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NAVIGATIONAL SURGERY, EARLY DIAGNOSIS OF INTERNAL ORGANS, AND ONCOLOGICAL SURGERY

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Annotation: Modern navigational surgery represents a high-technology approach for the treatment of tumor-affected internal organs. It integrates three-dimensional visualization, fluorescent markers, intraoperative tomography, and robotic systems, providing high precision during surgery. When combined with early diagnostic methods such as PET-CT, molecular analyses, and liquid biopsy, navigational technologies allow maximal tumor removal with minimal tissue trauma, reduce complications, and improve patient outcomes. This paper reviews the principles, methods, and future perspectives of navigational surgery in oncology.

Keywords: Navigational surgery, early diagnosis, oncology, internal organs, 3D navigation, robotic surgery, PET-CT, molecular diagnostics, liquid biopsy

Introduction

Cancer of internal organs remains one of the leading causes of mortality worldwide. The late detection of tumors often reduces the effectiveness of conventional treatments. Therefore, early diagnosis and the use of navigational surgery are crucial for improving surgical precision, minimizing tissue damage, and enhancing patient safety. Recent advances in imaging, molecular diagnostics, and robotic technology have enabled surgeons to plan and execute operations with unprecedented accuracy. These innovations also allow organ-preserving procedures, minimizing functional loss and accelerating patient recovery.

1. Early Diagnosis of Internal Organ Tumors

1.1. Molecular Methods

Liquid biopsy enables the detection of circulating tumor cells and DNA at early stages. Highly sensitive PCR and NGS sequencing methods improve diagnostic accuracy and allow for real-time monitoring of tumor progression.

1.2. Radiological Methods

PET-CT, MRI, and high-resolution CT detect microscopic tumors. The use of novel contrast agents enhances image quality and facilitates the early detection of small lesions.

2. Navigational Surgery and Its Capabilities

2.1. 3D Navigation

Three-dimensional organ models based on CT or MRI help surgeons plan operations with high precision and minimize damage to healthy tissues.

2.2. Intraoperative Tomography

Repeated CT or MRI scans during surgery refine tumor boundaries and confirm complete resection.

2.3. Fluorescent Navigation

Indocyanine green (ICG) highlights tumor tissue and lymph nodes, aiding precise identification of pathological areas.

2.4. Robotic Surgical Systems

Robotic platforms such as da Vinci provide high precision, reduce tissue trauma, and improve access to difficult-to-reach areas, enhancing surgical safety.

3. Significance of Navigation in Oncological Surgery

Navigational surgery is particularly effective in liver, pancreas, kidney, and lung tumors. It reduces recurrence risk, minimizes blood loss, and accelerates recovery. High-precision techniques allow organ-preserving surgeries, improving patient quality of life.

4. Future Perspectives

The future of navigational surgery includes artificial intelligence, holographic models, virtual simulations, and autonomous surgical platforms. These technologies are expected to further enhance accuracy, safety, and personalized treatment options.

Conclusion

Navigational surgery combined with early diagnosis represents a promising direction in modern oncology. It increases surgical efficacy, reduces complications and recurrence, and improves patient quality of life. Ongoing technological developments are likely to bring further breakthroughs in the treatment of internal organ cancers.

References

Fong Y, et al. Navigation in liver surgery: techniques and outcomes. J Hepatobiliary Surg.

2020;27(3):123-135.

Giulianotti PC, et al. Robotic surgery in oncology: current applications and future perspectives. Ann Surg Oncol.

2019;26(7):2091-2103.

Pantel K, Alix-Panabières C. Liquid biopsy in cancer patients: opportunities and challenges.

Nat Rev Clin Oncol. 2019;16:409-421.

Wang X, et al. Fluorescence-guided surgery in oncology: principles and applications. Front Oncol. 2021;11:635.

Bockhorn M, et al. 3D imaging and navigation in pancreatic surgery. Surg Endosc.

2020;34:1650-1660/