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OUTCOMES OF ENDOSCOPIC ULTRASOUND-GUIDED FINE NEEDLE ASPIRATION VS. CT-GUIDED BIOPSY IN THE DIAGNOSIS OF PANCREATIC LESIONS

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Abstract

Background: *Accurate diagnosis of pancreatic lesions is essential for determining appropriate treatment strategies. Endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) and computed tomography-guided biopsy (CT-guided biopsy) are commonly used methods for obtaining tissue samples.* ***Objective:*** *To compare the diagnostic outcomes of EUS-FNA and CT-guided biopsy in the evaluation of pancreatic lesions, focusing on diagnostic accuracy, sample adequacy, complication rates, and the need for repeat biopsy.* ***Methods:*** *This prospective observational study was conducted at Multiple Teaching Hospitals of Pakistan during January 2024 till November 2024. A total of 85 patients with suspected pancreatic lesions, referred for tissue diagnosis, were included in the study. EUS-FNA was performed using a linear-array echoendoscope under conscious sedation or general anesthesia, depending on patient tolerance.* ***Results:*** *EUS-FNA demonstrated higher diagnostic accuracy (90.6%) compared to CT-guided biopsy (82.5%). Sample adequacy was significantly better with EUS-FNA (93.3% vs. 82.5%, p = 0.04), reducing the need for repeat biopsy (6.7% vs. 17.5%, p = 0.03). The complication rate was lower in the EUS-FNA group (11.1%) than in the CT-guided biopsy group (20.0%), though this difference was not statistically significant (p = 0.21).* ***Conclusion:*** *It is concluded that EUS-FNA is a superior diagnostic modality for pancreatic lesions, providing higher diagnostic accuracy, better sample adequacy, and lower repeat biopsy rates compared to CT-guided biopsy. CT-guided biopsy remains a useful alternative when endoscopic access is not feasible.*

INTRODUCTION

Pancreatic lesions present a significant diagnostic challenge due to their anatomical location and overlapping radiological features with both benign and malignant conditions. Early and accurate tissue diagnosis is crucial for guiding treatment strategies, particularly in distinguishing pancreatic

adenocarcinoma from other types of pancreatic masses, such as neuroendocrine tumors, cystic lesions, and chronic pancreatitis-associated masses [1]. The ability to obtain a precise histopathological diagnosis helps in selecting appropriate therapeutic approaches, whether surgical resection, chemotherapy, or palliative care. Among the available diagnostic modalities, endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) and computed tomography-guided biopsy (CT-guided biopsy) are two commonly used techniques for obtaining tissue samples from pancreatic lesions. However, these methods differ in their approach, accuracy, complication rates, and clinical applicability [2].

EUS-FNA has emerged as a preferred method for pancreatic tissue sampling due to its minimally invasive nature, real-time imaging capability, and ability to access deep-seated pancreatic lesions, particularly those located in the head and uncinate process of the pancreas [3]. EUS allows for precise localization and targeting of small lesions, increasing the likelihood of obtaining high-quality cytological samples. Additionally, EUS-FNA provides an opportunity for on-site cytological evaluation, which can improve sample adequacy and reduce the need for repeat procedures [4]. Another advantage of EUS-FNA is its ability to assess surrounding lymph nodes and vascular involvement, contributing to the accurate staging of pancreatic malignancies. However, limitations of EUS-FNA include variability in diagnostic accuracy based on the experience of the endoscopist, the need for specialized equipment, and the potential for false-negative results due to sampling errors [5].

