On Progress in Surgical Treatment of Lung Cancer

Yaoxing Xiao, Dongyu Zang*
Guangzhou Red Cross Hospital Affiliated to Jinan University, Guangzhou 510000, Guangdong, China
DOI: 10.32629/jcmr.v3i2.819

Abstract: Lung cancer, as one of the malignant tumors with the greatest impact on human health and life in the world, ranks first in the cancer mortality rate of urban population in China. As the first choice of surgery for early lung cancer, lobectomy is still the most commonly used clinical treatment. In this paper, lung cancer and surgery are taken as keywords, and the data are summarized and analyzed in the academic resource database of CNKI and Wanfang.
***Keywords*:** lung cancer, treatment, operation

Lung cancer is one of the malignant tumors with the greatest harm to human life and health and the highest mortality rate among urban population in China[1]. A retrospective analysis of epidemiological data[2] showed that in 8323 cases of patients with primary lung cancer,the prevalence rate among males were higher than that of females, which increased with age to varying degrees. Adenocarcinoma was the most commonly discovered. At present, surgery is still one of the important measures to improve the survival rate of lung cancer patients. Surgical treatment has been considered to be the key to improving survival for patients with early stage lung cancer. With the continuous progress of surgical technology, surgical contraindications for locally advanced lung cancer may become a thing of the past, and surgical procedures can still help patients achieve a long survival and good quality of life[3]. This paper reviews the surgical progress of lung cancer.

1. Surgical methods of lung cancer

1.1 Lobectomy

Lobectomy is a common surgical procedure in thoracic surgery, which is used for patients with lesions limited to one lobe. When the lesion is removed, the tumor and lymph nodes in the lesion can be completely removed to avoid recurrence. Zhang Jianjun et al.[4] compared the effects of single-port and three-port thoracoscopic lobulectomy in patients with early lung cancer, and the results showed that single-port surgery had less trauma and faster postoperative recovery.

1.2 Segmentectomy

Surgical indications: (1) Histological type belongs to adenocarcinoma in situ; (2) The content of ground glass was more than 50% in CT images. (3) Imaging monitoring of tumor multiplication time ≥400 days. This operation is widely applicable to patients with weak cardiopulmonary function, small tumor lesions, whihc is limited to a certain lung segment. The therapeutic effect can be brought into play by removing the lung segment completely. Scholar Lin Junfeng[5] compared the effects of thoracoscopic lobectomy and segmental lung resection in the treatment of early lung cancer and believed that the latter was more conducive to reducing serum marker levels of patients and improving body immunity.

1.3 Expanded resection

This type of operation refers to the method of local reconstruction and repair by excision of adjacent organs (such as esophagus and atrium, etc.) invaded by lesions while conventional lung cancer surgery. It can not only ensure maximum tumor resection, but also remove invasive cancer cells and reduce the risk of recurrence, which plays an important role in improving the survival of patients. Liang Hongliang et al.[6] applied extended resection in patients with locally advanced non-small cell lung cancer, and the results showed that stage Ⅲa patients had better short-term and long-term effects.

1.4 Total pneumonectomy

Surgical indications: (1) The tumor invaded the bronchial opening of the pulmonary lobe, and the lesion had invaded the main bronchus on one side; (2) Tumor invasion of the pulmonary trunk; (3) The central type of the lung is limited to one side, but protrudes towards the hilum, making the treatment of the pulmonary blood vessels difficult; (4) Peripheral lung cancer, involving other lung lobes; (5) Extensive organic lesions on one side of the lung loss of most functions, such as bronchiectasis, lung cysts, etc. Total pneumonectomy mainly deals with the superior pulmonary vein, inferior pulmonary vein and pulmonary artery. It was previously believed[7] that total lung resection is beneficial to radical treatment of cancer

lesions and to minimize or avoid recurrence. In the context of the continuous development of modern medical treatment, whether patients need to undergo total lung resection should be treated differently according to the pathological tissue environment and tumor invasion. Pneumonectomy may be the best choice for patients with normal organ function, good physical condition and the ability to tolerate surgery.

