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Original Article

Diagnostic Yield of Routine Fundoscopy in Severe Headaches and the Prevention of CVST Misdiagnosis: A Cross-Sectional Study from a Primary Clinical Setting

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Abstract

Background: Headache is a common presentation in primary care. While mostly benign, secondary causes like Cerebral Venous Sinus Thrombosis (CVST) are frequently misdiagnosed in community settings where MRI/MRV is unavailable. **Methods:** A cross-sectional observational study was conducted on 321 selected patients (from an initial pool of 998) with severe headaches. at the Medicine OPD of Brahmanbaria District Hospital. All patients were subjected to clinical examination and direct ophthalmoscopy followed by NCCT (National Center for Competency Testing). While fundoscopic findings were intended to guide imaging, nearly all patients underwent NCCT scans due to patient pressure, which provided a cross-check for fundoscopic efficacy. **Results:** Abnormal fundoscopy was identified in 9 (2.8%) subjects with papilledema in 7, sub-hyaloid hemorrhage in 1, and optic atrophy in 1. Fundoscopy successfully identified all cases of CVST (Cerebral Venous Sinus Thrombosis) (n=5) and IIH (n=2) via the presence of papilledema, highlighting its critical role in detecting raised intracranial pressure when initial CT scans were normal. In these instances, fundoscopy was the primary tool that prevented misdiagnosis. It was also applicable for a headache patient where the underlying cause was glaucoma. Yield was lower for SAH (Sub-arachnoid Hemorrhage) (5%) and ICSOL (Intracranial Space-Occupying Lesion) (0%). Logistic analysis identified significant correlations of abnormal fundoscopy with female gender (p=0.041), age >30 (p=0.032), and visual disturbances (p<0.001). **Conclusion:** Routine fundoscopy is a vital, low-cost screening tool that enhances patient safety. It is particularly effective for catching CVST and IIH (Idiopathic Intracranial Hypertension) in community settings where gold-standard imaging is unavailable and initial CT scans may appear normal.

Keywords: Headache, Fundoscopy, Papilledema.

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Introduction

Headache is one of the most ubiquitous clinical presentations in primary healthcare, accounting for approximately 4% of all emergency department visits and a substantial proportion of outpatient consultations. [1] While the vast majority of these cases represent primary headache disorders—such as migraine or tension-type headaches—a small but critical subset stems from life-threatening secondary etiologies, including intracranial hemorrhage, cerebral venous sinus thrombosis (CVST), and idiopathic intracranial hypertension (IIH). [2,3]

The diagnostic challenge for the primary care physician lies in the "grey zone" where secondary headaches mimic the features of primary disorders like migraine or tension-type headaches. [4,5] While "red flag" screening tools (e.g., SNNOOP-10) are widely advocated, their specificity remains variable. [6] In many resource-limited settings, non-contrast computed tomography (NCCT) of the brain is the primary neuroimaging modality due to its availability and lower cost. However, NCCT is insensitive to early-stage raised intracranial pressure (ICP) and is frequently normal in the initial stages of CVST and IIH. [7]

Direct fundoscopy, or ophthalmoscopy, has traditionally been the bedside "window" into the intracranial environment. The detection of papilledema, swelling of the optic disc due to axoplasmic flow stasis, indicates elevated ICP. [8,9] Despite its inclusion in standard physical examination protocols, its routine use has declined due to the operator-dependent nature of this technique and perceived superiority of neuroimaging. However, in patients where MRI/MRV is unaffordable or inaccessible, the omission of fundoscopy may lead to catastrophic delays in diagnosing conditions that may appear normal in CT scan. [10, 11] This study aimed to evaluate the diagnostic yield of routine fundoscopic examination in a primary care setting and to identify clinical markers and associated demographic factors that necessitate its application.

Methodology

The cross-sectional observational study was carried out at medicine OPD, district sadar hospital, Brahmanbaria from 01 July 2022 to 30 December 2023.

Participants: About 1,000 headache patients were encountered. The study included 321, who were aged above 18 years with headache severe enough to impair daily life, or those with chronic and recurrent headache with progressive increase in frequency and severity. The study included both males and females who attended the outpatient and emergency units.

Excluded from the study were those with pre-existing documented optic pathway lesions or those who had prior intracranial surgery, those with head trauma in the last three months, and those who had media opacities that would preclude sufficient fundoscopic examination, including dense cataracts and vitreous hemorrhage.

