INPLASY

Impact of Wet Suction on Specimen Quality and Diagnostic Accuracy in EUS-Guided Tissue Acquisition: A Systematic Review and Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - N/A.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202580029

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 9 August 2025 and was last updated on 9 August 2025.

INTRODUCTION

Review question / Objective To evaluate whether the wet-suction technique improves specimen quality and diagnostic accuracy compared with the conventional dry-suction technique in endoscopic ultrasound-guided tissue acquisition (EUS-TA) for solid lesions.

Rationale Endoscopic ultrasound-guided tissue acquisition (EUS-TA) is the gold standard for diagnosing many pancreatic and non-pancreatic solid lesions, but its diagnostic yield can be limited by poor specimen quality, including blood contamination, low cellularity, and tissue fragmentation. The wet-suction technique—prefilling the needle lumen with saline before aspiration—has been proposed to enhance vacuum force transmission, reduce air interference, and potentially improve tissue yield and diagnostic accuracy compared with the conventional dry-suction technique. Although individual randomized controlled trials have examined these two techniques, results remain inconsistent, and variations in lesion type, needle design, and procedural approach complicate interpretation. A systematic review and meta-analysis of RCTs is therefore warranted to clarify the comparative benefits of wet suction versus dry suction in EUS-TA and to inform evidence-based clinical practice.

Condition being studied Solid lesions of the gastrointestinal tract and adjacent organs (e.g., pancreas, lymph nodes, subepithelial tumors) requiring EUS-guided fine-needle aspiration (FNA) or fine-needle biopsy (FNB) for pathological diagnosis.

METHODS

Search strategy Two reviewers (P.-F.H. and H.-W.C.) independently searched PubMed, Embase, ClinicalKey, Cochrane CENTRAL, ProQuest, ScienceDirect, and Web of Science from inception to January 31, 2025. The search combined controlled vocabulary and free-text terms: ("endoscopic ultrasound" OR "fine needle

aspiration" OR "FNA" OR "fine needle biopsy" OR "FNB" OR "dry-suction" OR "wet-suction") AND ("pancreatic mass" OR "solid lesions"). To identify unpublished and ongoing trials, ClinicalTrials.gov was also searched. Reference lists of relevant review articles and included studies were manually screened for additional eligible trials. No language restrictions were applied.

Participant or population Human participants.

Intervention Wet-suction technique—prefilling the EUS needle with saline before aspiration to enhance tissue yield and reduce blood contamination.

Comparator Conventional dry-suction technique—aspiration performed with an air-filled EUS needle without saline preflush.

Study designs to be included Randomized controlled trials.

Eligibility criteria
Inclusion:

Randomized controlled trials (RCTs) in human participants.

Compared wet-suction vs. dry-suction techniques in EUS-guided tissue acquisition.

Reported at least one of the following outcomes: blood contamination score, cellularity score, integrity score, specimen adequacy, or diagnostic accuracy.

Information sources Electronic databases searched included PubMed, Embase, ClinicalKey, Cochrane CENTRAL, ProQuest, ScienceDirect, and Web of Science (from inception to January 31, 2025). ClinicalTrials.gov was searched for unpublished or ongoing studies. Reference lists of relevant reviews and included articles were manually screened. No language restrictions were applied.

Main outcome(s) Blood contamination score, cellularity score, and integrity score of specimens obtained by EUS-guided tissue acquisition.

Additional outcome(s) Diagnostic accuracy and specimen adequacy of EUS-guided tissue acquisition.

Data management Two reviewers independently extracted study data, including baseline characteristics, intervention details, and outcome measures, using a standardized form. Data accuracy was cross-checked, and discrepancies were resolved by a third reviewer. For missing or unclear information, corresponding authors were contacted. In crossover trials, only first-phase data were used to avoid carry-over effects. All extracted data were compiled in a shared database for analysis.

Quality assessment / Risk of bias analysis Methodological quality was assessed using the Cochrane Risk of Bias 2 (RoB 2) tool, evaluating:

Randomization process

Deviations from intended interventions (per-protocol approach)

Missing outcome data

Measurement of outcomes

Selection of reported results

Overall risk of bias

Two reviewers performed assessments independently; disagreements were resolved by a third reviewer. Studies were classified as low risk, some concerns, or high risk of bias for each domain and overall.

Strategy of data synthesis A random-effects meta-analysis was conducted using Comprehensive Meta-Analysis (CMA) version 4 to account for expected clinical and methodological variability.

Effect measures:

Continuous outcomes (blood contamination, cellularity, integrity) → Hedges' g with 95% CIs.

Dichotomous outcomes (diagnostic accuracy, specimen adequacy) → Risk ratios (RRs) with 95% CIs.

Heterogeneity: Assessed with I^2 (25%, 50%, 75% indicating low, moderate, high heterogeneity) and Cochran's Q test.

Sensitivity analyses: Leave-one-out method to test robustness.

Publication bias: Assessed by funnel plot inspection and Egger's test.

Only first-phase data from crossover studies were included to avoid carry-over effects.

Subgroup analysis Preplanned subgroup analyses were performed by needle type:

EUS-FNA (fine-needle aspiration)

EUS-FNB (fine-needle biopsy)

Outcomes analyzed separately included diagnostic accuracy and specimen adequacy to evaluate whether the effect of wet suction differed by needle type.

Sensitivity analysis A leave-one-out approach was applied, sequentially removing each study to assess the stability of pooled estimates for all primary and secondary outcomes. This tested whether any single study disproportionately influenced the overall results.

Language restriction No language limit.

Country(ies) involved Taiwan.

Keywords Endoscopic ultrasound, fine-needle aspiration, fine-needle biopsy, wet suction, dry suction, tissue acquisition, specimen quality, diagnostic accuracy, meta-analysis.

Contributions of each author

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