

Diagnostic utility of fine needle aspiration cytology at a peripheral district headquarters hospital

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ABSTRACT

Objective: To determine the epidemiological and cytomorphological spectrum of palpable swellings at a district headquarters hospital.

Material and methods: This descriptive cross-sectional study was conducted between 1st January 2024 to 31st December 2024 enrolled 187 consecutive patients of either gender and all ages with palpable superficial swellings; deep-seated and visceral lesions were excluded. FNAC used a 22–24gauge needle, with Haematoxylin and Eosin staining. Data were analysed in SPSS 23.0 using the chi-square or Fisher's exact test, with $p < 0.05$ considered significant.

Results: The mean age was 34.3 (15.2%) years and 137 patients (73.3%) were female (female-to-male ratio 2.7:1). The thoraco-abdominal region was commonest (97; 51.9%), led by the breast, followed by the head and neck region (71; 38.0%). Lipomatous lesions were the commonest diagnosis (48; 25.7%), then granulomatous/tuberculous lymphadenitis (30; 16.0%) and fibroadenoma (17; 9.1%). Atypical, suspicious or malignant cytology was significantly common above 40 years (30.8% versus 8.3%; $p < 0.001$) but unrelated to sex ($p = 0.16$); anatomical region was strongly associated with the diagnostic category ($p < 0.001$).

Conclusion: FNAC is a simple, rapid and inexpensive first-line investigation that characterizes a wide spectrum of palpable superficial swellings even in a peripheral, resource-limited setting, and helps identify older patients at higher risk of malignancy.

Keywords: Fine-needle aspiration cytology, Lymphadenopathy, Tuberculosis.

This article can be cited as: Karim N, Ashraf M, Zaheer H, Sahrish F, A Sommiya. Diagnostic utility of fine needle aspiration cytology at a peripheral district headquarters hospital. Pak J Pathol. 2026; 37(2): 108-113.

DOI: <https://doi.org/10.55629/pakipathol.v37i2.1022>

INTRODUCTION

Palpable superficial swellings are among the commonest reasons for outpatient consultation across all ages and arise from the skin and subcutaneous tissue, lymph nodes, breast, thyroid, salivary glands and soft tissues, spanning a broad spectrum from inflammatory and infective conditions to benign and malignant neoplasms [1]. Fine needle aspiration cytology (FNAC) is a simple, rapid, inexpensive and minimally invasive outpatient procedure that serves as a first-line investigation for these lesions, separating non-neoplastic from neoplastic and benign from malignant disease and frequently sparing the patient an unnecessary operation [2, 3]. Performed without anaesthesia and

yielding a same- or next-day report, it shortens the diagnostic pathway, lowers cost and reserves scarce operative capacity for patients who genuinely require surgery; in experienced hands its accuracy for superficial lesions is high.

The clinical importance of accurate triage of superficial swellings is underscored by the regional disease burden. Breast cancer is the most frequently diagnosed cancer in women worldwide, with about 2.3 million new cases in 2022, and Asia carries the largest share of this burden [8]. Pakistan has the highest age-standardised breast-cancer incidence in Asia, where roughly one in nine women is affected during her lifetime, and most patients still present late [8]. The country is also among the five highest-burden tuberculosis (TB) countries globally, and granulomatous lymphadenitis most likely tuberculous inflammation is a frequent cause of superficial lymphadenopathy for which FNAC offers rapid early diagnosis [4,5,6,7].

Standardised systems for reporting thyroid, breast and salivary gland cytology have improved diagnostic consistency across these sites [9,10,11]. However, most published series describing the

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Receiving Date: 18 Mar 2026

Revision Date: 21 May 2026

Acceptance Date: 18 Jun 2026

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cytomorphological spectrum of superficial swellings originate from tertiary care or specialist head and neck centres, whereas data from peripheral district hospitals where diagnostic resources are limited yet the patient burden is high, remain comparatively scarce [12]. Characterizing this spectrum at such a centre is valuable for audit, training and service planning.