All enrolled patients underwent a standardized clinical evaluation, including a detailed history-taking with a focus on headache features and accompanying red-flag symptoms.

Fundoscopic Technique

Clinical examination was performed using a standard handheld direct ophthalmoscope. Non-mydriatic fundoscopy (without pupillary dilation) was prioritized for clinical efficiency and patient throughput. The examination focused primarily on the optic nerve head (ONH) to identify signs of papilledema, such as blurring of disc margins, loss of spontaneous venous pulsations, and splinter hemorrhages [12]. While pupillary dilation with 1% tropicamide is often recommended for comprehensive retinal screening, it was deemed non-essential for the primary goal of detecting raised intracranial pressure (ICP) in an outpatient setting, as macular and peripheral retinal pathologies are rarely causal in primary or secondary headache disorders [13].

Diagnostic Protocol

While clinical red flags and fundoscopic findings were intended to guide the need for imaging, the decision to perform NCCT in nearly all cases—including those with low clinical suspicion—was often driven by significant pressure from patients and their families for definitive "visual" proof of health. This comprehensive imaging approach, however, provided a unique research advantage, allowing for a systematic cross-check of fundoscopy's effectiveness against neuroimaging results. [5]. In cases where NCCT was normal but papilledema was present, patients were escalated to MRI and MRV to evaluate for Cerebral Venous Sinus Thrombosis (CVST) or Idiopathic Intracranial Hypertension (IIH) [14].

Demographic variables such as age, sex, and the use of hormonal contraceptives among females, together with clinical features, fundoscopic findings, and neuroimaging findings where applicable, were recorded. Final diagnoses were rendered by a combination of clinical features, fundoscopic examination, and neuroimaging findings, where necessary. Data were entered and analyzed using SPSS version 26, and a p-value <0.05 was taken as statistically significant.

Results

The study included a total of 321 patients, with a high female predominance of 67.9% (n=218), while 32.1% (n=103) were male. The most prevalent age group was 40–49 years (31.6%), followed by those > 50 years (28.7%). Among female participants, 18.3% (n=40) were using hormonal contraceptives.

Table I: Baseline Demographic Characteristics of Study Population (N = 321).

Variable	Category	Frequency n (%)
Age Group (years)	18-29 years	66 (20.6)
	30-39 years	62 (18.9)
	40-49	101 (31.6)
	≥ 50	92 (28.7)
Sex	Male	103 (32.1)
	Female	218 (67.9)
Hormonal Contraceptive Use (Females only, n=218)	Yes	40 (18.3)
	No	178 (81.7)

The most common symptom was severe throbbing headache, present in 77.6% (n=249) of the cohort. "Red-flag" symptoms, such as "worst-ever" headaches, were reported by 9.2% (n=30). Associated features included nausea/vomiting (21.6%), visual disturbances (12.6%), and rare neurological deficits (1.8%).

Table II: Clinical Presentation and Initial Assessment.

Clinical Feature	Frequency n (%)
Severe/Throbbing Headache	249 (77.6)
Chronic/Recurrent Headache	57 (17.8)
Visual Disturbances	40 (12.6)
Nausea/Vomiting	69 (21.6)
Neurological Deficits	6 (1.8)
Red Flag Symptoms (e.g., worst-ever headache)	30 (9.3)

Fundoscopic Yield and Diagnostic Correlation:
Abnormal fundoscopic findings were identified in 9 out of 321 subjects (2.8%). These included papilledema (n=7), sub-hyaloid hemorrhage (n=1), and optic atrophy (n=1).
Table III shows that the most common diagnoses were primary headache disorders with normal fundoscopy and neuroimaging (n = 263, 81.9%). Five cases of CVST/IIH were diagnosed exclusively by the presence of fundoscopic evidence of papilledema, despite normal imaging at the outset. Two cases of hydrocephalus were with papilledema on fundoscope that was confirmed later on CT scan. Only one case of the 20 subarachnoid hemorrhage cases revealed subhyaloid hemorrhage on fundoscopy. Thirty intracranial space-occupying lesions evidenced mainly by abnormal imaging were normal on fundoscopy -indicating the absence of raised intracranial pressure even if the lesion is in subtentorial space and large enough for pressure effect. Optic atrophy was identified in one case of glaucoma; it had been initially misdiagnosed as a primary headache with normal CT brain, which pointed out the diagnostic utility of ophthalmoscopy.

