International Journal of Health Technology
An Official Journal of Kalam Institute of Health Technology

RESEARCH ARTICLE

Clinical Effectiveness of Bronchoscopy (EBUS-TBNA/EUS-FNA): A Systematic Review and Meta analysis

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Received: 17th February, 2022; Accepted: 03rd March, 2022; Available Online: 22nd March, 2022

ABSTRACT

The review mainly focusses on the goals to evaluate the viability of Bronchoscopy in decrease of mortality, length of stay and other complications in adults above 18 years.

Introduction: *Inclusion Criteria*: This review is conducted in adult patients in both male and female with lung cancer age over 18–65.

Methods: The databases of web indexes like PubMed, Google researcher and Cochrane were utilized for this review. The titles and abstracts are screened and evaluated based on the inclusion criteria of the review. Depending on inclusion criteria the full text articles were assessed exhaustively and chosen studies were recovered by methodological quality.

Results: In this review among the retrieved articles 67 studies which met the inclusion criteria and those studies were pooled statistically and their outcomes were measured. All those studies explain the effectiveness of bronchoscopy [endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA)/Endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA)] to show sensitivity and specificity

Conclusion: Meta-analysis assessing the combined approach of EBUS-TBNA and EUS-FNA for media stinal node staging of lung cancer. The current evidence suggests that the combined technique EBUS-TBNA/EUS-FNA is more effective than EBUS-TBNA or EUS-FNA alone.

Keywords: False Positive and False Negative, Sensitivity, Specificity, Test accuracy, True Negative, True Positive.

International Journal of Health Technology (2022)

How to cite this article: Nagaseshu P, Kachroo K, Sharma J. Clinical Effectiveness of Bronchoscopy (EBUS-TBNA/EUS-FNA): A Systematic Review and Meta analysis. International Journal of Health Technology. 2022;1(1):24-32.

Source of support: Department of Health Research (DHR), India.

Conflict of interest: None

INTRODUCTION

Lung cancer is the leading cause for cancer-related mortality within the world. If carcinoma is suspected, a tissue diagnosis should be obtained to determine an explicit diagnosis. Endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) and, last endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA)[1] are promising invasive imaging tests gaining acceptance as carcinoma staging tools. These methods are suggested as reasonable alternatives to mediastinoscopy.[2] Recent studies have found that combining EBUS -TBNA and EUS-FNA into one procedure includes a higher staging accuracy than either procedure alone in patients with confirmed or suspected carcinoma. Because EBUS-TBNA and EUS -FNA are complementary methods for the diagnosis of mediastinal disease,[3] they need different accessibilities to the mediastinum. The EBUS-TBNA has been extensively utilized for the evaluation of mediastinal and hilar lymph nodes further as endobronchial lesions[4] Compared to mediastinoscopy, the gold standard for mediastinal LN sampling, EBUS-TBNA is a smaller amount invasive, are often performed on an outpatient basis with moderate sedation and might be wont to sample hilar lymph nodes. EUS-FNA could be a minimally invasive ultrasound-guided FNA technique that goes through the oesophagus. When a linear EBUS ultrasound scope is employed to sample tissue through the transoesophageal route, the terminology is EUS-B. The technique of needle aspiration with EUS is analogous to EBUS. lymph gland puncture is achieved with a fast forward movement advancing the needle. In and out movements are performed with the needle inside the lymphatic tissue. it's important to determine the needle moving inside the lymphatic tissue and to not move the node with the needle. Combining EBUS-TBNA with EUS-FNA/EUS-B-FNA provides a way broader ability to biopsy lymph nodes compared with conventional mediastinoscopy in staging NSCLC. It

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allows for the whole staging of the mediastinum and allows access to commonly involved metastatic structures below the diaphragm. The sensitivity of mediastinal nodal staging in patients with proven or suspected carcinoma is increased when EBUS-TBNA/EUS-FNA is added to EBUS-TBNA.[5]

REVIEW QUESTION

To show sensitivity and specificity of bronchoscopy (EBUS-TBNA/EUS-FNA) in adults patients with lung cancer over 18–65 years in both males and females.

Inclusion Criteria: Participants

The articles that were considered for inclusion criteria of participants above 18 years of age are considered in this review with lung cancer.

Intervention

The EUS-TBNA combined with Endoscopic ultrasound-guided fine-needle aspiration biopsy (EBUS-TBNA+EUS-FNA) is compared with (EBUS-TBNA) and (EUS-FNA).

Comparator

The EBUS-TBNA, Transbronchial needle aspiration (TBNA), Endoscopic ultrasound-guided fine-needle aspiration biopsy (EUS-FNA).

Outcomes

Sensitivity, Specificity.

