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Cancer Surgery Combines with Nanotechnology

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Abstract

The most prevalent type of tumor is lung cancer, which has emerged as one of the most significant life-threatening factors. The surgical treatment of lung cancer is becoming increasingly sophisticated as a result of advancements in equipment and public awareness. Patients with varying goals and stages of lung cancer can benefit greatly from surgery as part of individualized treatment plans. Additionally, a paradigm shift in the approach to lung cancer surgical treatment has been brought about by the concept of minimally invasive, precise, and intelligent procedures. As a result, the focus of this review is on the history of lung cancer surgery, focusing on the transition from traditional surgery to TV-assisted minimally invasive thoracic surgery. A comprehensive overview of the various surgical methods' operating procedures and treatment outcomes, as well as future plans for their optimization and enhancement, are included. Nanotechnology is increasingly being investigated for use in the surgical treatment of lung cancer, which is in line with the idea of minimally invasive surgical techniques. An efficient treatment option for cancer in the present day is the application of nanotechnology in the imaging of lung cancer and the combination of Nano medicine and surgery. As a result, the potential uses of nanotechnology before, during, and after lung cancer surgery are also outlined in this review.

Keywords: Lung cancer • Surgical treatment • Nanotechnology • Synergistic treatment

Introduction

We are all aware that the most common treatment option for tumors today is surgery as the primary method of resection for solid tumors. However, a growing number of postoperative reports indicate that, regardless of the type of tumor, postoperative recurrence or metastasis is extremely common, and long-term survival is poor. There are two main considerations that must be made in order to reduce the likelihood of recurrence and maximize the effect of surgical treatment. First, the clinical concept of complete resection does not imply that the surgical margins will always be infinitely expanded. The situation of various patients should determine the area of surgical resection, and then the boundaries of surgical resection should be specified. Second, surgery is a macroscopic resection of the tumor that cancer surgery only removes MRD. Theoretically, "complete resection" can effectively prevent recurrence and metastasis due to tumor dissemination by removing all lesions. However, how can "complete excision" be achieved? For nearly two centuries, researchers and oncologists have struggled with this conundrum. As a result, strategies for adjuvants with synergistic anticancer effects should receive more attention. The era of precision surgery, which is dominated by precise tumor resection, has received new hope thanks to the development of new technologies [1].

Literature Review

Numerous imaging techniques must be used to determine the location, size, and structure of the tumor in order to evaluate the possibility and risk of surgery when determining whether lung cancer patients need or can undergo surgery. CT, MRI, and PET/SPECT are three types of imaging that are frequently utilized in clinical practice. Before, during, and after surgery, patients can receive comprehensive care based on the imaging results of these imaging techniques. Predicting the likelihood of postoperative recurrence through evaluation of residual areas and surgical complications is the most important of these. The likelihood of recurrence after surgery generally decreases with cancer surgery greater surgical resection of the tumor site. However, traditional intraoperative imaging technologies like CAS are unable to achieve real-time precision image-guided surgery (IGS) even in the era of precision surgery. As a result, the tumor site cannot be displayed to its fullest extent, preventing the removal percent of the tumor. The surgeon's experience and spatial imagination are more important factors in determining the surgical resection boundary during the actual procedure. As a result, the rate of recurrence following surgery is high, and surgical complications can result in organ dysfunction, failure, or even death. Due to its high resolution and deep tissue penetration, which can compensate for the shortcomings of existing devices, NM is being used in clinical surgery. In order to eliminate the remaining disease, multifunctional NMs can collaborate with other adjunctive therapies like phototherapy, immunotherapy, and chemotherapy [2].

Discussion

The clinical use of nanotechnology, particularly how it can be used to treat multimodal IGS-assisted precision surgery with more advanced forms of nanomaterials (NM). Based on the enhanced permeability and retention (EPR) effect, all nanoformulation contrast agents can passively accumulate into the tumor site during precision image-guided surgery. Another unique advantage of nanocontrast agents is that they can be expressed in accordance with the specific and highly expressed receptors of lung cancer or other tumors. The nanodeveloping agent can then be specifically targeted and accumulated at the tumor site through ligand-receptor interaction after matching receptors are attached to its surface. Both the concentration of the contrast agent at the site of the tumor and its accumulation in healthy tissues cancer surgery can be decreased, thereby minimizing side effects. In addition, the size of nanoparticles can be flexibly adjusted using a variety of design strategies, ranging from large to small. This increases the nanoparticles' ability to penetrate solid tumors and makes it possible to distribute more contrast agents to the tumor edge area, greatly improving the accuracy of preoperative tumor detection and intraoperative tumor margin delineation. Nanoparticles can be engineered into multifunctional therapeutic and diagnostic nanoplatforms that combine imaging and navigation capabilities with other treatments to create diagnostic-therapeutic-integrated nanoplatforms. These nanoplatforms allow for complete macroscopic tumor resection to assist patients in eradicating cancer. A promising new strategy for treating tumors in the twenty-first century combines surgery and nanotechnology [3].

