

# Comparison between EUS-FNAC Results and Final Histopathology Results for Diagnosing Intra-Abdominal Lesions

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## ARTICLE INFO

**Received:** 09 September 2026  
**Accepted:** 18 September 2026  
**Published Online:** 23 September 2026

DOI: 10.5281/zenodo.22920141

Volume: 10, Number: 2, Page: 579-584

e-ISSN: 2789-5912  
 ISSN: 2617-0817

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## ABSTRACT

**Background:** Intra-abdominal lesions, including pancreatic, hepatobiliary, gastrointestinal, and lymph nodal masses, pose a diagnostic challenge because imaging alone cannot reliably distinguish benign from malignant disease. Endoscopic ultrasound-guided fine needle aspiration cytology (EUS-FNAC) permits real-time, minimally invasive sampling of otherwise inaccessible lesions, yet its performance against final histopathology in a South Asian tertiary-care setting remains insufficiently documented. **Objective:** To compare the diagnostic accuracy of EUS-FNAC with final histopathological examination in patients with intra-abdominal lesions. **Methods & Materials:** This observational analytical study was conducted in the Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from January 2016 to February 2017. Twenty-five patients with intra-abdominal lesions underwent EUS-FNAC, and findings were compared with final histopathology, the reference standard. Sensitivity, specificity, predictive values, and diagnostic accuracy were calculated, and complications recorded. **Results:** The mean age was  $50.04 \pm 18.89$  years, and 68.0% were male. Pancreatic lesions were commonest (64.0%). FNAC identified malignancy in 72.0% of cases, while histopathology confirmed malignancy in 84.0%. Among 24 evaluable patients, EUS-FNAC showed a sensitivity of 90.0%, specificity of 100.0%, positive predictive value of 100.0%, negative predictive value of 66.67%, and diagnostic accuracy of 91.67%. Complications occurred in 28.0% of patients, all minor, most commonly abdominal pain (20.0%), with no factor significantly associated with their occurrence. **Conclusion:**

EUS-FNAC demonstrates high sensitivity, specificity, and diagnostic accuracy for intra-abdominal lesions against final histopathology, with an acceptable and predominantly minor complication profile, supporting its role as a reliable first-line tissue-sampling modality.

**Keywords:** Endoscopic ultrasound; fine needle aspiration cytology; histopathology; intra-abdominal lesions; diagnostic accuracy.

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## INTRODUCTION

Intra-abdominal lesions arising from the pancreas, hepatobiliary tree, gastrointestinal tract, lymph nodes, and adrenal glands remain among the most challenging diagnostic problems in surgical and gastroenterology practice. Among these, pancreatic masses carry particular importance because pancreatic cancer is among the most lethal solid-organ malignancies worldwide, with a five-year survival rate below ten percent despite advances in imaging and treatment [1]. Globally, the incidence and mortality of pancreatic cancer have risen steadily over the past three decades, with more than half a million new cases and a comparable number of deaths recorded annually according to recent Global Burden of Disease estimates [2]. A substantial proportion of this burden is attributable to modifiable risk factors such as tobacco smoking, which alone accounts for more than one-fifth of pancreatic cancer deaths

worldwide [3]. Because early-stage disease is frequently silent, most intra-abdominal malignancies, whether pancreatic, hepatobiliary, or nodal in origin, are diagnosed only after they have become locally advanced or unresectable, underscoring the need for accurate and minimally invasive diagnostic tools that can be applied early in the clinical pathway. Conventional cross-sectional imaging modalities, including transabdominal ultrasonography and computed tomography, are valuable for lesion detection and anatomical localization but are frequently unable to reliably differentiate benign from malignant pathology, particularly for small or deep-seated lesions adjacent to the gastrointestinal lumen. Endoscopic ultrasound-guided fine needle aspiration cytology (EUS-FNAC) has therefore emerged as a pivotal tool that combines high-resolution real-time imaging with the

ability to obtain cytological material directly from the lesion under direct visualization, avoiding many of the risks associated with percutaneous or surgical biopsy. Since its introduction, EUS-FNAC has been increasingly applied to a wide spectrum of intra-abdominal pathologies, including solid pancreatic masses, gastrointestinal stromal tumors, hepatobiliary lesions, adrenal masses, and unexplained abdominal lymphadenopathy, with reported diagnostic accuracies generally exceeding eighty percent [4,5]. Several single-center and multicenter studies have evaluated EUS-FNAC against final histopathology, consistently reporting high specificity but more variable sensitivity depending on lesion type, needle gauge, number of passes, and on-site cytological adequacy assessment [6,7]. Studies addressing intra-abdominal lymphadenopathy of unknown origin have similarly shown that EUS-FNAC can obviate more invasive diagnostic surgery

while providing sufficient material for immunohistochemical evaluation [8,9]. Technical refinements, including fine needle biopsy devices, needle-gauge optimization, and rapid on-site evaluation, have been explored to further improve diagnostic yield, although evidence for their incremental benefit remains inconsistent [10,11].

