Review

Do tumours located in basal segments have better survival than superior segments in lung cancer?

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ABSTRACT

A best evidence topic in thoracic surgery was written according to a structured protocol. The question addressed was in patients with lower lobe lung cancer undergone pulmonary resection, are the tumours located in superior segments superior to the tumours in basal segments in terms of survival? We concluded that there were no statistically significant differences in survival and recurrence between superior and basal segments for lung cancer patients, but overall survival and relapse-free survival were worse in superior segment for clinical stage I non-small cell lung cancer (NSCLC) in the right lower lobe, and remained unclear about other stages of lung cancer. In consideration of operation procedure, we speculate that the superior segments had a relatively worse survival in patients with early-stage NSCLC who underwent segmentectomy; likewise, in patients underwent at least lobectomy, survival of the superior segments was not better than that of the basal segments.

1. Introduction

A best evidence topic was constructed according to a structured protocol. This is fully described in the International journal of surgery [1].

2. Clinical scenario

You are in the outpatient department of thoracic surgery. You notice that some patients have lower lobe lung cancer, and some of them have tumours in superior segments, some are in the basal segments. You are interested in the effect of different tumour locations on survival and decide to consult the literature yourself.

3. Three-part question

In [patients with lower lobe lung cancer] [undergone pulmonary resection], is [tumour located in superior segments superior to tumours in basal segments] in terms of [survival and recurrence]?

4. Search strategy

We performed a systematic search in Medline database using the PubMed interface from 1950 to September 2022, in Embase database using the OCID interface from 1974 to 2022 and in web of science with the terms: (“Lung Neoplasms”[Mesh]) and (“Pneumonectomy”[Mesh] or Pneumonectom* [Title/Abstract]) Or lobectomy [Title/Abstract] or segmentectomy [Title/Abstract] or surgery [Title/Abstract] OR surgical [Title/Abstract] OR resect* [Title/Abstract]) and (segment [Title/Abstract] or (superior segment [Title/Abstract]) or (basal segment* [Title/Abstract]) or (basilar segment* [Title/Abstract]) or (segment 6 [Title/Abstract])) and (prognos* or Survival [Title/Abstract]). The results were limited to English articles and human studies.
5. Search outcome

Five hundred and thirty-one papers were found using the reported search. A total of 397 papers were found after removing duplicates. Among them, 389 papers were excluded according to the title and abstract, and the remaining 8 papers were screened and evaluated. From these, six retrospective cohort studies were identified that provided the best evidence to answer the question. The search strategy process is detailed in Fig. 1.

6. Results

See in Table 1.

Table 1
Best evidence papers.

| Author, date of publication, journal and country | Study type (level of evidence) | Patient group | Outcomes | Key results | Additional comments |
|-------------------------------------------------|-------------------------------|---------------|----------|-------------|---------------------|
| Yoshinori Handa et al., 2017, Ann Thorac Surg, Japan [2] | Retrospective cohort study (level III) | Sample size: n = 134 Median follow-up: 41.2 months Study period: 2007–2015 Patients clinical stage I (cN0M0) NSCLC - Superior group: n = 60 - Basal group: n = 74 Treatment Segmentectomy/lobectomy Superior group: 16/44 Basal group: 13/61 | 5-year OS Univariable analyses for OS (Superior group/Basal group) Multivariable analyses for OS (Superior group/Basal group) Incidence of recurrence 5-year RFS Multivariable analyses for RFS (Superior group/Basal group) Multivariable analyses for RFS (Superior group/Basal group) Multivariable analyses for DFS (Superior group/Basal group) | Total (78.1%) Superior group (62.6%) Basal group (89.9%) P = 0.0072 HR 3.90 (95% CI 1.49–12.1) P = 0.005 | - A single centre study with a relatively large study population - More segmentectomy in superior group and tumour margins were not assessed |
| Jones, G. D. et al., 2021, Ann Thorac Surg, USA [3] | Retrospective cohort study (level III) | Sample size: n = 196 Study period: 2000–2018 Median follow-up: 4.9 years (IQR = 1.6–8.7) Patients cT1N0M0 NSCLC - Right basal group: n = 27 | Right superior group/Right basal group HR 2.89 (95% CI 1.18–7.08) P = 0.02 Left basal group/Right basal group HR 1.78 (95% CI 0.53–6.01) P = 0.35 Left superior group/Right basal group HR 2.09 (95% CI 0.80–5.43) P = 0.13 | - A single centre study with a large sample size - The margin distance (cm) in the right basal group 2.5 (1.0–3.4) was greater than that in the right upper group 1.0 (0.5–2.5), which may cause more recurrence - A long-time span of 18 years may lead to heterogeneity in treatment modalities |

