

Research Article

Diagnostic Yield of Ultrasound-Guided FNAC versus Open Excisional Biopsy in Persistent Cervical Lymphadenopathy

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ABSTRACT

A common issue in head and neck practice is persistent cervical lymphadenopathy, and it is often difficult to address when we have limited results from imaging and clinical evaluations. Although ultrasound-guided fine-needle aspiration cytology (USG-FNAC) is a popular minimally invasive diagnostic option, open excisional biopsy is still the gold standard among patients where USG-FNAC is performed. Existing literature has also failed to assess the direct comparison of diagnostic yields of USG-FNAC and excisional biopsy, along with the procedural and patient outcomes. The purpose of this study is to investigate the difference in diagnostic yields of USG-FNAC and excisional biopsy for patients with persistent cervical lymphadenopathy. This was a prospective comparative study conducted at Swat Medical College Teaching Hospital Saidu Sharif Swat, where a total of 120 patients with persistent cervical lymphadenopathy were included. USG-FNAC was performed for patients in Group A (n=60), while open excisional biopsy was performed for patients in Group B (n=60). Information was collected on definitive diagnosis, diagnostic adequacy, time taken to complete the procedure, complications, post-procedure pain (measured by the Visual Analog Scale), time to histopathology, and the need to repeat the diagnostic procedure. Statistical analyses were performed utilizing SPSS version 26.0. A p-value of <0.05 was considered significant. For ultrasound-guided FNAC, the overall diagnostic yield was 88.3%, and for open excisional biopsy, 98.3%. Open excisional biopsy had significantly greater diagnostic yield with lower repeat procedure rates ($p < 0.05$). However, ultrasound-guided FNAC had less procedure time, lower post-procedural pain scores, and was associated with fewer minor complications and quicker recovery ($p < 0.05$). Time for the initial diagnostic was also shorter in the FNAC group, allowing for earlier clinical interventions. Due to its rapid diagnostic capability, advantages to the patient, and being less invasive, ultrasound-guided FNAC is a timely and effective first-line diagnostic test for cases of persistent cervical lymphadenopathy. Open excisional biopsy is still warranted for persistent cases of cervical lymphadenopathy, and FNAC is still warranted for cases of cervical lymphadenopathy with an uncertain diagnosis and when definitive assessment of cytopathology is warranted. A stepwise diagnostic test process that begins with ultrasound-guided FNAC and is followed by a selective excisional biopsy may help in diagnostic precision with a lower rate of surgical intervention.

Keywords: Ultrasound-Guided Fnc, Excisional Biopsy, Diagnostic Yield, Persistent Cervical Lymphadenopathy, Cervical Lymph Nodes, Head and Neck Surgery.

INTRODUCTION

When diagnosing persistent cervical lymphadenopathy, clinicians must consider a variety of complex conditions in infectious disease, oncology, and surgical pathology. However, most conditions need to be evaluated when cervical lymphadenopathy lasts longer than four to six weeks without abating on its own or after treatment with antibiotics. The differential diagnosis when evaluating persistent cervical lymphadenopathy spans a variety of conditions, from benign conditions (e.g., granulomatous conditions including

tuberculous lymphadenitis) which can be found in developing countries and those with endemic tuberculosis, to malignancies with high potential including metastatic lymphatic head and neck squamous cell carcinomas and primary hematological malignancies which include lymphomas of Hodgkin and non-Hodgkin type (Al Qout et al., 2023; Kumbi et al., 2024; Şahin et al., 2023). Unfortunately, standard clinical procedures (physical examination, and a battery of laboratory tests) are insufficient to differentiate minor conditions with lymphadenopathy from more serious

causes of malignancy. Thus, the only definitive diagnostic method will remain the direct histological examination of the excised lymph node (Alharbi et al., 2025).