Types of Studies

Randomized control trail, observational, Retrospective and prospective studies are included.

METHODS

Search Strategy

The primary electronic databases search was used for conducting systematic review. Searches were conducted in PubMed, Google scholar and Cochrane data bases. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement was developed for this review.

Literature Search Database

The systematic review was conducted by primary electronic database search. Searches were conducted in PubMed, Google scholar and Cochrane data bases. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was developed for this project (Figure 1).

Study Selection

The full text articles were collected and exported into EndNote and duplicates were removed. Abstracts and titles were screened by their methodological quality as per the inclusion criteria. The full texts articles of eligible studies were retrieved and from those full-text studies which do not meet the inclusion criteria were excluded.

Data Extraction

The first stage of the data extraction is calculation of sensitivity and specificity for each study, which is conducted as per the standard 2 × 2 table which is shown below.

Assessment Criteria

The methods should contain information on eligibility criteria, information sources, search, study selection, risk of bias in individual studies, data items, and synthesis of the results and risk of bias across studies.

Critical Appraisal

Quality assessment of this review. It includes studies in terms of risk of bias and concerns regarding applicability over four domains, (patient selection, index test(s), reference standard, and flow and timing), which are each rated in terms of risk of bias. A summary graphic may be helpful to convey the methodological quality of each study. Risk of bias graph and summary shows how published DTA systematic reviews have graphically summarized the methodology quality of the included studies.

Risk of Bias in Individual Studies

Risk of bias in the included studies refers to the addressing of specific aspects that may have introduced systematic errors (i.e., bias) into a study. The most widely accepted tool for methodological appraisal of the studies included in the review is the quality assessment of diagnostic accuracy studies-2 (QUADAS-2) tool, which assesses the quality of the included studies in terms of biases affecting their applicability in four domains: patient selection, index test, reference standard and flow and timing. A summary estimate of data combined in meta-analysis is considered to be the highest level of evidence. The data will be combined clinically, methodologically, and statically having similar characteristics with same outcomes Figures 2 to 9.

