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A study to compare a new non-invasive technique with traditional methods for locating lung nodules before surgery

Submission date
18/11/2024

Recruitment status
No longer recruiting

Registration date
19/11/2024

Overall study status
Completed

Last Edited
19/11/2024

Condition category
Surgery

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[ ] Record updated in last year

Plain English summary of protocol

Background and study aims
Lung cancer is a leading cause of death worldwide, and small lung nodules often need to be removed to confirm or treat early-stage cancer. Before surgery, these nodules must be accurately located to guide the surgeon. Traditional methods use a CT scan to insert a needle into the lung and mark the nodule with a dye. While effective, this process can cause discomfort and complications, such as a collapsed lung or bleeding. This study aims to test a new non-invasive technique that uses 3D imaging to locate lung nodules without inserting a needle, making the procedure safer and more comfortable.

Who can participate?
Adults aged between 18 and 75 years old with a small lung nodule that needs removal and who are healthy enough for surgery can take part. Patients with nodules in difficult-to-reach areas or severe medical conditions will not be eligible.

What does the study involve?
Participants will be randomly assigned to one of two groups. One group will have their lung nodule located using the new non-invasive 3D imaging system, while the other group will undergo the standard CT-guided method using a needle and dye. Both groups will then have the nodule removed using minimally invasive keyhole surgery. The study will compare the accuracy of the two techniques, their impact on surgical outcomes, and any complications.

What are the possible benefits and risks of participating?
Participants may benefit from accurate and safer localization of their lung nodules. Those in the experimental group may avoid complications like pain or lung injury from needle insertion. However, there is a small risk that the new method may not locate the nodule as precisely as the traditional method, requiring adjustments during surgery.

Where is the study run from?
The First Affiliated Hospital of Guangzhou Medical University, China

When is the study starting and how long is it expected to run for?
June 2022 to August 2023

Who is funding the study?
1. National Key Research and Development Program of China, China
2. Guangdong Basic and Applied Basic Research Foundation, China
3. Science and Technology Projects in Guangzhou, China

Who Is the Main Contact?
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Study information

Scientific Title
Real-time non-invasive localization in sub-lobar resection for small pulmonary nodules: a noninferiority randomized clinical trial

Acronym
REAL-3D

Study objectives
The real-time non-invasive 3D localization technique is non-inferior to CT-guided percutaneous localization in achieving successful resection of small pulmonary nodules during sub-lobar resection, with fewer localization-related complications and reduced patient discomfort.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 02/06/2022, Institutional Review Board of the First Affiliated Hospital of Guangzhou Medical University (No.28 Qiaozhong Zhong Lu, Guangzhou, 510140, China; +86 (0)20 81566250; gyfyyiit@163.com), ref: ES-2024-129-02

Primary study design
Interventional

Study design
Single-center interventional open-label randomized controlled trial

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Precise localization of small pulmonary nodules for sub-lobar resection in patients with early-stage lung cancer or suspected malignancy

Interventions
For this interventional study, participants are randomized into two arms in a 1:1 ratio using block randomization with a block size of 4. The randomization sequence is generated using SAS software (version 9.4) and allocation is concealed in sealed, opaque envelopes until enrollment.

Experimental Arm (Non-invasive 3D Localization):
Participants will undergo real-time non-invasive localization using a multi-view, glasses-free 3D display system based on preoperative CT-derived 3D reconstructions. The system enables precise visualization of pulmonary nodules without physical markers or needle placement. The surgeon uses the 3D model intraoperatively to guide resection.

Control Arm (CT-guided Localization):
Participants will receive standard preoperative localization using CT-guided percutaneous injection of indocyanine green (ICG). The dye provides fluorescence marking for intraoperative visualization of the nodule. This method involves needle insertion into the lung under CT guidance.

The study will compare both methods in terms of localization accuracy, successful resection rates, localization-related complications, and patient safety. Both interventions are performed prior to sub-lobar resection, which is conducted using video-assisted thoracoscopic surgery (VATS).