Table 4 shows that fundoscopy consistently identified papilledema in all recorded cases of CVST/IIH and hence was very effective in diagnosing those with elevated intracranial pressure. Nevertheless, the detection rate for the subarachnoid hemorrhage was much lower at 5% because subhyaloid hemorrhage is a relatively rare occurrence. Fundoscopy did not detect any of the 30 intracranial space-occupying lesions (detection rate 0%), and this is most likely a reflection of the fact that such lesions were not large enough to interrupt CSF circulation and produce elevated intracranial tension.

Table 5 depicts that Papilledema was only observed in females and in the 30-39-year-old group; it was related to users of hormonal contraceptives. Normal fundoscopic examinations are well represented in both genders (218 in females and 103 in males). Optic atrophy due to glaucoma was noted in one female patient. Subhyaloid hemorrhage due to subarachnoid hemorrhage was only present in the male group (n=103).

Table 6 demonstrates that several variables were predictive of abnormal fundoscopy findings.

Female Gender (p=0.041): While there were more females in the study, they held a disproportionate share of the abnormalities (7 out of 9), often linked to hormonal contraceptive use.

Age: greater than 30 years (p = 0.032).

Visual Disturbances (p<0.001): This is the strongest predictor because 6 of the 9 abnormal cases reported visual symptoms, compared to only 34 of the 312 normal cases [21].

Red-flag symptoms (p<0.001) and the presence of neurologic deficits (p<0.001) were strongly predictive of abnormal findings. Nausea/vomiting was significantly associated (p=0.018). These observations indicate that selective fundoscopy in patients with the aforementioned findings could optimally maximize diagnostic utility while sparing patients in the absence of headache of discomfort of an additional examination.

Table III: Neuroimaging Findings Compared to Fundoscopy.

Final Diagnosis	Total Cases	Fundoscopy Finding	CT Result	Additional Note
Primary Headache (Migraine/Tension)	263	Normal	Normal	Diagnosis confirmed; low risk group
CVST / IIH	5	Papilledema	Normal	Missed by CT; confirmed by MRI and MRV
Hydrocephalus	2	Papilledema	Abnormal	Diagnosis suspected before CT
SAH	20	Subhyaloid Hemorrhage (1)	Abnormal	Fundoscopy caught only 1/20 cases
Intracranial Space-Occupying Lesions (ICSOL)	30	normal	abnormal	Fundoscopy is insensitive in diagnosis of ICSOL at least at primary stage
Glaucoma	1	Optic atrophy	normal	Headache associated glaucoma may be mistaken for primary headache even after CT brain if fundoscopy is not used

Table IV: Diagnostic yield of fundoscopy by condition.

Diagnosis	Total Cases	Detected via Fundoscopy	Detection Rate (%)
CVST / IIH	5	5	100
Hydrocephalus	2	2	100
SAH	20	1	5
ICSOL	30	0	0
Primary Headache	263	0 (true negative)	N/A
Glaucoma	1	1	Incidental finding

Table V: Fundoscopy Findings by demographic profiles.

	Variable	Papilledema (n=7)	Normal Fundus (n=312)	Optic Atrophy (n=1)	Subhyaloid Hemorrhage (n=1)
Age	18-29	1	65	0	0
	30-39	5	55	0	1
	40-49	1	100	0	0
	>50	0	92	1	0
Sex	Female	6	211	1	0
	Male	1	101	0	1
Hormonal pill Use		5	35	0	0

Table VI: Factors Associated with Abnormal Fundoscopic Findings.

Variable	Abnormal fundus (n=09)	Normal fundus (n=312)	Total patients (n=321)	*p* value
Female sex	7	211	218	0.041
Male sex	2	101	103	
Age ≥30 years	7	248	255	0.032
Age <30 years	2	64	66	
Visual disturbance	6	34	40	<0.001
Nausea/vomiting	5	64	69	0.018
Red-flag symptoms	8	22	30	<0.001
Neurological deficit	3	3	6	<0.001

Discussion

This cross-sectional study of 321 patients highlights the indispensable role of fundoscopy in bridge-building between clinical suspicion and definitive neuroimaging. Our finding of a 2.8% prevalence of abnormal fundoscopy findings, while numerically low, is clinically profound. Every instance of detected papilledema led to a diagnosis that would have likely been missed or delayed by a reliance on NCCT alone.