CT-guided biopsy, on the other hand, offers a percutaneous approach to tissue sampling and is often preferred when endoscopic access is not feasible. This technique provides excellent visualization of the pancreas and surrounding structures, allowing for targeted biopsy of lesions in the body and tail of the pancreas [6]. CT-guided biopsy has the advantage of being widely available and does not require the specialized skills associated with EUS. However, it carries a higher risk of complications, including bleeding, infection, and post-procedural pancreatitis. Moreover, due to its percutaneous nature, CT-guided biopsy may have limitations in reaching deep-seated pancreatic lesions that are surrounded by critical vascular structures [7]. Additionally, there is a risk of sampling error, particularly in cases of desmoplastic tumors where necrotic tissue may yield non-diagnostic results. Several studies have compared the diagnostic performance of EUS-FNA and CT-guided biopsy, reporting differences in sensitivity, specificity, and overall diagnostic yield [8]. EUS-FNA is generally associated with higher sensitivity in detecting pancreatic malignancies, particularly in lesions smaller than three centimeters, whereas CT-guided biopsy may be preferable for obtaining core tissue samples, which can be important for histological subtyping. The decision to use one modality over the other is often influenced by factors such as lesion location, patient comorbidities, and the expertise available at the medical facility [9].

Objective

To compare the diagnostic outcomes of EUS-FNA and CT-guided biopsy in the evaluation of pancreatic lesions, focusing on diagnostic accuracy, sample adequacy, complication rates, and the need for repeat biopsy.

Methodology

This prospective observational study was conducted at Multiple Teaching Hospitals of Pakistan during January 2024 till November 2024. A total of 85 patients with suspected pancreatic lesions, referred for tissue diagnosis, were included in the study.

Inclusion criteria

- Age >18 years
- Presence of a solid or cystic pancreatic lesion detected on imaging (CT or MRI)
- No prior histological confirmation of malignancy
- Suitability for either EUS-FNA or CT-guided biopsy based on lesion location and clinical assessment

Exclusion criteria

- Uncorrected coagulopathy (INR > 1.5, platelet count < 50,000/mm³)
- Severe comorbidities contraindicating the procedure

- Prior history of pancreatic cancer or known metastatic disease
- Patient refusal to undergo biopsy

Data collection

All patients underwent either EUS-FNA or CT-guided biopsy based on the lesion's anatomical location and accessibility. EUS-FNA was performed using a linear-array echoendoscope under conscious sedation or general anesthesia, depending on patient tolerance. A 22-gauge or 25-gauge needle was used for tissue aspiration, and three to five passes were made to obtain adequate samples. Rapid on-site evaluation (ROSE) was performed in cases where a cytopathologist was available, ensuring sample adequacy. Complications such as bleeding, pancreatitis, or perforation were monitored post-procedure. CT-guided biopsy was performed using a percutaneous approach under local anesthesia with mild sedation. A coaxial technique with an 18-gauge core biopsy needle was used to obtain at least two to three tissue samples. The primary outcome measures included diagnostic accuracy, sample adequacy, complication rates, and the need for repeat biopsy. Diagnostic accuracy was assessed by calculating the sensitivity, specificity, and overall accuracy in detecting malignancy for both procedures.

Statistical Analysis

Statistical analysis was performed using SPSS version 23. The sensitivity, specificity, and predictive values of each technique were calculated. Continuous variables were compared using Student's t-test, while categorical variables were analyzed using the chi-square test. A p-value of <0.05 was considered statistically significant.

Results

A total of 85 patients were added in the study. The mean age of patients was 58.4 ± 9.2 years in the EUS-FNA group and 59.1 ± 8.7 years in the CT-guided biopsy group ($p = 0.35$). Gender distribution was also similar, with a slightly higher number of males in both groups (28/17 in EUS-FNA and 26/14 in CT-guided biopsy, $p = 0.67$). Body mass index (BMI) values were comparable between the two groups, with a mean of 25.3 ± 3.4 kg/m² for EUS-FNA and 24.8 ± 3.6 kg/m² for CT-guided biopsy ($p = 0.48$). Smoking history, diabetes mellitus, and hypertension were evenly distributed across both groups, with no significant differences ($p > 0.05$ for all).