The clinical management of cases with persistent cervical lymphadenopathy has changed over the years with the inclusion of focused interventional techniques. One such technique is Ultrasound-guided fine needle aspiration cytology (USG-FNAC), which is a combination of Doppler ultrasonography and fine needle aspiration. This technique offers real-time observation of features such as lymph node cortical thickening, fatty hilum and vascular distribution. USG-FNAC also provides the opportunity for precise placement of the needle to avoid necrotic cores and major vascular structures (Fu et al., 2024; Yan et al., 2025). As a first line diagnostic investigation, USG-FNAC has several benefits, such as a reduction in morbidity, ease of performance, negligible costs, the absence of general anesthesia, and the rapid arrival of results and diagnostic processes. Therefore, it is the best technique for the assessment of both epithelial carcinomas and granulomatous disease (Bayrak, 2025).

Even with its extensive use in clinics, fine needle aspiration remains limited by its sample composition. Aspirates contain only a liquid suspension of cells or microaggregates with no connective tissue frameworks. Cyto-pathology alone may not be sufficient to give a definitive diagnosis, particularly in cases where the tissue arrangement is critical for diagnosis. This is particularly true in cases of primary lymphoproliferative disorder, low-grade non-Hodgkin lymphoma and necrotizing tuberculous lesions where the cellular yield is ambiguous or inadequate (Şahin et al, 2023). Because of this, the Open Excisional Lymph Node Biopsy is the gold standard for diagnosis. This biopsy provides fully intact lymph node histology along with the evaluation of multiple special tests, including immuno-histochemical studies, molecular assays for gene rearrangement, and flow cytometry (Al Qout et al, 2023; Sharma et al, 2021). However, extensive reliance on the Open Excisional Biopsy as the main diagnostic option results in trade-offs, including extensive costs associated with surgical procedures, lengthy delays for diagnosis, and exposing the patient to additional risks of surgery including nerve palsies, localized infections, hematomas, and scarring of the neck (Fu et al, 2024).

Recent studies in comparative literature have been addressing the ongoing discussion

regarding the diagnostic performance indices, particularly the diagnostic yield sensitivity, specificity, and non-diagnostic rates, of USG-FNAC in comparison to Open Surgical Excision. Although a number of studies have shown that USG-FNAC has a diagnostic accuracy of greater than 85% to 90% for metastatic malignancy and tuberculous lymphadenitis, it is associated with a considerable degree of variability across different clinical populations, different sizes of lymph nodes, and different levels of skill of the operators (Fu et al., 2024; Yan et al., 2025). In addition, it is common in the literature to mix unguided, palpation-based FNAC with USG-based FNAC in the immediate presence, or to neglect the role of modern cytopathologic classification systems, such as the Sydney System for reporting of lymph node cytopathology, in the determination of the indeterminate aspirates (Yan et al., 2025).

In certain geographic areas with a combined endemic tuberculosis population and late-presenting metastatic cases, the late comparative diagnostic yield of USG-FNAC versus open excisional histopathology is relatively unknown. There, the choice between aspiration and surgical excision impacts the cost of diagnosis and the time required. Current diagnostic frameworks either inappropriately consume open excisional biopsies for benign, inflammatory, and reactive conditions or inappropriately consume non-diagnostic cytological aspersions, thus postponing an essential oncological intervention. In this context, to demonstrate safe, inexpensive, and precise diagnostic pathways, the direct evidence of the definitional parameters of diagnostic test studies (i.e., sensitivity, specificity, positive and negative predictive values, and the rate of FN) of USG-FNAC, in comparison to excisional biopsy, is extremely critical.

METHODOLOGY

The study was conducted at Swat Medial College Teaching Hospital Saidu Sharif Swat and study duration was six months. This study aimed to evaluate and compare the diagnostic yield of ultrasound-guided fine-needle aspiration cytology (USG-FNAC) and open excisional biopsy among patients with persistent cervical lymphadenopathy. This study adhered to the ethical principles documented in the Declaration of Helsinki. Participants provided documented and dated informed consent prior to study participation,

and personally identifiable information was not disclosed during and after the study.