The Diagnostic Utility of Fundoscopy in CVST and IIH.

While fundoscopy successfully identified all five cases of CVST and IIH in our cohort, we acknowledge that claiming "100% sensitivity" is limited by our small sample size for these specific pathologies. Rather than absolute sensitivity, these results emphasize the high specificity of papilledema as an indicator of raised intracranial pressure (ICP). These conditions frequently present in young, female patients—often those using hormonal contraceptives, as seen in 5 out of our 7 papilledema cases [12,13]. The pathophysiology of CVST involves obstructed venous outflow, leading to increased ICP while the brain parenchyma initially remains structurally normal on NCCT [14]. Our results mirror the work of Moss et al., who emphasize that optic disc edema is often the only objec-

tive sign of pathology in the early stages of these syndromes [15]. Relying solely on CT in these demographics creates a "false sense of security" that fundoscopy effectively mitigates.

Physiological limitations in Acute Vascular and Space-Occupying Lesions

Conversely, our study confirms the limitations of fundoscopy in acute vascular events and early-stage space-occupying lesions (ICSOLs). The low yield for subarachnoid hemorrhage (5%) and ICSOLs (0%) underscores that papilledema is a late-developing sign of mass effect [16]. In cases of SAH, Terson's syndrome (intraocular hemorrhage) occurs in only 13–50% of cases and is associated with higher mortality, but it is not a sensitive screening marker for the hemorrhage itself [17]. Therefore, a normal fundus should never be used to rule out an acute bleed or a tumor if other red flags are present.

Risk-Stratified Screening in Primary Care

Our analysis identified female gender, age ≥30, visual disturbances, and the use of hormonal contraceptives as significant predictors of abnormal fundoscopy. These findings support a "risk-stratified" approach. While fundoscopy may not be sensitive enough to serve as a universal "rule-out" tool for all secondary headaches, it remains a mandatory, high-specificity screen for the "high-risk phenotype"—the young female patient on hormonal therapy with a migraine-like presentation [18]. Furthermore, the incidental detection of optic atrophy in a glaucoma patient highlights the "collateral benefit" of the exam. Headache is a known symptom of subacute angle-closure glaucoma; without fundoscopy, these patients risk irreversible vision loss while being treated for a "primary headache" [19,20].

A notable aspect of our study was the high volume of neuroimaging performed despite benign clinical presentations. In many primary care settings, physicians face immense pressure from patients to order CT scans for reassurance. While this often leads to over-utilization of resources, in this study, it served to validate the diagnostic yield of the ophthalmoscope. Our findings demonstrated that while CT was the "requested" test, it was frequently "blind" to the early stages of raised ICP of CVST and IIH.

By cross-checking every fundoscopic exam with a CT scan, we confirmed that fundoscopy did not miss any cases of raised ICP that a CT might have picked up; conversely, fundoscopy caught five critical cases (CVST/IIH) that the CT scans missed entirely. This reinforces that while a CT scan might satisfy a patient's demand for imaging, it is the fundoscopic exam that often provides the more life-saving data in the community setting

Limitations of the Study: This study was limited by the use of direct ophthalmoscopy, which has inherent operator dependency and may have reduced sensitivity for subtle papilledema compared to advanced techniques like optical coherence tomography or fundus photography. Additionally, the single-center design and lack of long-term follow-up may limit generalizability and assessment of false-negative cases.

Conclusion

Routine fundoscopy remains a vital, low-cost safety net in the evaluation of headaches. It is particularly superior to NCCT in detecting conditions of raised intracranial pressure, such as CVST and IIH, which are otherwise easily overlooked. We recommend that fundoscopy be considered an essential component of the physical exam for all headache patients presenting with red flags, and a mandatory screen for young women on hormonal contraceptives, regardless of the absence of focal neurological deficits. In the era of high-cost imaging, the "old-fashioned" ophthalmoscope remains one of the most cost-effective tools for ensuring patient safety and the judicious use of MRI/MRV resources.