Despite this growing evidence base, data from South Asia, and Bangladesh in particular, remain limited, and most published accuracy figures for EUS-FNAC derive from higher-resource settings with different disease spectrums and sampling protocols. Given the resource constraints, high burden of tuberculosis-related lymphadenopathy, and evolving endoscopic ultrasound expertise within our region, locally generated evidence on the accuracy of EUS-FNAC against final histopathology is essential to guide its rational use in routine surgical practice. This study was therefore undertaken to compare EUS-FNAC findings with final histopathological diagnosis in patients with intra-abdominal lesions at a tertiary-care university hospital in Bangladesh, establishing the sensitivity, specificity, predictive values, and overall diagnostic accuracy of this technique, alongside its complication profile, in a real-world South Asian surgical setting.

## METHODS & MATERIALS

This was an observational analytical study conducted in the general surgery unit, Department of Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, between January 2016 and February 2017. The study population comprised 25 patients presenting with clinically or radiologically suspected intra-abdominal lesions who underwent endoscopic ultrasound-guided fine needle aspiration cytology (EUS-FNAC) followed by histopathological confirmation as the reference standard.

### Selection Criteria

#### Inclusion criteria:

- Patients presenting with a clinically or radiologically suspected intra-abdominal lesion accessible to endoscopic ultrasound

- Patients aged above 12 years, of either sex
- Patients willing and able to provide written informed consent

#### Exclusion criteria:

- Patients with uncorrectable coagulopathy or bleeding diathesis
- Lesions inaccessible to the endoscope or obscured by intervening vessels
- Patients unfit for endoscopic sedation or unwilling to provide consent
- Pregnant patients

#### Data Collection Procedure

All patients presenting to the general surgery unit with clinically or radiologically suspected intra-abdominal lesions were screened against the eligibility criteria, and those who fulfilled the inclusion criteria and provided written informed consent were enrolled consecutively until the target sample size was reached. Baseline sociodemographic and clinical information, including age, sex, religion, socioeconomic status, presenting complaints, and duration of symptoms, was recorded on a pre-tested structured data collection sheet through direct patient interview and physical examination. All patients underwent a linear-array endoscopic ultrasound examination performed by an experienced endosonographer, during which the number, size, location, and echogenic characteristics of the lesion were documented. EUS-guided fine needle aspiration cytology was performed under conscious sedation using a 22-gauge needle, with three to four needle passes obtained from each lesion according to institutional protocol to ensure adequate cellularity. Aspirated material was immediately smeared onto glass slides, fixed, and stained, and the smears were reported by an experienced cytopathologist blinded to the final histopathological outcome. Immediate and delayed procedure-related complications were monitored clinically for twenty-four hours after the procedure and recorded on a standard proforma. Definitive tissue

diagnosis was subsequently obtained through image-guided or surgical biopsy and processed by the Department of Pathology, and histopathological findings were treated as the reference standard against which cytological results were compared. To ensure accuracy, reliability, and consistency, all data collection instruments were pre-tested, a single trained investigator performed data extraction, and the cytopathologist and reporting pathologist remained blinded to each other's findings throughout the study. Patient confidentiality was strictly maintained throughout the study; all data were coded, stored securely, and used solely for research purposes with prior ethical approval from the institutional review board.

#### Statistical Analysis

Data were entered and analyzed using SPSS version 25.0. Quantitative variables were expressed as mean  $\pm$  standard deviation, and categorical variables as frequency and percentage. Sensitivity, specificity, predictive values, diagnostic accuracy, and 95% confidence intervals (Wilson method) were calculated using final histopathology as the reference standard. The Welch independent t-test and Fisher's exact test were used to compare complication-related factors, with  $p < 0.05$  considered statistically significant.

## RESULTS

A total of 25 patients with intra-abdominal lesions were included in the study. *Table I* shows the baseline characteristics of the study population. The mean age of the participants was  $50.04 \pm 18.89$  years, with an age range of 14–77 years. Most participants were male (17, 68.0%) and Muslim (23, 92.0%). Regarding socioeconomic status, 13 (52.0%) participants were from the lower socioeconomic class, 10 (40.0%) from the middle class, and 2 (8.0%) from the upper class. A palpable abdominal lump was present in 24 (96.0%) patients, while 19 (76.0%) reported abdominal pain. Constitutional symptoms were present in 6 (24.0%) patients.