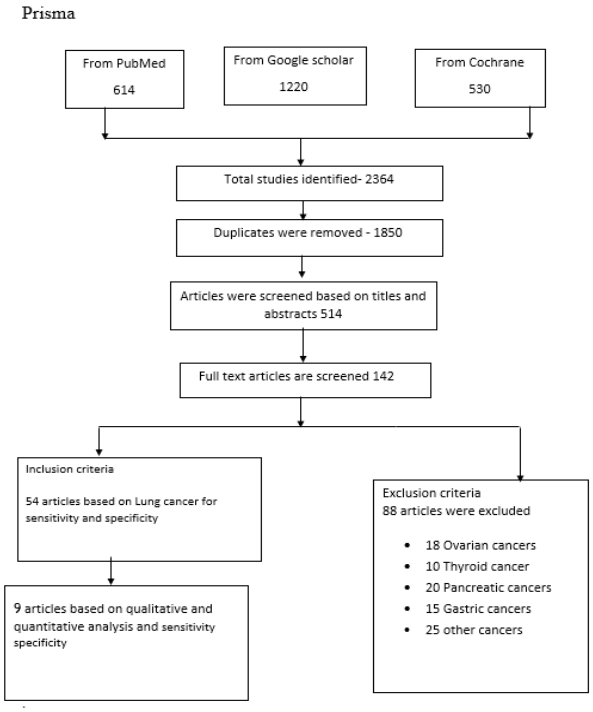

Figure 1: Prisma

EBUS-TBNA

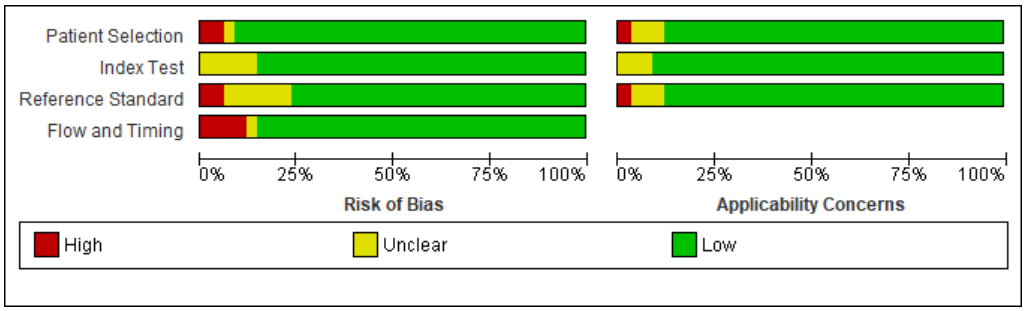

Figure 2: Risk of Bias Graph for EBUS-TBNA

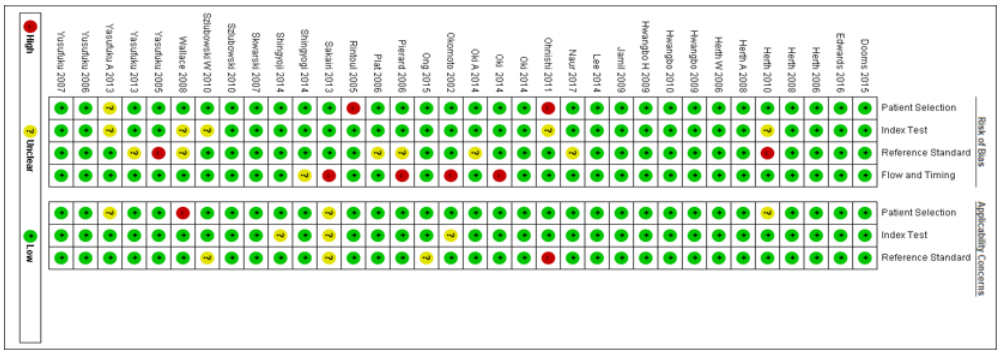

Figure 3: Risk of bias Summary for EBUS-TBNA

TBNA

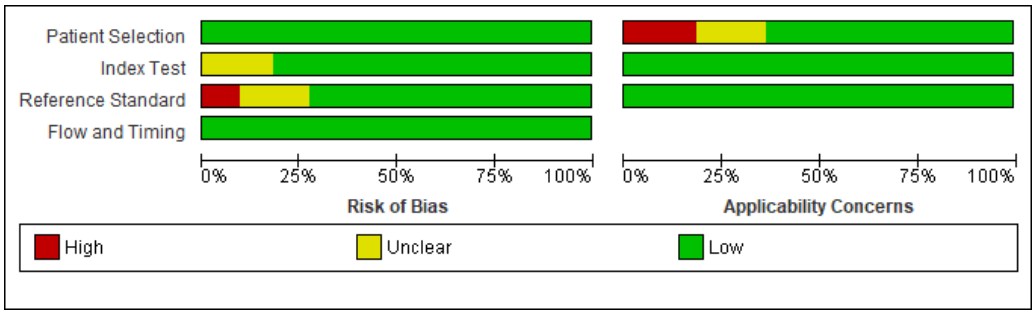

Figure 4: Risk of bias graph for TBNA

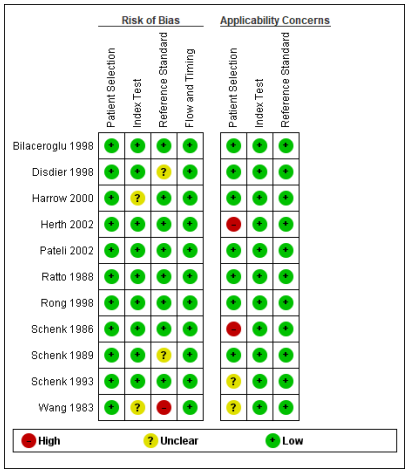

Figure 5: Risk of Bias Summary for TBNA

EUS-FNA

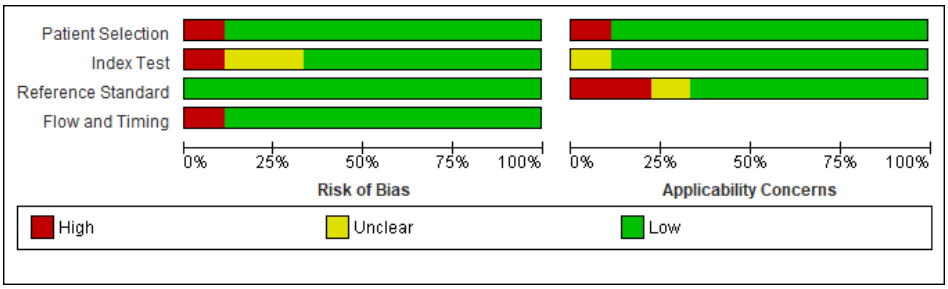

Figure 6: Risk of Bias graph for EUS-FNA

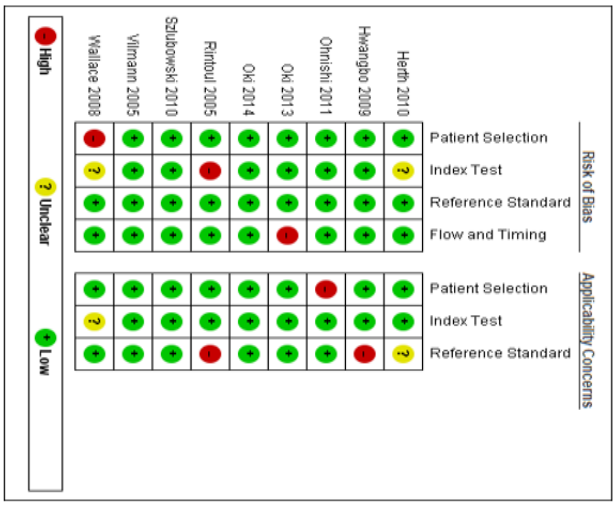

Figure 7: Risk of bias Summary for EUC-FNA

EBUS-TBNA+EUS-FNA

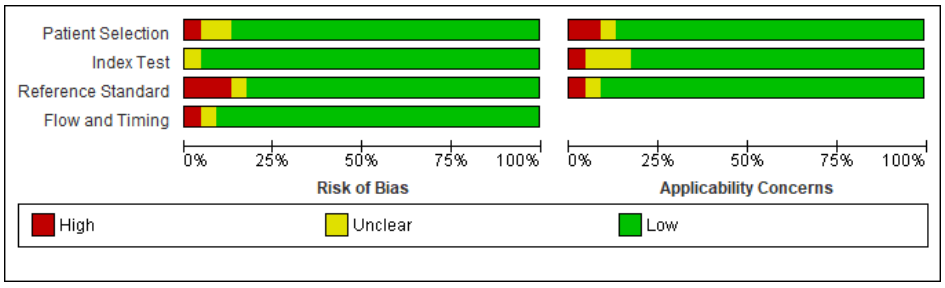

Figure 8: Risk of bias Graph for EBUS-TBNA+EUS-FNA

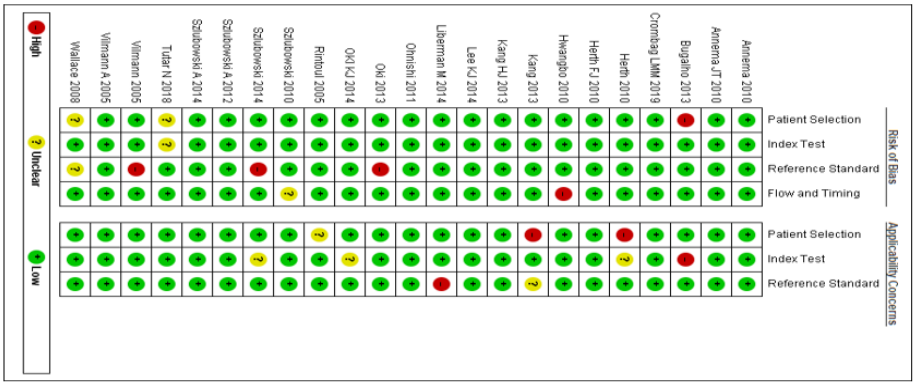

Figure 9: Risk of bias Summary for EBUS-TBNA+EUS-FNA

RESULTS

The results section includes information on study selection, study characteristics, risk of bias within studies, results of individual studies, synthesis of results, risk of bias across studies.

Study Selection

A total of 2364 articles were identified by the search strategy of different databases like PubMed, Google scholar and Cochrane of which 1850 were removed based on duplicates, 514 articles were removed based the title and abstract. The full texts of 142 articles were screened, of which 54 articles met the inclusion criteria and were included in this review and 9 articles were taken into consideration based on the qualitative and quantitative analysis.

Study Characteristics: Description of the Included Studies