The present study therefore aimed to determine the epidemiological characteristics and cytomorphological spectrum of palpable superficial swellings diagnosed by FNAC at a district headquarters hospital, and to examine whether lesion nature was associated with sex, age or anatomical site. Using Non-Probability Consecutive sampling, all patients of either gender and any age presenting with a clinically palpable superficial swelling and referred for FNAC during the study period were included. Patients with deep-seated or visceral lesions, swellings smaller than one centimetre, clinically obvious vascular lesions, a bleeding diathesis, or who declined consent were excluded

MATERIAL AND METHODS

This descriptive cross-sectional study was carried out in the Department of Pathology, District Headquarters Hospital, Nankana Sahib, Punjab, Pakistan, from 1st January 2024 to 31st December 2024, after approval by the institutional review board vide Letter No.0349/Path/24, dated 27-12-2024.

The sample size was estimated using the OpenEpi single-proportion formula, taking an expected proportion of 25% for the commonest cytological category, a 95% confidence level and an absolute precision of 6.3%, which gave a minimum required sample of 182 [13]. All 187 eligible patients presenting during the 12-month period were enrolled, satisfying this requirement.

After cleaning the overlying skin of lesion with alcohol swab, FNAC was performed with a 22–24gauge needle attached to a 10 mL syringe. Air-dried smears were alcohol-fixed smears and stained with haematoxylin and eosin. All slides of thyroid, breast and salivary aspirates were reported by consultant Histopathologists, categorised according to the Bethesda, Yokohama and Milan systems respectively where applicable [9,10,11].

Data were analysed using IBM SPSS Statistics version 23. For each patient, age, sex, anatomical site and cytological diagnosis were recorded on a structured proforma. Age was summarised as mean (standard deviation) and range, and sex, anatomical region and cytological diagnosis as frequencies and

percentages [n (%)]. For association testing the cytological diagnoses were grouped by nature into benign/ inflammatory and atypical/ suspicious/ malignant; non-diagnostic aspirates were excluded from these comparisons. The association of lesion nature with sex and with age group, and of anatomical region with the broad diagnostic category, was assessed using the Pearson chi-square test, with Fisher's exact test applied where more than 20% of cells had an expected count below five. A two-sided p-value < 0.05 was considered statistically significant.

RESULTS

A total of 187 patients were studied. The recorded mean age was 34.3 years and age range was 7–80 years, and most patients were in the 21–40-year group ((n=94,50.3%). Females predominated, with (n=137,73.3%) females and (n=50, 26.7%) males, a female-to-male ratio of 2.7:1 (Table-I). The thoraco-abdominal region was the commonest region (n=97, 51.9%), within which the breast was the single most frequently sampled site, followed by the head and neck region (n=71, 38.0%; cervical lymph nodes 41), the limbs (n=14; 7.5%) and the perineum (n=5; 2.7%) (Table-II). On cytomorphology, lipomatous lesions were the commonest diagnosis (n=48; 25.7%), followed by granulomatous inflammation/tuberculous lymphadenitis (n=30; 16.0%) and fibroadenoma (n=17; 9.1%). Frankly malignant lesions accounted for (n=10,5.3%) and a further (n=9,4.8%) were reported as suspicious for malignancy, while aspirates (n=14,7.5%) were non-diagnostic. The complete spectrum is shown in Table-III.

On association testing (Table-IV), atypical, suspicious or malignant cytology was not significantly related to sex (17.9% of females versus 8.0% of males; Fisher's exact p = 0.16). It was, however, strongly associated with age: the proportion rose from 6.3% in patients aged ≤20 years to 44.4% in those older than 60 years (p = 0.001), and patients older than 40 years had almost five times the odds of atypical/ suspicious/ malignant cytology compared with those aged 40 years or younger (30.8% versus 8.3%; odds ratio 4.9; Fisher's exact p < 0.001). Anatomical region was also strongly associated with the broad diagnostic category ($\chi^2 = 103.0$, p < 0.001): breast lesions occurred almost exclusively in the thoraco-abdominal region, inflammatory and reactive nodal lesions predominated in the head and neck, and lipomatous lesions were concentrated in the thoraco-abdominal region and limbs.

