checked before the operation. If the patient has had a coronary heart event just before the operation, serum myocardial enzyme level should also be checked. With routine blood glucose examination, asymptomatic type II diabetes can be detected.

Serum tumor markers detection

The commonly used domestic and foreign primary pulmonary and esophageal malignancy tumor markers include carcinoembryonic antigen (CEA), neuron-specific enolase (NSE), cytokeratin fragment 19 (CYFRA21-I), pro-gastrin-releasing peptide (ProGRP), and squamous cell carcinoma (SCC) antigen. Using a combination of these tumor markers can improve their sensitivity and specificity in clinical applications.

Imaging examination

Commonly used imaging methods in thoracic surgery include: chest X-ray, computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, radionuclide imaging, and positron emission-CT scan. These tests are mainly used in the diagnosis, classification, post-treatment monitoring of lung and esophageal malignant tumors, and determining prognosis. In the clinical diagnosis and treatment process, one or more appropriate imaging methods should be selected.

Chest X-ray

Chest radiograph is a basic imaging examination method used before and after treatment for lung cancer and esophageal cancer. It generally includes chest posteroanterior and lateral images. If the physician detects a suspicious area on the chest radiograph, or wants additional information that may help the diagnosis, additional imaging examination methods should be selected.

Chest CT examination

Chest CT can provide information that is difficult to discover by X-ray chest. This method can effectively detect early peripheral lung cancer, verify lesion sites and range of involvement, and identify benign or malignant lesions. Therefore, it is the most important and most commonly used imaging method for diagnosis, staging, evaluating outcome, and follow up. For chest lesions that are difficult to diagnose, CT-guided percutaneous lung puncture biopsy can be used to obtain a cytological and histological diagnosis. For patients with esophagus cancer, the neck,

chest, and epigastrium should be imaged to check the metastatic condition of the esophagus cancer and lymph nodes and to know the involved layer and degree of invasion of esophageal lesion and surrounding tissue.

MRI examination

MRI examinations can be selectively used before the thoracic surgery to determine whether the chest wall or mediastinum is invaded; show the relationship between a pulmonary sulcus tumor and brachial plexus and blood vessels; differentiate between pulmonary hilar mass and pulmonary atelectasis, obstructive pneumonia. For patients for whom iodine contrast agent is contraindicated, MRI is the first choice to observe the mediastinum, pulmonary hilum great vessels invasion, and lymph node enlargement. It is also useful for identifying post-radiotherapy fibrosis and tumor recurrence. MRI is also suitable for judging the brain and bone marrow metastasis, contrast-enhanced MRI of the brain should be routine for pre-operative classification of lung cancer.

Ultrasound

Ultrasound is mainly used to determine whether there is metastasis in the solid organs of the abdomen, abdominal cavity, retroperitoneal lymph nodes, and neck and supraclavicular lymph nodes. For pulmonary lesions close to the chest wall or chest wall lesions, it can identify its cystic or solid nature and is useful for ultrasound-guided biopsy; ultrasound is also used to position drainage tubes for pleural effusion and pericardial effusion.

Bone scanning examination

This routine examination is used to evaluate bone metastasis of patients suffering from malignant pulmonary tumors. When the bone scanning examination indicates suspected bone metastasis, MRI, CT or PET-CT can be conducted to verify the suspect lesions.

PET-CT examination

For some patients with a pulmonary lesion in a deeper location that is close to the central region, it is hard to obtain a biopsy by bronchoscopy, PET-CT examination can be used to check the standardized uptake value of fluorodeoxyglucose to determine the benign or malignant nature of the lesion, and whether there is metastasis in the mediastinum and hilar lymph nodes. It is the best method for the diagnosis of lung and esophagus malignant tumor, and evaluation of outcomes and prognosis (1).

Splanchnoscopy

Bronchoscopy

Bronchoscopy is a popular method to diagnose pulmonary malignant tumors by means of brush biopsy, or needle aspiration using a bronchoscope and bronchial lavage to obtain a cytology and histology diagnosis. The detection rate can be improved if several of the above methods are combined.

Transbronchial needle aspiration (TBNA) and endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA)

Tracheal puncture and paracentesis of lymphaden and lump beside parabronchial masses are helpful for lung cancer diagnosis and lymphaden staging. Traditional TBNA is defined as a blind procedure based on the chest CT, but is generally not recommended because it is highly dependent on operator skill. Hospitals with sufficient trained operator should try the traditional TBNA method. EBUS-TBNA, with its high safety and reliability, is used for needle aspiration to obtain an accurate pathologic and cytologic diagnosis for focal and lymph node metastasis.