2. Progress in surgical measures for lung cancer

2.1 Video-assisted thoracoscopic surgery for lung cancer

Thoracoscopic surgery appeared in the 1990s. Compared with traditional thoracotomy, thoracoscopic surgery has the advantages of less trauma, less bleeding, faster recovery and fewer complications, and has less impact on patients' cardiopulmonary function. With the continuous development and improvement of this technology, it has experienced the development of thoracoscopic assisted small incision, complete thoracoscopic 4-hole to single-hole. Relevant studies suggest that[8], the prognosis of patients treated by single-port VIDEO-assisted thoracoscopy may be related to complications, lung cancer pathological stage, degree of differentiation and postoperative adjuvant therapy. However, in general, single-port VIDEO-assisted thoracoscopy has obvious advantages such as minimally invasive surgery and fast postoperative recovery. As long as the principles of surgical tumor treatment or resection standard and thoracic surgical resection are not violated, thoracoscopic surgery can be considered for treatment. Li Xuchi et al.[9] applied video-assisted thoracoscopy in elderly lung cancer patients, which was significantly superior to traditional thoracotomy in terms of incision size, operation time, postoperative extubation time, body inflammation indicators, complications, etc., with good clinical safety.

2.2 Minimally invasive ablation

In minimally invasive ablation, the probe is used to puncture the tumor site, and then the tumor is heated in the form of microwave until the tumor is heated to about 85°C. Under the effect of high temperature, the protein of the tumor tissue is solidified, resulting in apoptosis and formation of necrotic tissue, which can be digested and absorbed by the body to achieve the purpose of treatment. The operation is mainly suitable for: (1) Lost surgical resection opportunity of metastatic or primary lung cancer; (2) Patients or family members who do not agree to surgery or chemoradiotherapy; (3) Tumor-reducing treatment of multiple lung lesions; (4) Surgical exploration and remedial treatment; (5) The diameter of single lesion was less than 10cm; (6) For patients with multiple lesions, the number of lesions in one lung should not be less than 3, and the diameter should not be higher than 3.5cm. Bilateral lesions should be treated in batches; (7) At least 1cm between lesions and large vessels and organs; (8) Platelet level is not less than 100×109/L, INR is not more than 1.5.

Zhang Chunning et al.[10] applied minimally invasive cryoablation in patients with advanced non-small cell lung cancer, which can not only effectively reduce the tumor load, but also improve the cellular immune function of patients, clinical treatment efficiency and postoperative survival rate of patients are significantly improved.

Liu Haiyan et al. [11] applied rf ablation in patients with sudden variant lung cancer, and the results showed that the levels of Th1 cytokines (TNF-α, IFN-γ, IL-2) and Th2 cytokines (IL-4, IL-10, IL-5) were significantly increased after treatment. The results showed that the immune function of the patients was improved and the clinical effect was satisfactory.

2.3 Leonardo's robot

The Leonardo's robotic system is an advanced robotic platform technology designed to perform complex surgical procedures based on minimally invasive techniques. Leonardo's robot is mainly composed of doctor control system, bedside robot arm and imaging system. The range of motion of each joint of the robot arm is greater than 90°. At the same time, robotic surgery also has the function of mobility reduction, the movement of the operating rod 5mm, its mechanical end in the body only need to move 1mm, the safety and accuracy of surgery have been greatly improved. In terms of the imaging system, it can enlarge the surgical field of vision by more than 10 times, and effectively present a three-dimensional high-definition image in advance, which is conducive to the operator to grasp the operating distance, and further identify and understand the anatomical structure of the lesion and surrounding tissues.

Zhou Jing et al.[12] compared the effects of Leonardo's robot and thoracoscopic surgery in patients undergoing radical lung cancer surgery, and the results showed that assisted treatment with Leonardo's robot resulted in lower trauma, better overall postoperative nutritional status and stronger immunity.

Chai Xinchun et al.[13] compared the short-term efficacy of Leonardo's robot and Video-assisted thoracoscopic segmentectomy in stage Ⅰa patients with non-small cell lung cancer. The results showed that intraoperative blood loss was (34.40±12.96)ml VS (85.10±26.41)ml, respectively. The number of lymph node dissection stations was (4.72±1.20) VS(3.60±1.40), $P < 0.05$. This shows that the application of Leonardo's robot can reduce the amount of blood loss, and the

number of lymph node dissection stations is significantly more.