Table-I. Demographic characteristics of patients undergoing FNAC (n = 187)

Variable	Category	Value
Total patients	—	187
Age (years)	Mean (SD)	34.3 (15.2%)
	Range	7–80
Sex, n (%)	Female	137 (73.3%)
	Male	50 (26.7%)
Age group, n (%)	1-20	36 (19.3%)
	21-40	94 (50.3%)
	41-60	48 (25.7%)
	61-80	9 (4.8%)

SD, standard deviation.

Table-II. Anatomical site distribution of FNAC cases (n = 187)

Region	Site	n	%
Thorax & abdomen	Breast	66	35.3
	Axillary swelling / lymph nodes	10	5.3
	Back / scapular swelling	7	3.7
	Chest wall	6	3.2
	Abdominal wall / flank	5	2.7
	Clavicular region	3	1.6
Subtotal		97	51.9
Head & neck	Cervical lymph nodes	41	21.9
	Submandibular swelling	8	4.3
	Other head & neck	7	3.7
	Parotid gland	7	3.7
	Thyroid gland / nodule	5	2.7
	Pre/postauricular swelling	3	1.6
Subtotal		71	38.0
Limbs	Upper limb	11	5.9
	Lower limb	3	1.6
Subtotal		14	7.5
Perineum	Gluteal region	2	1.1
	Inguinal lymph nodes	2	1.1
	Suprapubic swelling	1	0.5
Subtotal		5	2.7
Grand total		187	100.0

Table-III: Cytomorphological spectrum of lesions diagnosed on FNAC (n = 187).

Cytological diagnosis	n	%
Lipomatous lesions	48	25.7
Granulomatous inflammation / tuberculous lymphadenitis	30	16.0
Fibroadenoma	17	9.1
Inadequate / non-diagnostic aspirates	14	7.5
Epidermal inclusion cyst	13	7.0
Malignant lesions	10	5.3
Reactive lymphadenitis	10	5.3
Suspicious for malignancy	9	4.8
Pyogenic inflammation	8	4.3
Breast inflammatory / benign lesions	4	2.1
Pleomorphic adenoma	4	2.1
Atypical lymphoid infiltrate	4	2.1
Atypical cells of undetermined significance	3	1.6
Thyroid lesions (FLUS and MNG)	3	1.6
Spindle cell neoplasm	3	1.6
Cystic lesions	2	1.1
Giant cell lesions	2	1.1
Salivary gland lesions	2	1.1
Xanthogranulomatous inflammation	1	0.5
Total	187	100.0

Breast inflammatory/benign lesions comprise mastitis, fat necrosis, fibrocystic change and galactoceles. FLUS, follicular lesion of undetermined significance; MNG, multinodular goitre.

Table-IV: Association of lesion nature with sex and age group (n = 173; non-diagnostic aspirates excluded).

Variable	Benign/inflammatory n (%)	Atypical/suspicious/malignant n (%)	p-value
Sex			
Female (n = 123)	101 (82.1)	22 (17.9)	0.16*
Male (n = 50)	46 (92.0)	4 (8.0)	

Age group (years)

≤20 (n = 32)	30 (93.8)	2 (6.3)	0.001†
21–40 (n = 89)	81 (91.0)	8 (9.0)	
41–60 (n = 43)	31 (72.1)	12 (27.9)	
>60 (n = 9)	5 (55.6)	4 (44.4)	

*Fisher's exact test. †Pearson chi-square (exact/Monte-Carlo where expected counts < 5). Dichotomised by age, patients > 40 years versus ≤ 40 years: 30.8% versus 8.3% atypical/suspicious/malignant; odds ratio 4.9; Fisher's exact $p < 0.001$.