Recommendations: Future studies should examine the cost-effectiveness of non-mydriatic fundus photography as a screening modality and formulate clinical decision rules for variable risk factors for fundoscopy. A multi-center prospective study would be of great help for determining risk factors for evaluating headaches for long-term follow-up.

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Original Article

Sociodemographic Characteristics of Childhood Asthma in Bangladeshi Population: An Observational Study

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Abstract

Background: Childhood asthma is a growing public health concern in Bangladesh. Understanding the sociodemographic profile of affected children is essential for targeted preventive and management strategies. Objectives: To describe the sociodemographic and early-life characteristics of children with asthma attending a tertiary care hospital in Bangladesh. **Methods:** This hospital-based cross-sectional observational study was conducted at the Department of Paediatrics, Rajshahi Medical College Hospital. A total of 104 children aged <12 years with physician-diagnosed asthma were enrolled over twelve months. Sociodemographic and early-life variables were collected through structured interviews and analyzed using SPSS version 24. Continuous variables were expressed as mean ± SD and categorical variables as frequency and percentage. **Result:** The mean age of children was 7.97 ± 2.06 years. The majority (43.3%) were aged 8–<10 years. Male children constituted 55.8% (male: female ratio 1.26:1). Most parents were aged 30–40 years (59.6%). Urban residence was observed in 70.2% of cases. Regarding parental education, 27.9% completed higher secondary certificate (HSC), 26% below SSC, and 18.3% were illiterate. Monthly family income was most commonly 10,000–20,000 BDT (39.4%). Cesarean section delivery was reported in 58.7% of children. Only 38.5% had exclusive breastfeeding for six months. Family history of asthma was present in 32.7% of cases. Most families (63.5%) had two children. **Conclusion:** Childhood asthma in this tertiary-care cohort was more common among school-aged boys, urban residents, and middle-income families. A considerable proportion had cesarean birth history and lacked exclusive breastfeeding. These findings highlight potential sociodemographic and early-life patterns relevant for asthma risk profiling in Bangladesh.

Keywords: Childhood asthma, sociodemographic profile, Bangladesh, observational study, paediatric epidemiology.

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Backgrouind

Asthma is one of the most common chronic respiratory diseases affecting children worldwide and it represents a major public health challenge, mainly in low- and middle-income countries. It is characterized by chronic airway inflammation, variable airflow limitation, and recurrent episodes of wheezing, chest tightness, cough, and shortness of breath. [1, 2] Globally, approximately 300 million individuals are affected by asthma, and this number is projected to increase to 400 million by 2025. [3] The International Study of Asthma and Allergies in Childhood (ISAAC) reported a global prevalence of 11% among children aged 6–7 years and 14% among those aged 13–14 years. [4]

In South Asia, the burden of childhood asthma is increasing steadily. In Bangladesh, asthma remains a significant contributor to pediatric morbidity. A community-based study in a coastal area of Bangladesh reported a childhood asthma prevalence of 11.8%, [5] while the National Asthma Prevalence Study identified asthma symptoms in 7.3% of children aged 5–14 years. [6] Asthma is associated with substantial school absenteeism, activity limitation, and impaired quality of life. [7] Poorly controlled asthma during childhood may also predispose individuals to chronic obstructive pulmonary disease later in life. [8, 9]

Sociodemographic and early-life factors are increasingly recognized as important determinants of asthma risk and disease expression. Urban residence has been linked with higher asthma prevalence, possibly due to environmental pollution and lifestyle changes. [10, 11] Mode of delivery, particularly cesarean section, has been associated with altered immune development and increased risk of allergic diseases, including asthma. [12] Exclusive breastfeeding has been suggested to have a protective effect against allergic sensitization and respiratory illnesses. [13] Furthermore, genetic predisposition plays a role, as family history remains a recognized risk factor. [14]

Despite the growing burden of childhood asthma in Bangladesh, limited hospital-based data exist describing the sociodemographic distribution and early-life characteristics of affected children. Understanding these patterns is essential for risk stratification, targeted prevention strategies, and resource allocation. Therefore, this study aimed to describe the sociodemographic characteristics of children with asthma attending a tertiary care hospital in Bangladesh.