The study focused on patients 18 years and older with cervical lymphadenopathy that had been persistent for more than 4 weeks. In this case, cervical lymphadenopathy was considered persistent if it did not resolve following usual care. The sample size required was 120, and this was calculated with the OpenEpi Sample Size Calculator (Version 3.01), taking a 95% confidence interval, 80% study power, and previous studies for reference for expected differences in diagnostic yield of the two diagnostic tests. Consecutive non-probability sampling was utilized, and this continued until the sample size of 120 was met. Once this was met, participants were allocated into one of the two groups. Group A (n=60) underwent ultrasound-guided FNAC, and Group B (n=60) underwent open excisional biopsy.

Patients were included in this study if they had uno or multiple cervical lymph nodes measuring greater than 1 cm in their greatest diameter and persisting for more than four weeks, had not been previously diagnosed by a pathologist, and provided informed and voluntary consent. Patients with acute cervical lymphadenitis of an infectious nature and responding to antibiotics, bleeding disorders, and courses of anticoagulant treatment that could not be discontinued, recurrent cervical lymphadenopathy with a previously known diagnosis, previous surgeries of the neck that involved the affected lymph node, pregnancy, and a severe systemic disease that would make her unfit to undergo surgery were excluded from this study.

A structured data collection proforma established to capture demographic and clinical data like age and sex, education and socioeconomic status, duration of lymphadenopathy, smoking history, and medical history. Laterality of lymph node involvement, lymph node size, and smoking history were also captured, in addition to constitutional symptoms and history of smoking. Each patient underwent a meticulous examination of the head and neck. For some patients, a complete blood count, coagulation profile and other common blood tests, and some relevant imaging were also ordered.

Group A patients had ultrasound-guided fine needle aspiration cytology (FNAC) done by an expert radiologist using a high frequency linear ultrasound probe (7–12Mhz). After disinfection, a 22- or 23-gauge needle connected to a 10mL syringe was used to target lymph nodes under

ultrasound guidance. A few passes were made to collect the sample while taking care to avoid large blood vessels and necrotic tissues. After being aspirated, the sample was either air dried or fixed by 95% ethanol to make a Papanicolaou stain, while an air dried smear was stained by May–Grunwald–Giemsa stain. The sample of FNAC was independently assessed by a consultant histopathologist who was blinded to the clinical report and the biopsy.

Group B patients had open excisional biopsy performed under local anesthesia with or without sedative adjunct according to the clinical situation. The lymph nodes were incised and dissected in the skin crease of the cervical region, along with the adjacent neurovascular structures. These were excised in to and wound closure was performed in layers. The samples were preserved in 10% neutral buffered formalin and transported to the pathology lab for histopathological assessment. The samples were primarily stained with hematoxylin and eosin. Special stains or immunohistochemistry were performed as required.

The main outcome of interest was the diagnostic yield and was defined as the percentage of patients who obtained a definite pathological diagnosis after the initial diagnostic procedure. The secondary outcomes of interest included the adequacy of the specimen, the rate of diagnosis, the duration of the procedure, and a 10-cm Visual Analog Scale (VAS) for assessment of post-procedural pain, as well as the rate of complications, and the time taken to achieve a final diagnosis, length of hospital stay, and the assessment for the performance of additional diagnostic procedures. Minor complications included pain, hematoma, and wound infection, along with the temporary irritation of nerves and bleeding which were evaluated during the follow up period.

To reduce operator-related variability, all procedures were conducted by surgeons and radiologists with a minimum of five years clinical experience. Histopathological assessment was carried out independently by consultant pathologists who were kept in the dark regarding the initial cytological findings as much as was practicable. Quality of data was ensured with the implementation of standard operating procedures, calibration meetings before the study commenced, daily checks to confirm the completed study forms, and double data entry to the statistical database to prevent transcription errors.