**Table I**

Baseline characteristics of the study population (n=25).

| Characteristic          | Frequency, n           | Percentage, %              |
|-------------------------|------------------------|----------------------------|
| Age (years)             | Mean $\pm$ SD<br>Range | 50.04 $\pm$ 18.89<br>14–77 |
| Gender                  | Male<br>Female         | 17<br>8                    |
|                         | Lower                  | 13                         |
| Socioeconomic status    | Middle                 | 10                         |
|                         | Upper                  | 2                          |
| Palpable abdominal lump | Yes<br>No              | 24<br>1                    |
| Abdominal pain          | Yes<br>No              | 19<br>6                    |
| Constitutional symptoms | Yes<br>No              | 6<br>19                    |
|                         |                        | 24.0<br>76.0               |

Table II presents the EUS findings and diagnostic results. On EUS examination, pancreatic lesions were the most frequently identified, accounting for 16 (64.0%) cases, followed by lymphadenopathy in 5 (20.0%), adrenal masses in 2 (8.0%), and

hepatobiliary and gastrointestinal tract lesions in 1 (4.0%) patient each. All 25 patients underwent EUS-FNAC with 3–4 needle passes according to institutional protocol. FNAC yielded a malignant result in 18 (72.0%) patients, a benign result in 6

(24.0%), and a non-diagnostic result in 1 (4.0%). On final histopathological examination, 21 (84.0%) lesions were malignant and 4 (16.0%) were benign.

**Table II**

EUS findings and diagnostic results (n=25).

| Variable                      | Frequency, n | Percentage, % |
|-------------------------------|--------------|---------------|
| Hepatobiliary lesion          | 1            | 4.0           |
| Pancreatic lesion             | 16           | 64.0          |
| Gastrointestinal tract lesion | 1            | 4.0           |
| Lymphadenopathy               | 5            | 20.0          |
| Adrenal mass                  | 2            | 8.0           |
| Needle passes, 3–4            | 25           | 100.0         |
| FNAC – Non-diagnostic         | 1            | 4.0           |
| FNAC – Benign                 | 6            | 24.0          |
| FNAC – Malignant              | 18           | 72.0          |
| Histopathology – Benign       | 4            | 16.0          |
| Histopathology – Malignant    | 21           | 84.0          |

Table III describes the cross-tabulation and diagnostic performance of EUS-FNAC against final histopathology. For diagnostic accuracy analysis, the single non-diagnostic FNAC result was excluded, leaving 24 evaluable patients, of whom 20 had malignant and 4 had benign

histopathological findings. FNAC correctly identified 18 of the 20 malignant lesions and all 4 benign lesions, with 2 false-negative and no false-positive results. The sensitivity of EUS-FNAC for detecting malignancy was 90.0% (95% CI: 69.90–97.21), specificity was 100.0% (95% CI:

51.01–100.00), positive predictive value was 100.0% (95% CI: 82.41–100.00), negative predictive value was 66.67% (95% CI: 30.00–90.32), and overall diagnostic accuracy was 91.67% (95% CI: 74.15–97.68).

**Table III (A)**

Cross-tabulation of FNAC results and final histopathology (n=24).

| FNAC result | Histopathology benign, n | Histopathology malignant, n | Total, n |
|-------------|--------------------------|-----------------------------|----------|
| Benign      | 4                        | 2                           | 6        |
| Malignant   | 0                        | 18                          | 18       |
| Total       | 4                        | 20                          | 24       |

**Table III (B)**  
Diagnostic performance of EUS-FNAC.

| Diagnostic measure          | Estimate (%) | 95% CI       |
|-----------------------------|--------------|--------------|
| Sensitivity                 | 90           | 69.90–97.21  |
| Specificity                 | 100          | 51.01–100.00 |
| Positive predictive value   | 100          | 82.41–100.00 |
| Negative predictive value   | 66.67        | 30.00–90.32  |
| Overall diagnostic accuracy | 91.67        | 74.15–97.68  |

Note: One non-diagnostic FNAC case was excluded from diagnostic accuracy analysis (n=24). Final histopathology was considered the reference standard; malignant FNAC was test-positive and benign FNAC test-negative. Confidence intervals were calculated using the Wilson method.