Materials and Methods

This hospital-based cross-sectional observational study was conducted in the Department of Pediatrics at Rajshahi Medical College Hospital, Bangladesh, over a twelve-month period (February 2022 to January 2023) following ethical approval from the Ethical Review Committee (Ref.-RMC/ERC/2022/57). A total of 104 children aged less than 12 years with physician-diagnosed bronchial asthma along with their parents, who attended inpatient and outpatient department of Pediatrics, were enrolled using purposive sampling after fulfilling inclusion and exclusion criteria. All the patients Children with asthma for at least one year whose parents provided informed written consent were included, while those with significant comorbidities such as cystic fibrosis, tuberculosis, cardiac disease, or immunodeficiency were excluded. Data were collected through direct, in-person interviews utilizing a predesigned and structured questionnaire. Socio-demographic variables included child's age, gender, mode of delivery, exclusive breastfeeding history, family history of asthma, number of siblings, parental age, education, monthly family income, and place of residence (urban/rural). All collected data were checked, coded, and entered into SPSS version 24.0 for analysis. Continuous variables were expressed as mean with standard deviation, and categorical variables were presented as frequencies and percentages. A p-value of less than 0.05 was considered statistically significant where applicable.

Results and Observation

A total of 104 children with physician-diagnosed asthma were included in the study. The mean age of the children was 7.97 ± 2.06 years, with the majority (43.3%) belonging to the 8–<10 years age group, followed by 22.1% in the 6–<8 years group, 21.2% in the 10–12 years group, and 13.5% in the 2–<6 years group (Figure 1). Male children constituted 55.8% of the study population, while females accounted for 44.2%, yielding a male-to-female ratio of approximately 1.26:1 (Figure 2). Most parents (59.6%) were aged between 30–40 years, followed by 26.9% aged 20–30 years and 13.5% aged over 40 years (Figure 3). Regarding residence, 70.2% of the children were from urban areas, whereas 29.8% were from rural areas (Figure 4). In terms of educational status, 27.9% of parents had completed higher secondary education (HSC), 26% had education below SSC, 21.1% had completed SSC, 18.3% were illiterate, and only 6.7% were graduates or above (Figure 5). Monthly family income was most commonly between 10,000–20,000 BDT (39.4%), followed by less than 10,000 BDT (26%), more than 40,000 BDT (20.2%), and 20,000–40,000 BDT (14.4%) (Figure 6). Cesarean section was the mode of delivery in 58.7% of cases, while 41.3% were delivered by normal vaginal delivery (Figure 7). Only 38.5% of children had a history of exclusive breastfeeding for the first six months, whereas 61.5% received mixed feeding (Figure 8). Most families (63.5%) had two children, 22.1% had one child, and 14.4% had more than two children (Figure 9). Family history of asthma was present in 32.7% of cases, while 67.3% reported no such history (Figure 10).

Overall, childhood asthma in this tertiary-care cohort was predominantly observed among school-aged male children from urban, middle-income families, with a notable proportion having cesarean birth history and absence of exclusive breastfeeding.

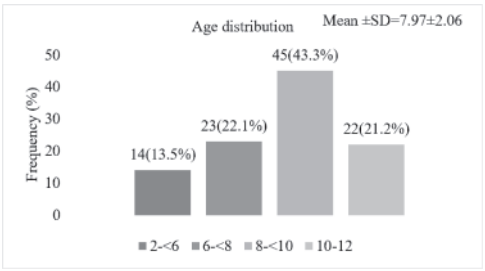


Figure 1: Age distribution of the study participants (n=104).

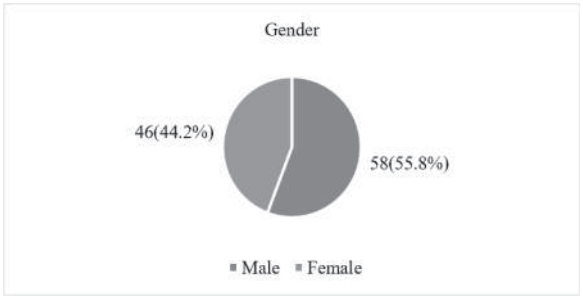


Figure 2: Gender distribution of the study participants (n=104).