Intervention Type
Procedure/Surgery

Primary outcome(s)
Successful resection rate for small pulmonary nodules, defined as achieving a resection margin that is equal to or greater than the diameter of the lesion or 2 cm, measured intraoperatively and confirmed by pathologic analysis during surgery

Key secondary outcome(s)
1. Margin distance: Measured intraoperatively on the excised specimen using a ruler or caliper. For confirmation, frozen section analysis may be performed to assess the distance between the nodule and the resection margin.
2. Conversion rate: Documented intraoperatively by the surgical team in the operation report, noting any conversions from VATS to open thoracotomy specifically due to localization challenges.
3. Intraoperative blood loss: Recorded intraoperatively by the anesthesiology team using suction canister measurements and surgical gauze weight, as documented in the anesthesia and surgical records.
4. Chest tube duration: Recorded in postoperative nursing records as the number of days from chest tube insertion to removal, based on daily clinical assessments of lung expansion and fluid output.
5. Hospital stay: Recorded in hospital discharge records as the total number of days from the date of admission for surgery to the date of discharge.
6. Localization-related complications: Documented intraoperatively and during the first 24 hours post-localization through clinical observations and imaging studies. Pneumothorax is assessed using chest X-rays or CT scans, pulmonary hemorrhage is identified during or after the procedure, and pain is measured using the visual analog scale (VAS) documented in patient records.
7. 30-day postoperative mortality: Assessed through follow-up via hospital records, outpatient visits, or direct patient or family contact. Any deaths occurring within 30 days of the surgical procedure are recorded.

Completion date
01/08/2023

Eligibility

Key inclusion criteria
1. Patients aged 18-75 years who voluntarily participate in the trial and can personally sign the written informed consent
2. Presence of a solitary pulmonary nodule with a maximum diameter of less than 20 mm
3. The target nodule appears as a pure ground-glass opacity (GGO) or a mixed GGO (with a consolidation-to-tumor ratio<0.5), with clinical or radiological features suggestive of malignancy
4. The minimum distance from the outer edge of the nodule to the nearest pleural surface is greater than or equal to 5mm
5. Cardiopulmonary function and other vital organ functions are generally normal, allowing the patient to tolerate surgery

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
18 Years

Upper age limit
75 Years

Sex
All

Total final enrolment
430

Key exclusion criteria
1. Patients who refuse to participate in the clinical trial
2. Pulmonary nodules located in the scapular region that limit percutaneous localization
3. Pulmonary nodules located near the mediastinum or major cardiac vessels
4. Patients with absolute contraindications to surgery, severe comorbidities, advanced disease, or other conditions deemed unsuitable for inclusion by the researchers

Date of first enrolment
01/07/2022

Date of final enrolment
31/07/2023

Locations

Countries of recruitment
China

Study participating centre
First Affiliated Hospital of Guangzhou Medical University
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Sponsor information

Organisation
First Affiliated Hospital of Guangzhou Medical University

ROR
https://ror.org/00z0j0d77

Funder(s)

Funder type
Government

Funder Name
National Key Research and Development Program of China

Alternative Name(s)
, National Basic Research Program of China (973 Program), Special Fund for the National Key Research and Development Plan, China National Key Research and Development Plan Project, National Key Research and Development of China, National Key Research and Development Program, National Key R&D Program of China, National Key R&D Programmes of China, China's National Key R&D Programmes, National Basic Research Program of China, 973 Program, National Program on Key Basic Research Project (973 Program), National Plan on Key Basic Research and Development, National Basic Research Program, NKRDPC, NKPs

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
China

Funder Name
Basic and Applied Basic Research Foundation of Guangdong Province

Alternative Name(s)
Guangdong Basic and Applied Basic Research Foundation, Guangdong Basic and Applied Basic Research Fund Regional Joint Youth Fund,

Funding Body Type
Government organisation

Funding Body Subtype
Local government

Location
China

Funder Name
Science and Technology Projects in Guangzhou

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study will be available upon request from Yu Jiang (yu_jiang1999@163.com).
Type of data to be shared: de-identified participant-level data, including demographic data, intervention details, and outcome measures.
Timing for availability: data will be available 12 months after publication of the primary study results.
Consent: informed consent was obtained from all participants, including consent for data sharing.
Data anonymization: all shared data will be fully anonymized to protect participant confidentiality.
Ethical and legal restrictions: data sharing will comply with applicable laws and institutional policies to ensure participant privacy and data security.
Additional comments: data will be available upon reasonable request to the corresponding author, with a formal data-sharing agreement required.

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Study website	Study website	11/11/2025	11/11/2025	No	Yes