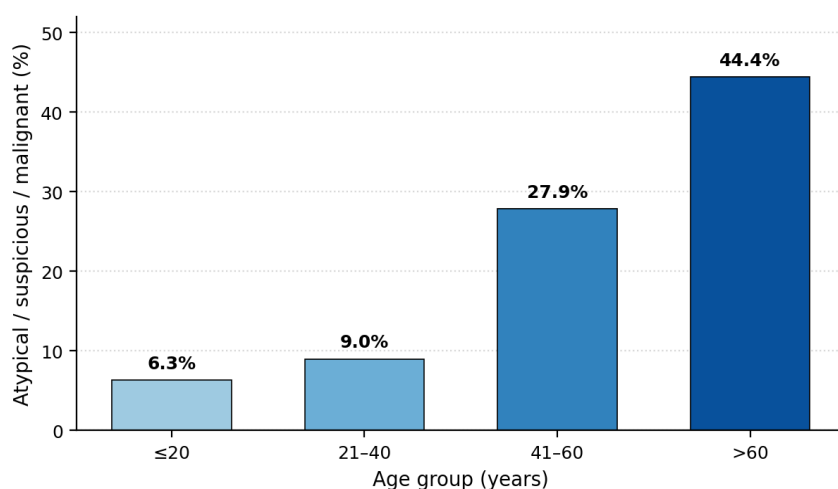


Figure-I: Proportion of atypical, suspicious or malignant cytology by age group (n = 173; non-diagnostic aspirates excluded). The proportion rose significantly with age ($p = 0.001$).

DISCUSSION

The overall pattern of our cohort aligns with regional and international FNAC series while reflecting the broader anatomical scope of this study. This study illustrates the wide anatomical and pathological spectrum of palpable superficial swellings at a peripheral district hospital, ranging from common benign inflammatory conditions to malignancies noted in breast, lymph nodes, soft tissue, thyroid and salivary glands. A majority of cases were reported as conclusive diagnosis, however small proportion of non-diagnostic aspirates were also seen. The demographic profile, a mean age in the fourth decade and a female preponderance driven by the high proportion of breast aspirates is consistent with comparable regional series [2,3,12,14,15].

Breast lesions were the most common site-specific category in our study, accounting for 35.3% of all FNAC cases. Fibroadenoma was the most frequent breast lesion 9.1% consistent with the Yadav *et al.* and Rioki *et al.* According to International Academy of Cytology Yokohama System the index study showed 5.3% of malignant breast lesions and 4.8% of suspicious for malignancy similarly reported by Yadav *et al.* Likewise, Rioki *et al.* reported benign lesions were more frequent overall [8,10,20].

In the head and neck region cervical lymph nodes constituted 21.9% of all FNAC cases in our study, making them one of the most frequently sampled sites. Granulomatous inflammation lymphadenitis

most likely tuberculosis was the predominant lymph node pathology 16.0% similar to Ulain *et al.* 90% and Mustafa *et al.* [16-17] Whereas reactive lymphadenitis represented only 5.3%. The high frequency of granulomatous lymphadenitis reflects the substantial burden of tuberculosis in Pakistan, India and Sudan [4-6]. The high prevalence of lipomatous lesions in our cohort may reflect the common occurrence of superficial benign soft-tissue masses presenting for cytological evaluation. Lipomatous lesions were the most common diagnosis in our study, 25.7% consistent with the observations of Dindalkoppa *et al.*, and Sugiyama *et al.* [18-19].

This study was a single-centre, descriptive study using non-probability consecutive sampling, lacking cyto-histopathological correlation limiting generalisability and sensitivity and specificity.

CONCLUSION

Fine needle aspiration cytology is a simple, safe, rapid and inexpensive procedure that, even in a peripheral district hospital with limited resources, characterises a wide range of palpable superficial swellings and distinguishes benign from malignant disease with minimal trauma to the patient. The risk of atypical, suspicious or malignant cytology rises markedly with age, and anatomical site strongly predicts the likely diagnosis. Where a trained cytopathologist is available, FNAC enables early detection of important conditions such as breast

malignancy and tuberculous lymphadenitis, supporting timely treatment, avoiding unnecessary surgery and ultimately helping to save lives.

CONFLICT OF INTEREST

None

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHORS CONTRIBUTION

Nasir Karim: Drafting the manuscript, acquisition, analysis, and interpretation of data. Critical review, literature search. Statistical review, critical review and discussion, final approval, responsible for every aspect of the research

Madiha Ashraf: Result analysis, review, final approval, responsible for every aspect of the research

Hassan Zaheer: Drafting, designing the study content, review, writing, and editing, final approval, responsible for every aspect of the research

Fariha Sahrish: Conception, data collection, formal Analysis, investigation, and resources, final approval, responsible for every aspect of the research

Sommiya Anum: Conception, data collection, formal Analysis, investigation, and resources, final approval, responsible for every aspect of the research

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