The study characteristics patients suffering with lung cancer for EBUS-TBNA, EUS-FNA TBNA and EBUS-TBNA/EUS-FNA are included in the study. Total number of studies included in this systematic review and meta-analysis all together are 67 studies. All the included studies are retrospective and prospective study design, respectively. All the studies are clinically, methodologically, and statistically similar in their characteristics with same outcomes. The accuracy of EBUS-TBNA, EUS-FNA TBNA and EBUS-TBNA/EUS-FNA were performed by meta-analysis through sensitivity and specificity which is represented by 2 x 2 table which shows the true positive, true negative, false positive and false negative values with the overall accuracy of the device performance was given in the percentage for lung cancer. The results of each individual study are presented. Meta-analysis was performed, the primary measures are pooled sensitivity and specificity, but, depending on the context, other diagnostic measures. Typically, reporting of the results includes information on the number of studies, number of patients and diagnostic measures can be calculated.

Sensitivity Analysis

The test result could be negative or above which it could be positive. With such a cut off, results of a diagnostic test could be placed in a 2 × 2 table with the test result. Positive predictive values, Negative predictive values, positive likelihood ratios, and negative likelihood ratios are the approaches which are used to synthesize diagnostic test accuracy studies. The relationship between the sensitivity-specificity pair will define the appropriate approach to synthesizing outcomes. Meta-analysis could be used to assess DTAs of the same condition, in which case the performance between tests should be described together with each test's individual performance.