Receiver operating characteristic (ROC) curve analysis of FNAC findings against final histopathology yielded an area under

the curve of 0.929 (p=0.008; 95% CI: 0.826–1.031), indicating excellent overall discriminative performance of EUS-FNAC.

Table IV shows the selected factors associated with complications following EUS-FNAC. Seven patients (28.0%) developed complications, most commonly abdominal pain in 5 (20.0%) patients, while aspiration occurred in 2 (8.0%) patients; all reported complications were minor, and no major complication was

documented. There was no statistically significant association between the occurrence of complications and age, gender, abdominal pain, EUS lesion category, or FNAC result (all p>0.05). The mean age was 51.22 ± 19.45 years among patients without complications and 47.00 ± 17.86 years among those with complications (p=0.59).

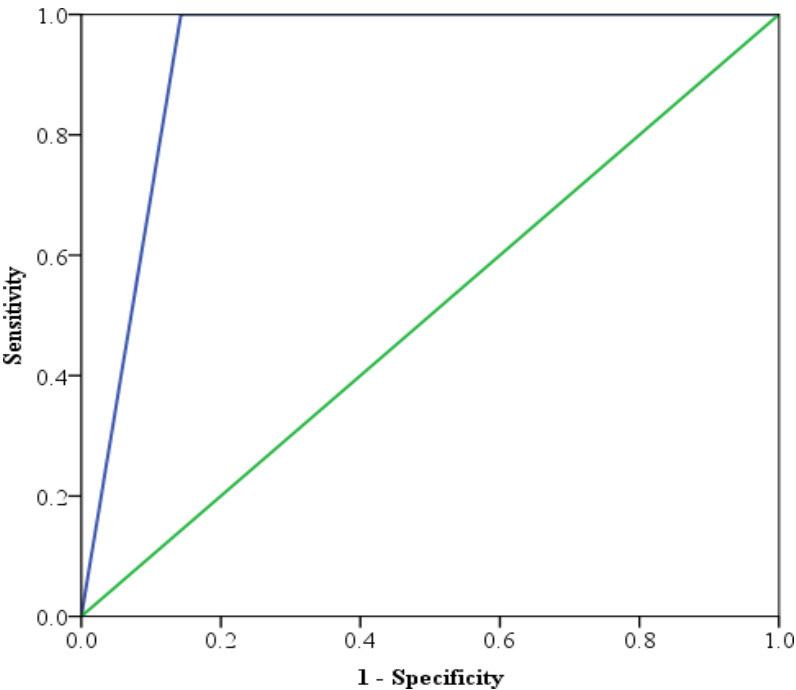


**Table IV**  
Selected factors associated with complications following EUS-FNAC.

| Variable              | No complication (n=18) | Complication (n=7) | p-value |
|-----------------------|------------------------|--------------------|---------|
| Age, mean ± SD, years | 51.22 ± 19.45          | 47.00 ± 17.86      | 0.59    |
| Male                  | 11 (61.1)              | 6 (85.7)           | 0.36    |
| Female                | 7 (38.9)               | 1 (14.3)           |         |
| Abdominal pain – Yes  | 12 (66.7)              | 7 (100.0)          | 0.14    |
| Abdominal pain – No   | 6 (33.3)               | 0 (0.0)            |         |
| Pancreatic lesion     | 13 (72.2)              | 3 (42.9)           | 0.2     |
| Other lesion          | 5 (27.8)               | 4 (57.1)           |         |
| FNAC benign           | 4 (22.2)               | 3 (42.9)           | 0.36    |
| FNAC malignant        | 14 (77.8)              | 4 (57.1)           |         |

Note: Welch independent t-test was used for age; Fisher’s exact test was used for categorical variables with sparse cell counts.

**DISCUSSION**

In the present study, EUS-FNAC demonstrated a sensitivity of 90.0%, specificity of 100.0%, positive predictive value of 100.0%, negative predictive value of 66.67%, and an overall diagnostic accuracy of 91.67% against final

histopathology, findings broadly consistent with the wider literature. Rawla et al. describe pancreatic cancer as a disease that is rarely detected early because it remains clinically silent until locally advanced, which explains why pancreatic lesions constituted most cases in the present cohort

and why malignancy was ultimately confirmed in 84.0% of patients on histopathology [1]. Nigam et al. reported a diagnostic accuracy exceeding ninety percent for EUS-FNA cytology in a large series of 288 pancreatic aspirates, closely mirroring the accuracy obtained here [4].

Similarly, Banafea et al., pooling twenty diagnostic accuracy studies, found a sensitivity of 90.8% and specificity of 96.5% for EUS-FNA in solid pancreatic lesions, values that align almost exactly with the sensitivity of 90.0% observed here, although the specificity recorded in this study was somewhat higher [5]. This correspondence lends external validity to the present findings despite the comparatively small sample size.