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Data entry and analysis were carried out using the Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Mean $\pm$ standard deviation was used to describe continuous variables, and frequencies and percentages were used to describe total variables. The independent sample t-test was

employed to evaluate differences in means of continuous variables between the two groups. The Chi-square test and Fisher's exact test were used to analyze categorical variables, as appropriate. A p-value < 0.05 was set as the threshold for statistical significance in all analyses.

RESULTS

Table 1. Demographic Characteristics of Study Participants (N=120)

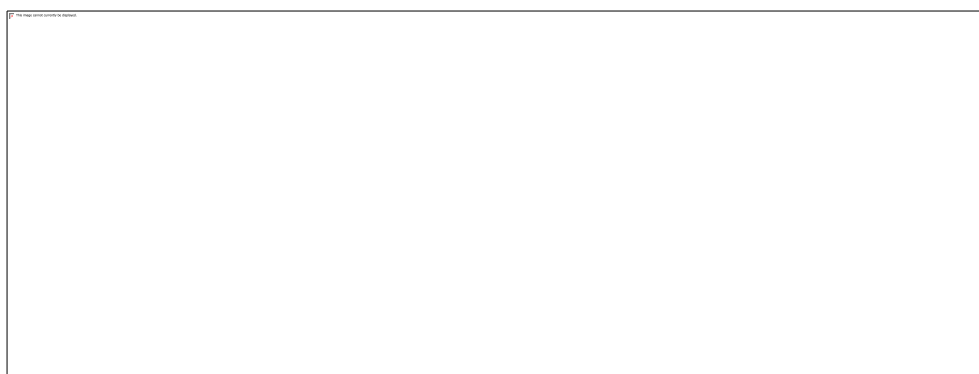
Variables	USG-FNAC (N=60)	Open Excisional Biopsy (N=60)	Total (N=120)	X ²	P
Age 18–30	18 (30.0%)	20 (33.3%)	38	0.84	0.840
31–45	24 (40.0%)	22 (36.7%)	46		
46–60	12 (20.0%)	11 (18.3%)	23		
>60	6 (10.0%)	7 (11.7%)	13		
Male	34 (56.7%)	36 (60.0%)	70	0.14	0.707
Female	26 (43.3%)	24 (40.0%)	50		
Low Socioeconomics Status	25(41.7%)	23(38.3%)	48(40.0%)	0.48	0.786
Middle Socio-Economic Status	27(45.0%)	29(48.3%)	56(46.7%)		
High Socioeconomics Status	8(13.3%)	8(13.3%)	16(13.3%)		

The distribution of demographics in each group was even, and there were no statistically significant differences in age, sex, or

socioeconomic group. Hence, both groups had a similar profile at the start of the study.

Table 2. Clinical Characteristics of Persistent Cervical Lymphadenopathy (N = 120)

Variables	USG-FNAC	Open Biopsy	Total	X ²	P
4–8 Weeks	29	31	60	0.33	0.848
>8 Weeks	31	29	60		
Unilateral	44	42	86	0.16	0.688
Bilateral	16	18	34		
<2 Cm	22	20	42	0.29	0.865
2–4 Cm	30	31	61		
>4 Cm	8	9	17		



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Clinical characteristics of the patients such as duration of symptoms, location of the lymphnodes, and size of the lesions were found

to be similar in both groups, and there were no statistically significant differences, even after the diagnostic procedures.

Table 3. Comparison of Diagnostic Performance between USG-FNAC and Open Excisional Biopsy

Variable	USG-FNAC (N=60)	Open Biopsy (N=60)	Test Statistic	P
Adequate Sample Obtained	53 (88.3%)	59 (98.3%)	$\chi^2=4.90$	0.027
Inadequate Sample	7	1		
Repeat Procedure Required	8	1	$\chi^2=5.89$	0.015

Open excisional biopsy showed much higher sample adequacy than ultrasound-guided fine-needle aspiration cytology. Non-diagnostic

outcomes were much less and resulted in fewer repetitions of the biopsy.