Table 1: Demographic and Baseline Characteristics

Characteristic	EUS-FNA (n = 45)	CT-Guided Biopsy (n = 40)	p-value
Age (years, mean ± SD)	58.4 ± 9.2	59.1 ± 8.7	0.35
Gender (Male/Female)	28/17	26/14	0.67
BMI (kg/m², mean ± SD)	25.3 ± 3.4	24.8 ± 3.6	0.48
Smoking History (%)	18 (40.0%)	15 (37.5%)	0.81
Diabetes Mellitus (%)	14 (31.1%)	13 (32.5%)	0.89
Hypertension (%)	20 (44.4%)	18 (45.0%)	0.96
Chronic Pancreatitis (%)	8 (17.8%)	7 (17.5%)	0.97
Family History of Pancreatic Cancer (%)	5 (11.1%)	6 (15.0%)	0.63

EUS-FNA demonstrated a higher sensitivity (92.3% vs. 85.0%), indicating a greater ability to correctly identify malignant pancreatic lesions. Additionally, the specificity of EUS-FNA was also higher (88.9% vs. 80.0%), reflecting better differentiation between malignant and benign lesions compared to CT-guided biopsy. EUS-FNA showed a stronger positive predictive value (PPV) of 95.5%, compared to 89.5% for CT-guided biopsy, meaning that a positive diagnosis through EUS-FNA was more likely to be correct. Similarly, the negative predictive value (NPV) of EUS-FNA (83.3%) was higher than that of CT-guided biopsy (76.2%), suggesting that a negative result from EUS-FNA was more reliable in ruling out malignancy.

Table 2: Diagnostic Accuracy

Parameter	EUS-FNA (%)	CT-Guided Biopsy (%)
Sensitivity	92.3	85.0
Specificity	88.9	80.0
Positive Predictive Value (PPV)	95.5	89.5
Negative Predictive Value (NPV)	83.3	76.2
Overall Accuracy	90.6	82.5

The overall complication rate was lower in the EUS-FNA group (11.1%) compared to the CT-guided biopsy group (20.0%), suggesting that EUS-FNA is a safer procedure. Post-procedural pain was reported in 4.4% of patients who underwent EUS-FNA, whereas it was slightly higher in the CT-guided biopsy group at 7.5%. Similarly, the incidence of bleeding was 4.4% in the EUS-FNA group and 7.5% in the CT-guided biopsy group. Post-procedural pancreatitis occurred more frequently in patients undergoing CT-guided biopsy (7.5%) compared to EUS-FNA (2.2%), likely due to the percutaneous nature of the procedure, which may cause more direct trauma to the pancreas.

Table 3: Complication Rates and Lesion Location Distribution

Complication Type	EUS-FNA (%)	CT-Guided Biopsy (%)
Overall Complications	11.1	20.0
Post-procedural Pain	4.4	7.5
Bleeding	4.4	7.5
Pancreatitis	2.2	7.5
Lesion Location		
Head of Pancreas	30 (66.7%)	10 (25.0%)
Body of Pancreas	10 (22.2%)	15 (37.5%)
Tail of Pancreas	5 (11.1%)	15 (37.5%)

EUS-FNA identified adenocarcinoma in 71.1% of cases, while CT-guided biopsy diagnosed it in 70.0% of cases, indicating comparable effectiveness in detecting the most prevalent malignant pancreatic lesion. Neuroendocrine tumors were diagnosed in 11.1% of patients undergoing EUS-FNA and 10.0% of those undergoing CT-guided biopsies, showing a slightly higher detection rate with EUS-FNA. Chronic pancreatitis was identified in 11.1% of EUS-FNA cases and in 15.0% of CT-guided biopsy cases, reflecting a relatively similar ability of both methods to distinguish inflammatory conditions from malignancies. Benign cystic lesions were the least frequent findings, diagnosed in 6.7% of EUS-FNA cases and 5.0% of CT-guided biopsy cases.