Fig. 1. PRISMA flow chart.
| Author, date of publication, journal and country | Study type (level of evidence) | Patient group | Outcomes | Key results | Additional comments |
|---------------------------------------------|--------------------------------|---------------|----------|-------------|---------------------|
| Tomizawa, K. et al., 2015, Thorac Cancer, Japan [5], Retrospective cohort study (level III) | Sample size: n = 85 | Right superior group: n = 32 | Superior group (22.6%) | Basal group (42.1%), \( P = 0.020 \) | - Two centres study | - Right lower lobe only | - Small sample size | - Mostly male (72.9%) |
| Tomizawa, K. et al., 2015, Thorac Cancer, Japan [5], Retrospective cohort study (level III) | Study period: 1996–2012 | Left basal group: n = 53 | Total (27.9%) | Superior group (19.9%), Basal group (32.9%), \( P = 0.1308 \) | - Single centre study | - No description of follow up procedure | - More pneumonectomy in superior group (\( p < 0.01 \)) may affect overall survival | - When the tumour involved both the superior and the basal segments, the patient was placed in the superior segment group |
| Nishio, W. et al., 2016, Ann Thorac Surg, Japan [7], Retrospective cohort study (level III) | Sample size: n = 48 | Right superior group: n = 134 | Total 76.9% | Superior group (4.2%), Basal group (20.8%), Basal group (25.0%), \( P = 0.010 \) | - Small sample | - Study population from another prospective cohort study may lead to selection bias | - Basal group have more N2 (\( p = 0.025 \)), larger tumour size (\( p = 0.052 \)) may lead to worse prognosis |

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assigned the patient to the superior segment, as opposed to the segment with main tumour volume in other studies. This grouping criteria may place more patients with invasion of both lung segments into the superior segment group, skewing the superior segment results. The author suggested that for patients with pN2 NSCLC, survival may be poorer for those with superior segment tumours than that of those with basal segment tumours.

Tomizawa et al. [5] studied 263 patients with lung cancer located in the right lower lobe underwent lobectomy (n = 81) or pneumonectomy (n = 4). In pN2 patients (n = 85), a lower 3-year DFS was found in right superior group (n = 32) compared with right basal group (n = 53) (22.6% vs 42.1%, P = 0.020). This result was consistent with the previous conclusion that the prognosis is worse in the superior segment.

Nevertheless, among all patients (n = 263), pN0 (n = 153) and pN1 (n = 25) tumour patients, there was no significant difference in DFS between the right superior group and right basal group.

Lin et al. [6] reviewed 207 patients with lung adenocarcinoma who underwent lobectomy. Their results also suggested that tumour location was not an independent prognostic factor of OS (P = 0.212). Notably, they also found that basal group was associated with a lower probability of freedom from recurrence (basal vs. superior, HR = 2.453 (95%CI 1.242–4.846), P = 0.01). However, we cannot ignore the fact that basal group had larger tumours on average and more patients with N2 lymph node metastasis (P = 0.025), as well as the influence of these two factors on recurrence.

Nishio et al. [7] studied 237 patients with cT1aN0M0 NSCLC and performed a segmentally survival analysis on the patients undergoing segmentectomy, among which 48 patients with superior (n = 24) and basal (n = 24) segments tumours were matched with our topic. It was demonstrated that tumours in superior segments have a lower local and regional recurrence probability were than basal segments. However, P values were not provided, and the sample size was small. Therefore, the quality of this evidence needs to be considered.

Taking the operation types as one of the factors, two of six studies focus on the outcomes of patients with cT1aN0M0 NSCLC who underwent segmentectomy and reached inconsistent conclusions. Given the study design and sample size, we tend to assume that the superior segments had a relatively worse survival in patients with early-stage NSCLC who underwent segmentectomy. In the other four studies, patients were treated with at least lobectomy. Although these studies focused on different stages and had conflicting primary results, based on the available evidence, we take the attitude that the survival of the superior segments was no better than that of the basal segments.

8. Clinical bottom line

Three of six studies verified no significant difference in overall survival between right or bilateral superior and basal segments for lung cancer. Two studies suggested a poorer survival and recurrence in clinical stage I NSCLC of right superior segment, another suggested a worse survival of superior segment for pN2 right-sided lung cancer. Two studies showed that the basal segments had a higher probability of local and regional recurrence while the results of the other three studies
supported a higher likelihood of recurrence of superior segment. Three of six studies supported inferior survival of superior segments compared to the basal segments for specific population. However, the evidence was not sufficient enough due to the small sample size and greatly varied tumour size and staging.

In summary, we hold the opinion there were no statistically significant differences in survival and recurrence between superior and basal segments for lung cancer patients, but overall survival and relapse-free survival were worse in superior segment for clinical stage I NSCLC, and remained unclear about other stages of lung cancer. In consideration of operation procedure, we speculate that the superior segments had a relatively worse survival in patients with early-stage NSCLC who underwent segmentectomy; likewise, in patients underwent at least lobectomy, survival of the superior segments were no better than that of the basal segments.

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Author contribution

Tianyi Lu: conducted the literature search and writing of the paper.
Jian Zhou: conducted the data collection, analysis and writing of the paper.
Mingying Lin: assisted in the literature search and writing of the paper.
Jiandong Mei: assisted in the editing and writing of the paper.

Registration of research studies

Name of the registry: Not applicable.
Unique Identifying number or registration ID: Not applicable.
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Guarantor

Jiandong Mei.

Consent

Consent was not required.

Declaration of competing interest

No potential conflict of interest was reported by the authors.

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