Table 4. Histopathological Diagnosis of Cervical Lymphadenopathy

Final Diagnosis	Usg-Fnac (N=60)	Open Biopsy (N=60)	Total
Reactive Lymphadenitis	18	17	35
Tuberculous Lymphadenitis	15	16	31
Metastatic Carcinoma	12	13	25
Lymphoma	5	8	13
Other Benign Lesions	3	5	8
Non-Diagnostic	7	1	8

Reactive lymphadenitis was the most commonly observed condition. Tuberculous lymphadenitis and metastatic carcinoma followed. Non-diagnostic findings occurred

mostly in the fine-needle aspiration group. Valid tissue for histopathological diagnosis was provided by all excisional biopsies

Table 5. Comparison of Procedure-Related Outcomes

Outcome	USG-FNAC(Mean±SD)	Open Biopsy (Mean±SD)	T	P
Procedure Time	16.8±4.2	41.5±8.4	-21.63	<0.001
Time To Diagnosis(Days)	2.6±0.9	6.8±1.5	-18.42	<0.001
VAS Pain(0-10)	2.3±1.0	5.8±1.4	-15.77	<0.001
Hospital Stay(Days)	0.2±0.4	1.3±0.6	-12.66	<0.001

FNA was quicker to perform and resulted in a diagnosis in less time. Open biopsies had longer procedure and recovery time. Patients had to stay in the hospital for a longer duration. Open

biopsies resulted in more post procedure pain compared to fine needle aspiration and patients reported less pain and shorter recovery times in the hospital

Table 6. Post-Procedural Complications

Complication	USG-FNAC (N=60)	Open Biopsy (N=60)	χ^2	P
No Complications	55(91.7%)	44(73.3%)	7.03	0.008
Mild Pain Requiring Analgesics	3(5.0%)	10(16.7%)		

Local Hematoma	1(1.7%)	3 (5.0%)		
Wound Infection	0 (0.0%)	2(3.3%)		
Temporary Nerve Irritation	1(1.7%)	1 (1.7%)		

Fine needle aspiration (FNA) had less incidence of post procedure complications than open biopsy. Patients had reported pain after the procedure and also had hematomas and localized infections at the biopsy site.

DISCUSSION

This study assessed the diagnostics and overall benefits of ultrasound-guided fine needle aspiration cytology (USG-FNAC) compared with open excisional lymph node biopsy (ELNB) for patients with persistent cervical lymphadenopathy. Using study groups with comparable demographics and similar lesions, dieses USG-FNAC and ELNB trade-offs for cytology and surgical histology in the clinical settings of USG-FNAC and ELNB. The study groups had similar demographics, and the cohort showed a slight male bias, with patients of young to middle age and a concentration of patients in the lower strata of the socioeconomic scale. This demographic distribution is noted in the global epidemiology of regions with the coexistence of late stage cancer with the granulomatous infections, with persistent cervical lymphadenopathy noted in young lower socioeconomic patients with chronic infectious diseases and with delayed presentation to the clinic. Clinically, the majority of lesions showed unilateral lymphadenopathy, lesions of moderate size and a long duration of persistence. This study confirms that the parameters of persistence and size of the lesion, and the side of involvement, cannot be used to statistically differentiate benign from malignant lesions and that rapid sampling of the lesion is warranted in the initial work-up of the patient.

A key area of interest was against sample adequacy and procedural success between the two modalities. Open surgical excision nearly reached optimal sample adequacy. However, the overwhelming majority of samples drawn during USG-FNAC were diagnostic. Of the few inadequate/non-diagnostic aspirates seen during USG-FNAC, the inadequate cytological yield is partly due to intranodal necrosis, fibrous capsule formation, or debris due to necrosis. Advanced tuberculous lesions and high-grade metastatic tumors also comprise liquid acellular debris and may be seen in advanced cases (Mahajan et al., 2023). In contrast, the USG-

FNAC relies on real-time guidance to draw the sample. Compared to traditional unguided techniques, USG-FNAC significantly increases the sample yield because the USG-FNAC operator can see and, therefore, be sure to avoid the necrotic, non-cytological core of the tumor (Luo et al., 2022). For the USG-FNAC cases, very few patients needed to undergo further diagnostic procedures, emphasizing that the procedure is both reliable and sufficient in the majority of cases.