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Forest Plot: EBUS-TBNA

EBUS-TBNA

The Diagnostic test accuracy is represented by the summary statistics and summary line from four sets of basic data, namely true positive (TP), false positive (FP), false negative (FN), and true negative (TN). Representative summary statistics are the sensitivity, specificity. A total of 33 studies were included in this meta-analysis Forest plot of sensitivity and specificity of detecting lung cancer with EBUS-TBNA+EUS-FNA with the 95 % CI for each population of the included studies (Figure 10).

Forest Plot: EUS-FNA

The Diagnostic test accuracy is represented by the summary statistics and summary line from four sets of basic data, namely TP, FP, FN, and TN. Representative summary statistics are the sensitivity, specificity. A total of 8 studies were included in this meta-analysis Forest plot of sensitivity and specificity of detecting Lung cancer with EBUS-FNA with the 95 % CI for each population of the included studies (Figure 11).

Forest Plot: EBUS-TBNA+EUS-FNA

The Diagnostic test accuracy is represented by the summary statistics and summary line from four sets of basic data, namely TP, FP, FN, and TN. Representative summary statistics are the sensitivity, specificity. A total of 26 studies were included in this meta-analysis Forest plot of sensitivity and specificity of detecting lung cancer with EBUS-TBNA+EUS-FNA with the 95% CI for each population of the included studies (Figure 12).

Forest Plot: TBNA

The Diagnostic test accuracy is represented by the summary statistics and summary line from four sets of basic data, namely true positive (TP), false positive (FP), false negative (FN), and true negative (TN). Representative summary statistics are the sensitivity, specificity. A total of 11 studies were included in this meta-analysis Forest plot of sensitivity and specificity of detecting Lung cancer with TBNA with the 95% CI for each population of the included studies (Figure 13).

Cumulative Analysis

The Diagnostic test accuracy is represented by the summary statistics and summary line from four sets of basic data, namely TP, FP, FN, and TN. Representative summary statistics are the sensitivity, specificity. Total cumulative 78 studies were included in this meta-analysis Forest plot of sensitivity and specificity of detecting Lung cancer with EBUS-TBNA Sensitivity 0.74(0.71, 0.77) and specificity 1.00(1.00,1.00) EBUS-TBNA/EUS-FNA 0.86(0.84,0.88), 0.98 (0.97, 0.99), EUS-FNA 0.75 (0.69, 0.80), 1.00(0.99, 1.00) and TBNA