The specificity and positive predictive value of 100.0% found in this study indicate that a malignant cytological diagnosis on EUS-FNAC can be accepted with high confidence, a pattern also observed by Ding et al., who reported a specificity and positive predictive value of 100% for EUS-FNAB across a heterogeneous group of intra-abdominal masses, even though their overall sensitivity was comparatively lower at 76.1% [12]. The lower negative predictive value of 66.67% recorded here, driven by two false-negative results among twenty evaluable malignant cases, echoes a recurring limitation described across the literature, in which a benign cytological result cannot fully exclude malignancy and mandates close follow-up or repeat sampling. Wang et al. similarly emphasized the high overall diagnostic yield of EUS-FNAC for mediastinal and intra-abdominal lymphadenopathy while cautioning that false-negative aspirates remain an inherent limitation of a cytology-based technique that samples only a fraction of the target lesion [6]. Comparable findings were reported by Pausawasdi et al., whose combined cytology and cell-block analysis of intra-abdominal mass lesions likewise achieved strong sensitivity and specificity but could not entirely eliminate sampling-related false negatives, prompting these authors to recommend combined cytological and histological assessment wherever feasible [7,8].

The 25 evaluable patients in the present cohort are considerably fewer than in most published series, several of which included over one hundred patients and reported narrower confidence intervals around their accuracy estimates [9,10]. Facciorusso et al., in a propensity-matched multicenter comparison, found that fine needle biopsy needles achieved higher diagnostic accuracy than conventional aspiration needles for abdominal lymph node sampling, suggesting that some false-negative results in FNA-based series, including the present study, might be reduced through core biopsy needles that preserve tissue architecture [13]. Comparable gains with fine needle biopsy over conventional aspiration have also been demonstrated in solid pancreatic lesions, with Renelus et al. reporting a pooled sensitivity advantage for biopsy needles in a meta-analysis [14]. Camus et al.

further showed that repeat sampling can rescue the diagnosis in a substantial proportion of initially non-diagnostic or false-negative pancreatic aspirates, an approach that may similarly benefit cases such as the two false negatives identified in the present cohort [15].

The role of rapid on-site cytological evaluation remains contested; Kong et al., in a meta-analysis of seven studies, found no significant improvement in diagnostic adequacy or accuracy with on-site evaluation for pancreatic masses, consistent with the present study, in which a fixed protocol of three to four passes without on-site evaluation nonetheless achieved high diagnostic accuracy [16]. This suggests a standardized multi-pass protocol may be a reasonable, resource-efficient alternative where on-site cytopathology support is unavailable.

The complication rate of 28.0% recorded in this study, composed exclusively of minor, self-limiting events such as transient abdominal pain and aspiration, is higher than rates typically cited in larger international series, which generally range from one to five percent for major adverse events [17]. This discrepancy most plausibly reflects differences in complication definitions and reporting thresholds, since minor, transient symptoms are captured more consistently within a small, closely monitored cohort than in larger retrospective databases. Reassuringly, and consistent with previous reports, none of the factors examined, including age, gender, abdominal pain, lesion category, or FNAC result, were significantly associated with complications, supporting the overall safety of EUS-FNAC across differing patient and lesion profiles when performed by experienced endosonographers using standardized needle-pass protocols.

## LIMITATION & RECOMMENDATIONS

This study has certain limitations that merit consideration. The sample size was relatively small and drawn from a single tertiary-care center, which may limit generalizability and resulted in wide confidence intervals around some diagnostic estimates, particularly the negative predictive value. The absence of rapid on-site cytological evaluation and use of a fixed needle-pass protocol may also have influenced diagnostic yield. Future multicenter studies with larger sample sizes, standardized needle-pass protocols, and longer follow-up are recommended to validate these findings and further define the role of EUS-FNAC across the spectrum of intra-abdominal pathology encountered in this region.

## CONCLUSION

This study demonstrates that EUS-FNAC offers high sensitivity, specificity, and

overall diagnostic accuracy for intra-abdominal lesions when validated against final histopathology, with an acceptable complication profile confined largely to minor, self-limiting events. Given its minimally invasive nature and reliable performance, EUS-FNAC can be recommended as an effective diagnostic modality for intra-abdominal lesions in resource-limited settings such as Bangladesh. Wider adoption, supported by adequate endosonography training, may reduce reliance on invasive diagnostic surgery and expedite appropriate oncological management.

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