Knowledge of pulmonary anatomy, which includes the relationships between pulmonary arteries, pulmonary veins, and airways, is the most fundamental

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knowledge that pulmonary surgeons must be proficient in. Additionally, there are a variety of treatment options for lung cancer stages. The fundamentals of lung cancer surgery are as follows. Lung anatomy the most significant anatomic, surgical, and pathologic unit of the lung is the bronchopulmonary segment. In his classic 1955 publication, Segmental Anatomy of the Lungs, Boyden described segmental anatomy in all cancer surgery of its complexity. Detail of the bronchopulmonary segments. The development of modern anesthetic methods is credited with the birth of lung cancer surgery. When general anesthesia first emerged, inhalants like chloroform or ether could be used. The patient started breathing on its own at this point. However, when the chest cavity is opened, ipsilateral lung failure and paradoxical breathing occur quickly as a result of the pneumothorax. As a result, the patient quickly loses oxygen and falls asleep. In contrast, surgery on a ventilated lung can be extremely risky and potentially fatal. Positive pressure ventilation, which can maintain continuous lung ventilation in the event of deep anesthesia and pneumothorax, was first described. The select one-lung for ventilation via contralateral main stem bronchial intubation was then initiated. Therefore, the anesthetic methods guarantee thoracic surgery's safety [4].

The first Pneumonectomy case, performed by Dr. Evarts Graham to remove the tumor from the lobus superior pulmonis sinister, marked the beginning of a new era in thoracic surgery. The video-assisted thoracoscopic surgery (VATS) lobectomy has gradually become the standard procedure for early-stage lung cancer as medical technology has advanced. At the same time, the widespread use of low-level exposure CT sifting led to the discovery of an increasing number of cases of early-stage lung cancer. However, the majority of cases of lung cancer are still in their later stages. Sleeve lobectomy became the preferred procedure for patients with centrally located NSCLC. If necessary, some patients cancer surgery with locally advanced disease may undergo integrated surgery to remove the primary tumor and any structures that are involved. Therefore, the traditional thoracotomy remains an essential component of lung cancer surgery. Fortunately, molecular imaging technology is constantly evolving in response to clinical requirements. Additionally, an increasing number of researchers are committed to the development of IGS technology, and an increasing number of IGS technology applications in clinical practice are advancing biomedical therapeutic diagnosis and application. In addition, nanomaterials (NMs) for IGS highlight the advantages of nanotechnology in synergistic cancer therapy with the development of nanotechnology. A look at how patients with lung cancer in the center or invading neighboring structures like the tracheal carina, chest wall, superior vena cava, and aorta are treated in modern surgery is provided below [5].

Conclusion

Under general anesthesia, cancer surgery double-lumen endotracheal intubation and one-lung ventilation are required for traditional VATS. One-lung ventilation after general anesthesia intubation is not without risks, most notably intubation-related trauma, ventilator-caused lung injury, atelectasis, and narcotic-induced postoperative nausea and vomiting. Non-intubated thoracoscopic surgery has been used for simple procedures like pneumothorax, pulmonary nodules, and lymph node biopsy in order to avoid the negative effects of general anesthesia. Anatomical lobectomy combined with mediastinal lymph node dissection can be successfully completed under spontaneous respiration with no coughing response during traction lung parenchyma with further exploration of non-intubation technology, which is currently the standard treatment for early lung cancer. Additionally, this method has been shown in some studies to reduce the length of stay in the hospital and speed up recovery after surgery, without increasing the risk of perioperative complications. Therefore, non-intubated VATS have been widely utilized in routine lung cancer treatments. For the purpose of performing the surgical removal of small peripheral pulmonary nodules, a brand-new type of thoracic surgery known as "tubeless surgery" has recently been developed. Neither an intraoperative tracheal intubation nor a postoperative chest tube is required in this new technique.

Acknowledgement

None.

Conflict of Interest

None.

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