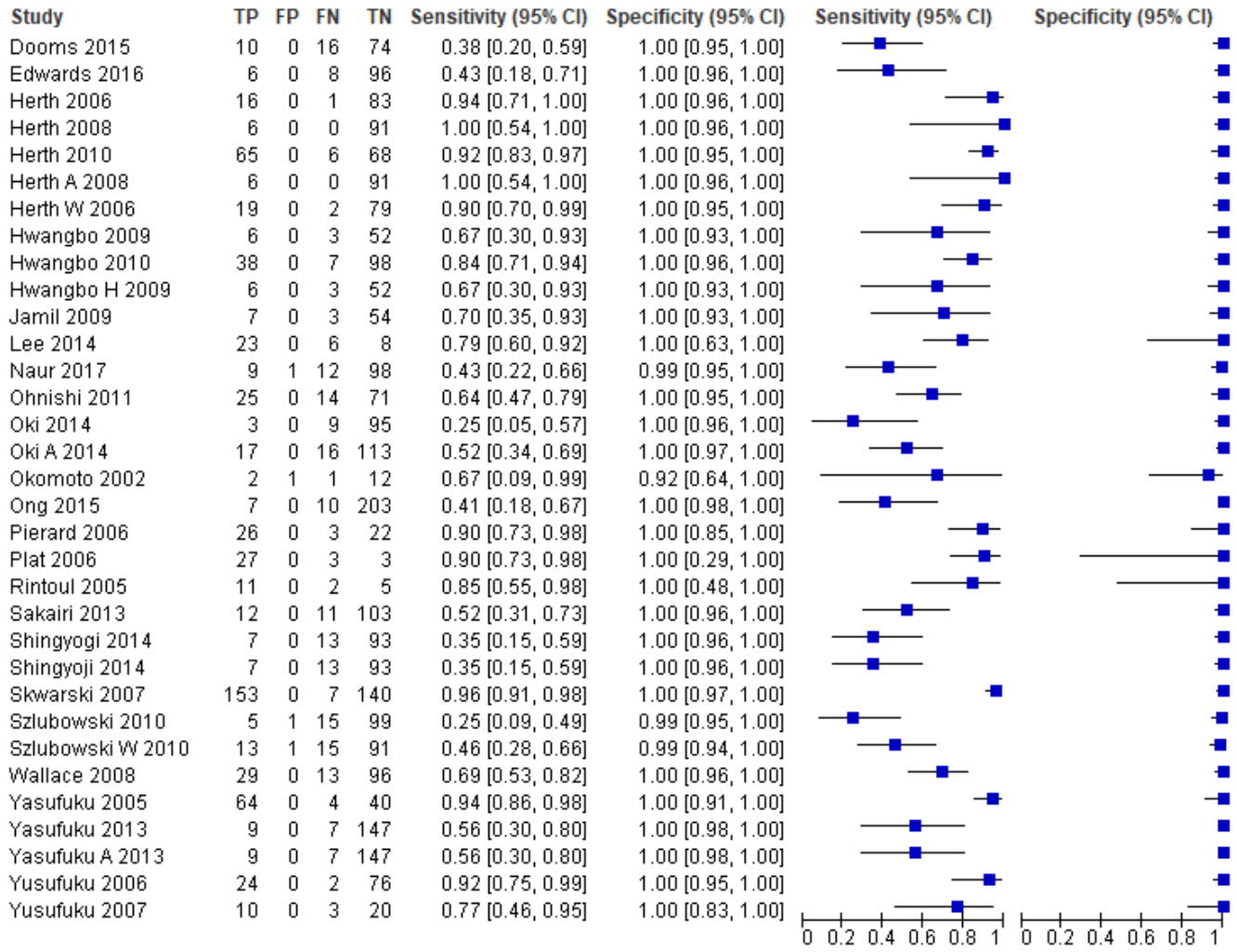

Figure 10: Forest plot for EBUS-TBNA

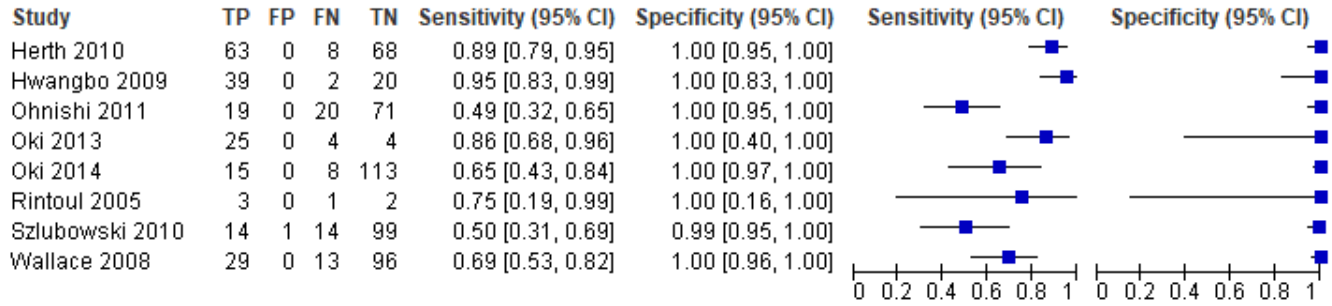

Figure 11: Forest plot for EUS-FNA

0.71 (0.67, 0.75), 0.98 (0.95, 1.00) with the 95% CI for each population of the included studies (Figure 14).

Receiver Operating Characteristic (ROC) Curve

The above ROC curve for Lung cancer shows EBUS-TBNA/EUS-FNA has outperformed with higher pooled sensitivity 0.86 (0.84,0.88), specificity 0.98 (0.97, 0.99) when compared to EBUS-TBNA, EUS-FNA, TBNA (Figure 15).

DISCUSSION

This meta-analysis evaluated the published literature for which oncological conditions EBUS-TBNA/EUS-FNA is likely to be shown to be diagnostically accurate compared to other available diagnostic modalities EBUS-TBNA, EUS-FNA, TBNA on lung cancer. The forest plot was plotted for lung cancers with a total of 78 studies and their sensitivity and