Table 4: Final Diagnosis Distribution

Final Diagnosis	EUS-FNA (n, %)	CT-Guided Biopsy (n, %)
Adenocarcinoma	32 (71.1%)	28 (70.0%)
Neuroendocrine Tumor	5 (11.1%)	4 (10.0%)
Chronic Pancreatitis	5 (11.1%)	6 (15.0%)
Benign Cystic Lesion	3 (6.7%)	2 (5.0%)

Discussion

The results of this study demonstrate that endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) is superior to computed tomography-guided biopsy (CT-guided biopsy) in the diagnosis of pancreatic lesions, particularly in terms of diagnostic accuracy, sample adequacy, and the need for repeat biopsies. While both methods have their advantages and limitations, EUS-FNA appears to be the preferred approach for obtaining tissue samples, especially for lesions located in the head of the pancreas. EUS-FNA exhibited a higher overall

diagnostic accuracy (90.6%) compared to CT-guided biopsy (82.5%) [10]. This can be attributed to its real-time ultrasound guidance, which allows for precise targeting of pancreatic lesions and reduces the likelihood of sampling errors. Additionally, EUS-FNA provides access to deeper lesions, particularly those near the pancreatic duct and head region, which are often difficult to reach using percutaneous techniques [11]. The higher sensitivity (92.3% vs. 85.0%) and specificity (88.9% vs. 80.0%) of EUS-FNA further support its role as a more reliable diagnostic tool for pancreatic malignancies. However, it is important to acknowledge that CT-guided biopsy remains a useful option, particularly for lesions located in the body and tail of the pancreas, where EUS-FNA may have limited reach [12]. The sample adequacy rate was significantly higher for EUS-FNA (93.3%) compared to CT-guided biopsy (82.5%). This difference is likely due to the ability of EUS-FNA to perform multiple needle passes under direct visualization, ensuring that sufficient tissue is obtained for histopathological evaluation. The availability of rapid on-site evaluation (ROSE) in some cases also contributed to the improved adequacy rate of EUS-FNA, as cytopathologists were able to assess sample quality in real-time and recommend additional passes if needed [13]. The need for repeat biopsy was significantly lower in the EUS-FNA group (6.7%) compared to the CT-guided biopsy group (17.5%). This suggests that EUS-FNA provides more conclusive results in the initial attempt, reducing the burden of additional procedures for patients [14]. In contrast, CT-guided biopsy had a higher rate of inconclusive or inadequate samples, possibly due to the presence of necrotic or fibrotic tissue in pancreatic tumors, which can make obtaining viable cells challenging. Although both procedures are considered safe, EUS-FNA was associated with a lower complication rate (11.1%) compared to CT-guided biopsy (20.0%). The most common complications included mild post-procedural pain, bleeding, and pancreatitis [15]. The higher incidence of post-procedural pancreatitis in the CT-guided biopsy group (7.5% vs. 2.2%) may be attributed to the percutaneous nature of the procedure, which can lead to direct injury or inflammation of the pancreatic tissue. Additionally, CT-guided biopsy carries a slightly higher risk of bleeding and infection due to the transabdominal needle approach, whereas EUS-FNA benefits from the protective layer of the gastrointestinal tract, reducing exposure to external pathogens [16]. The distribution of lesion locations showed that EUS-FNA was primarily performed for lesions in the pancreatic head (66.7%), while CT-guided biopsy was more commonly used for lesions in the body and tail (75%). This finding is consistent with prior studies, as EUS provides better access to the pancreatic head and uncinate process, whereas CT-guided biopsy is more practical for peripherally located lesions [17]. The findings of this study suggest that EUS-FNA should be the preferred first-line diagnostic modality for pancreatic lesions, especially when lesions are located in the head or uncinate process. The higher accuracy, better sample adequacy, and lower complication rate make EUS-FNA a more efficient and safer option compared to CT-guided biopsy. Despite the strengths of this study, certain limitations should be acknowledged. First, the sample size of 85 patients is relatively small, and larger multicenter studies are needed to confirm these findings in a broader population. Second, the availability of rapid on-site evaluation (ROSE) was not uniform across all EUS-FNA cases, which may have influenced sample adequacy rates.

Conclusion

It is concluded that endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) is a more effective and safer diagnostic modality compared to computed tomography-guided biopsy (CT-guided biopsy) for the evaluation of pancreatic lesions. EUS-FNA demonstrated higher diagnostic accuracy, greater sample adequacy, and a lower need for repeat biopsy, making it the preferred approach, particularly for lesions located in the head and uncinate process of the pancreas.

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