Transbronchial lung biopsy (TBLB)

TBLB is generally performed under the guidance of X-ray, CT, endobronchial ultrasound probe, virtual bronchoscope, or electromagnetic navigation bronchoscopy, and it is suitable for peripheral pulmonary lesions and at the same time examine the condition of the lumina, it is an important nonsurgical method for diagnosing means of bellow nodes.

Gastroscopy

For patients with esophageal focal lesions, a gastroscopic examination before surgery can help to determine the position of the lesion and judge whether the focal lesion is benign or malignant based on its appearance. For an esophageal focal lesion suspected to be malignant, a biopsy can be conducted to determine the pathologic diagnosis. The biopsy can be combined with a photoacoustic endoscopic probe to determine the depth of infiltrating of the tumor.

Endoscopic mucosal resection & endoscopic submucosal dissection

Endoscopic methods have become important for curing

early-stage esophageal cancer since the development of endoscope. Currently, widely used endoscopic treatment methods for early-stage esophageal cancer includes endoscopic mucosal resection and endoscopic submucosal dissection (2,3).

Pulmonary function test

Routine pulmonary function test

For the test of lung capacity and voluntary ventilation function, the most important indices are vital capacity (VC), forced vital capacity (FVC), the volume exhaled in the first second of maximal expiration (FEV_1), the percentage of VC exhaled in the first second of maximal expiration (FEV_1%), and maximal voluntary ventilation (MVV).

Routine pulmonary function tests are necessary prior to open chest surgery. The preliminary screening will determine whether complications such as respiratory failure will occur after the surgery. Generally, open chest surgery is regarded as high risk if VC <50%, MVV <50%, FEV_1 <1.0 L, or FEV_1% <50%. Some experts consider MVV as the index that best represents respiratory dysfunction to judge the risk of surgery, thinking that the patient can tolerate surgery if MVV >70%, the risk of surgery should be given careful consideration if MVV is 69–50%, conservative treatment should be given and surgery avoided if MVV is 49–30%, and surgery should not be performed if MVV is below 30% (4,5).

Unconventional pulmonary function test

Side pulmonary function test

This includes lateral position testing and side double-lumen endotracheal intubation measurement testing. The former is simple but has large errors, and the latter will give accurate results but is more invasive and needs special instruments. The side pulmonary function test is performed to determine the contribution of each lung to total lung function, especially for patients considering pneumonectomy. This test can evaluate whether the residual lung can bear the trauma of surgery and function well enough such that the patient can maintain regular daily activities after surgery.

Bronchial relaxation test

At present, the testing method and evaluation standard are not unified. Generally, the ventilation improvement rate is obtained by measuring FVC, FEV_1, or MVV before or after breathing 0.5% atomized Isuprel or subcutaneous injection of adrenaline in (1:1,000). It is significance if improvement is >15%. If there is a suspicion of reversible airway obstruction after the conventional bronchial relaxation test, this testing can be carried out. If lung function is improved after giving the medication, the patient likely has reversible airway obstruction, which commonly occurs with chronic obstructive pulmonary disease or bronchial asthma. The treatment targets the cause of airway disease to relieve the obstruction, which not only increases the surgery indication but can also help the patient survive the surgery.

Echocardiography

Doppler echocardiography is the only procedure that can dynamically display the cardiac intracavitary structure, heartbeat and hemokinesis without trauma to the body. Thoracic surgical procedures will bring considerable trauma and affect the circulation of patients after the surgery, especially as most patients are at middle-aged or elderly. Echocardiography before surgery can help doctors to get a preliminary indication of the cardiac reserve and patient tolerance for surgery so as to fully estimate the surgery risk. In addition, echocardiography before surgery is also used to determine cardiac structural abnormality or hemodynamic changes.

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References

1. Zhi X, Shi Y, Yu J. Diagnosis and treatment of primary lung cancer in China (2015 Edition). Chinese Journal of Oncology 2015;37.
2. Hamanaka H, Gotoda T. Endoscopic resection for early gastric cancer and future expectations. Digestive Endoscopy 2005;17:275-85.
3. Makuuchi H, Yoshida T, Ell C. Four-Step endoscopic esophageal mucosal resection (EEMR) tube method of resection for early esophageal cancer. Endoscopy 2004;36:1013-8.
4. Nakamura M, Iwahashi M, Nakamori M, et al. An analysis of the factors contributing to a reduction in the incidence of pulmonary complications following an esophagectomy for esophageal cancer. Langenbecks Arch Surg 2008;393:127-33.
5. Reid WD, Samrai B. Respiratory muscle training for patients with chronic obstructive pulmonary disease. Phys Ther 1995;75:996-1005.

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