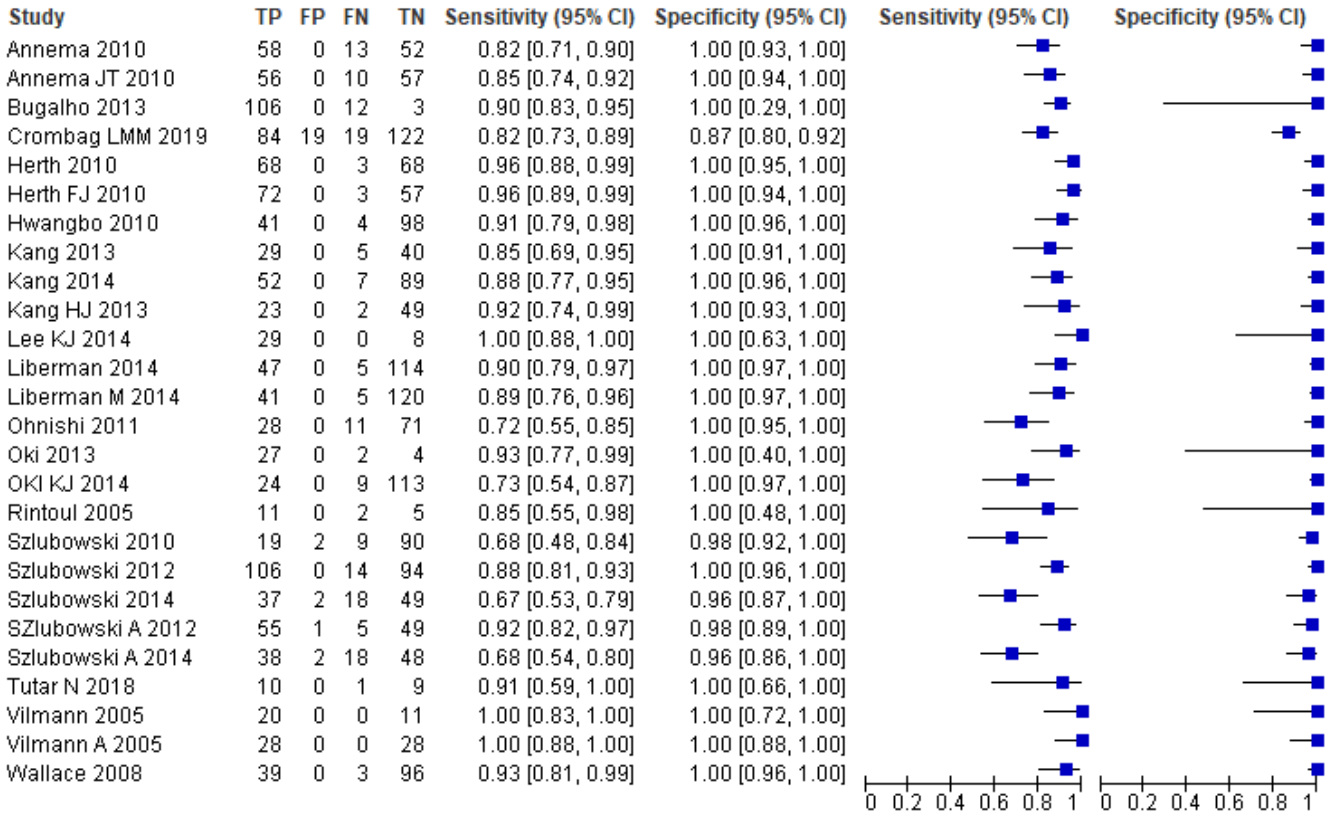

Figure 12: Forest plot for EBUS-TBNA+EUS-FNA

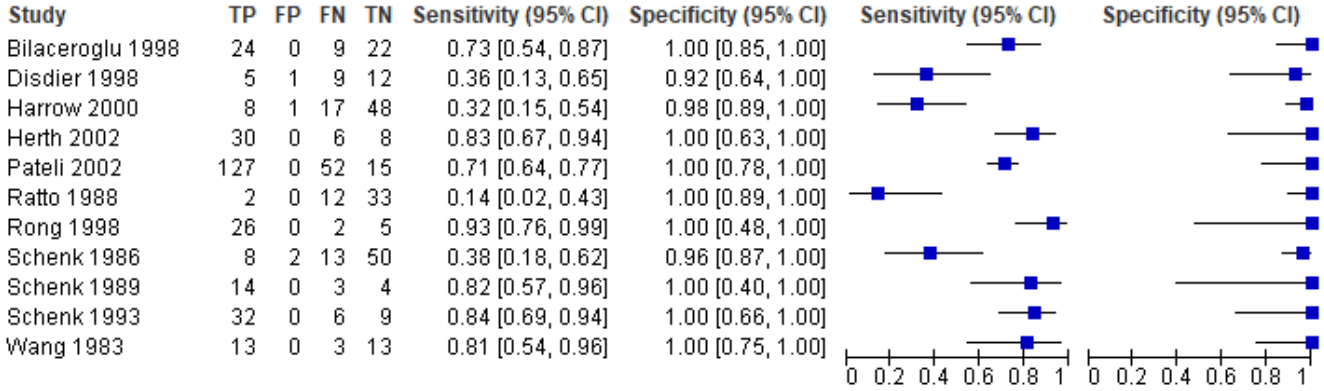

Figure 13: Forest plot for TBNA

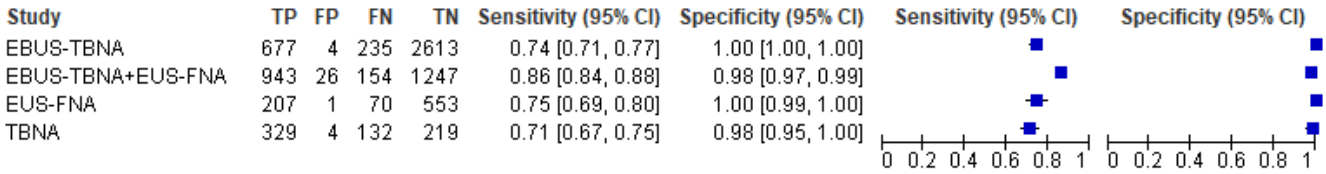

Figure 14: Cummulative Analysis

specificity was calculated. The pooled data for the cervical cancer with a sensitivity and specificity of EBUS-TBNA, EUS-FNA, TBNA and EBUS-TBNA/EUS-FNA in detecting lung cancer with sensitivity and specificity EBUS-TBNA sensitivity 0.74 (0.71, 0.77) and specificity 1.00 (1.00,1.00) EBUS-TBNA/EUS-FNA 0.86 (0.84,0.88), 0.98 (0.97, 0.99), EUS-FNA 0.75

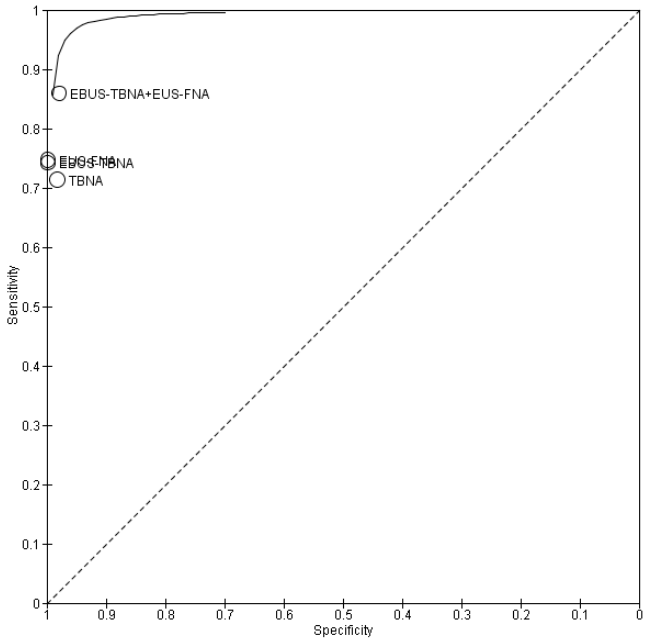

Figure 15: ROC Curve

(0.69, 0.80), 1.00 (0.99, 1.00) and TBNA 0.71 (0.67, 0.75), 0.98 (0.95, 1.00) with the 95% CI for each population of the included studies. Hence in ROC Curve EBUS-TBNA/EUS-FNA shown good sensitivity and specificity rather than EBUS-TBNA, EUS-FNA, TBNA. These findings have clinical implication in terms of providing useful information not only to radiologists in interpreting images but also choosing the imaging modality for the management of suspected Lung cancer patients.

CONCLUSION