3. Conclusion

The incidence and mortality of lung cancer ranks top among tumors with upward incidence. However, most patients proved unapparent early symptoms,and the cancer may have reached the middle and late stage as definitely diagnosed,so early detection and treatment is an important condition to improve the efficacy. The choice of surgical treatment still depends on the overall condition of the patient and the stage of lung cancer. Minimally invasive surgery also plays an important role in the comprehensive treatment of lung cancer. In the future, we can focus on the combination of minimally invasive technology with other disciplines to expand surgical indications to improve the efficacy and the quality of life of patients, and prolong the survival of patients.

References

[1] Gao Ming, Zhou Qing, Wu Yilong. Changes in the treatment of inoperable stage Ⅲ non-small cell lung cancer in the immune era [J]. *Evidence-Based Medicine*, 2022,22(1):1-3,29.

[2] Liu Fenglin, Ma Wei. Analysis of clinical epidemiological and pathological characteristics of lung cancer patients [J]. *China Medical Records*, 2021,22(5):53-55.

[3] Ding Xinlei. Focusing on Lung Cancer Minimally Invasive Multidisciplinary Exchange and Wisdom — The 2nd China Forum on Lung Cancer Minimally Invasive Diagnosis and Treatment and Standardized Study Class on Thermal Ablation of Tumors in the Pulmonary Vagina [J]. *China Medical Information Bulletin*, 2018,33(9):24.

[4] Zhang Jianjun, Sun Yu, Li Guyi. Comparison of the efficacy of single-port thoracoscopic and three-port thoracoscopic lobectomy in the treatment of early stage lung cancer [J]. *Chinese Journal of Clinicians*, 2022,50(2):184-187.

[5] Lin Junfeng. Comparison of the effect of thoracoscopic lobectomy and segmentectomy in the treatment of early lung cancer [J]. *Chinese and Foreign Medical Research*, 2018,16(9):52-54.

[6] Liang Hongliang, Li Zilin, Dong Xiaochao, et al. Application of cardiopulmonary bypass technology in extended resection of locally advanced non-small cell lung cancer [J]. *Chinese Journal of Cardiovascular Circulation*, 2021,19(6):347-350.

[7] Liu Yilan, Cheng Yingying. Observation on the effect of rapid rehabilitation in lung cancer patients undergoing pneumonectomy [J]. *China Health Standards Administration*, 2019,10(19):152-154.

[8] Yang Yongpo, Dong Xiaoqi, Wang Junliang. Effects of thoracoscopic surgery on serum inflammatory factors and pain stress indicators in patients with non-small cell lung cancer [J]. *Journal of Practical Cancer*, 2022,37(3):425-427.

[9] Li Xuchi, Zhou Tao, Li Long. To explore the efficacy and safety of video-assisted thoracoscopic minimally invasive surgery in the treatment of elderly patients with non-small cell lung cancer [J]. *Guizhou Medicine*, 2021,45(5):777-778.

[10] Zhang Chunning, Li Chaoming, Li Mingyao, et al. Effects of minimally invasive cryoablation on tumor markers, immune function and prognosis in patients with advanced non-small cell lung cancer [J]. *Journal of Huazhong University of Science and Technology (Medical Edition)*, 2021,50(1):67-71,76.

[11] Liu Haiyan, Chen Jun, Song Jian, et al. Effect of radiofrequency ablation combined with EGFR-TKIs in the treatment of EGFR-mutant lung cancer and observation of Th1/Th2 cell immunity [J]. *Journal of Beichuan Medical College*, 2020,35(5):783-786.

[12] Zhou Jing, Xia Hongxiang, Mao Changmin, et al. Comparison of the effects of Leonardo's robot and thoracoscopic surgery on the short-term curative effect, postoperative nutritional level and immune function of patients with radical lung cancer surgery [J]. *Journal of Clinical and Experimental Medicine*, 2022,21(3):303-307.

[13] Chai Xinchun, Xu Shiguang, Liu Bo, et al. Comparative analysis of the short-term efficacy of Leonardo's robot and video-assisted thoracoscopic segmentectomy for stage IA non-small cell lung cancer [J]. *Chinese Journal of Thoracic and Cardiovascular Surgery*, 2021,37(11):644-648.