From a pathological perspective, the cohort exhibited a broad spectrum of findings, of which the principal findings were benign conditions, especially reactive lymphadenitis and tuberculous lymphadenitis, along with metastatic carcinoma and lymphomas. In this cohort, USG-FNAC showed a favorable correlation with open biopsy histopathology in benign reactive conditions, tuberculous lymphadenitis, and metastatic epithelial malignancies. This finding agrees with the studies that support the use of USG-FNAC in metastatic head and neck squamous cell carcinomas and in cases of granulomatous inflammation (Nataraj et al., 2023; Rehman et al., 2022). On the contrary, in this study, the lymphoproliferative disorders showed the major diagnostic challenge in USG-FNAC, where the cytological examination grossly underestimated the incidence of lymphoma, which was later confirmed on open surgical biopsy. This was the major difference, as USG-FNAC could not ascertain the intact structure of the lymph node, including the capsule invasion and the arrangement of follicles, since the precise subtyping of both Hodgkin's and non-Hodgkin's lymphomas is dependent on architectural design and complex staining with Immunohistochemistry (Siddiqui et al., 2024; World Health Organization, 2022). Furthermore, though USG-FNAC is a reliable and conclusive test for metastatic malignancy and tuberculous inflammation, if the patient is suspected of having primary lymphoma, then open excisional biopsy should be done without delay.

When comparing USG-FNAC and open excisional biopsy, procedure length, post-procedure pain, and overall safety and efficiency, USG-FNAC has the advantage. Open surgical excisional biopsy has the disadvantage

of opening and closing the procedure in addition to the multi-day surgical tissue fixation and the diagnostic delay, which causes unnecessary anxiety and delays in patient care (Gupta et al., 2023). USG-FNAC also has the advantage of a shorter procedure and no pain in addition to the lengthy recovery and post-operative monitoring due to anesthesia and cutting the skin. In terms of safety, USG-FNAC has a minor complication of mild localized pain and minor hematomas when compared to the multiple complications of excisional surgery such as surgical site infection, big hematomas, and transient nerve irritation (Patel et al., 2022; Tripathy et al., 2024). These facts support the use of USG-FNAC in outpatient settings for initial diagnosis and of the open excisional biopsy in cases of non-diagnostic cellular materials and in cases that are suspicious of primary lymphoma.

CONCLUSION

This study illustrates that for persistent cervical lymphadenopathy, the first-line diagnostic tool should be ultrasound-guided fine-needle aspiration cytology, as it is quick, causes minimal discomfort, and has a lower complication rate than open excisional biopsy. Unfortunately, open excisional biopsy wins out in diagnostic usefulness and is the only way to definitively diagnose a lymph node, especially in cases of uncertain cytology or when lymphoma is suspected. A more efficient diagnostic method that FNAC employs in a stepwise technique, followed by a more judicious use of excisional biopsy, should reduce the risk of more extraneous surgical procedures.

Limitations of Study

The major limits to this study are that it was a single study based in a tertiary care center, and therefore the sample was small, as the patients were recruited from an available, non-probability sample, meaning the study is at serious risk for selection bias. Additionally, this study did not analyze the follow-up of the participants, nor the cost of the procedures, and did not measure the variability of cytology and pathology done by different persons.

Future Suggestions

It is recommended that validation of this research be done through larger, and more thorough, multiple studies. This research should also be done to analyze the cost/benefit of the different diagnostics done, and advances to diagnostic ultrasound and to molecular diagnostics should also be considered for their

impact on patients and their outcomes. The creation of uniform diagnostic methods and standards should allow for better and more thorough strategies to manage patients with persistent cervical lymphadenopathy.

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