Generally, EBUS-TBNA is used for real-time imaging and aspiration biopsy of mediastinal and hilar masses while EUS-FNA is used to assess the posteroinferior mediastinum (in stations. Since the first report of the combination of EBUS-TBNA and EUS-FNA for mediastinal staging, several studies have found that it can provide high sensitivity and specificity, which this review confirms by pooled analysis. As another advantage, this modality combination is more cost-effective than either EBUS-TBNA or EUS-FNA alone.[6] Meta-analysis assessing the combined approach of EBUS-TBNA and EUS-FNA for media stinal node staging of lung cancer. The current evidence suggests that the combined technique EBUS-TBNA/EUS-FNA is more effective than EBUS-TBNA or EUS-FNA alone. The diagnostic power of this combined technique is accurate. As an almost completely minimally invasive examination, EBUS-TBNA/EUS-FNA may replace more invasive method s for evaluating mediastinal node staging of lung cancer. Training in EUS techniques in addition to EBUS allows for diagnosis and complete staging of lung cancer in a single session, thereby decreasing healthcare cost, time delays, increased sedation time, and patient discomfort. With its superior cost-effectiveness and reduced risk profile compared to conventional mediastinoscopy, endoscopic approach has replaced mediastinoscopy as the initial step in lung cancer staging and diagnosis.[7]

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