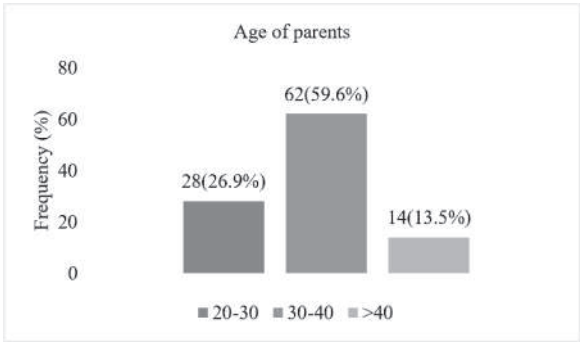


Figure 3: Age distribution of the parents of study participants (n=104).

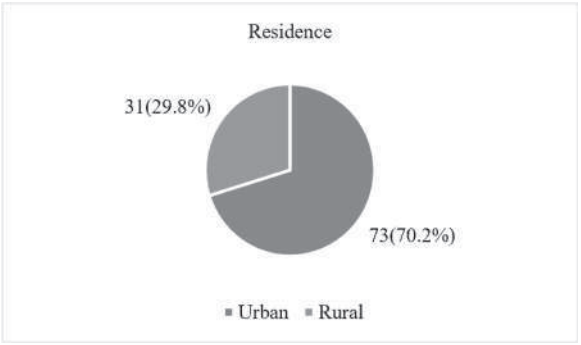


Figure 4: Residence of the parents of study participants (n=104).

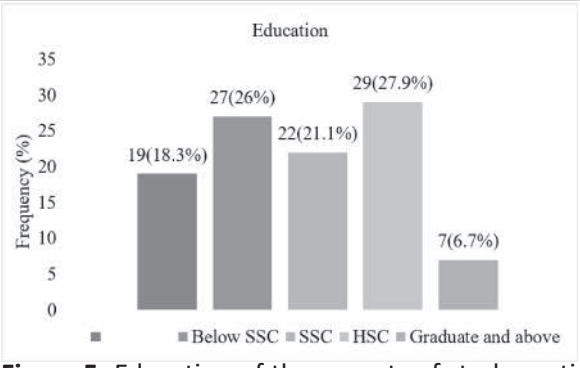


Figure 5: Education of the parents of study participants (n=104).

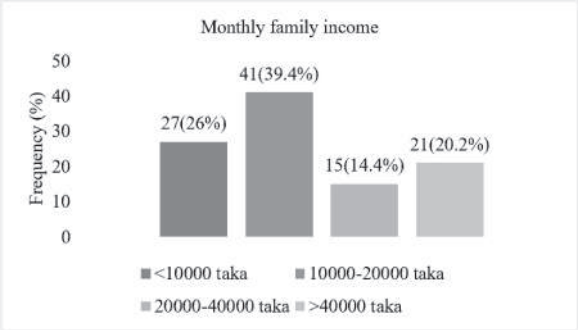


Figure 6: Monthly family income of the parents of study participants (n=104).

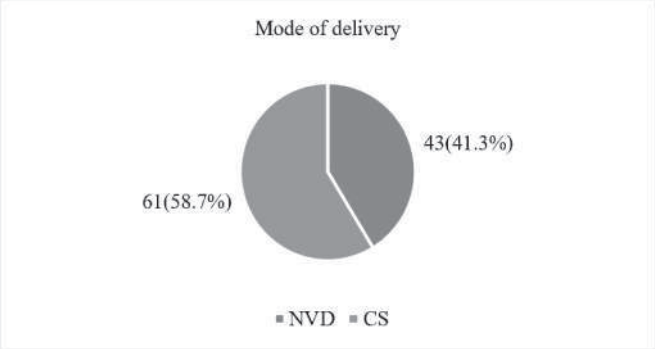


Figure 7: Mode of delivery of the study participants (n=104).

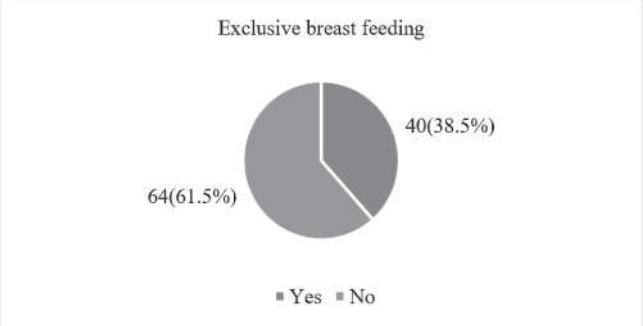


Figure 8: Exclusive breast feeding history of the study participants (n=104).

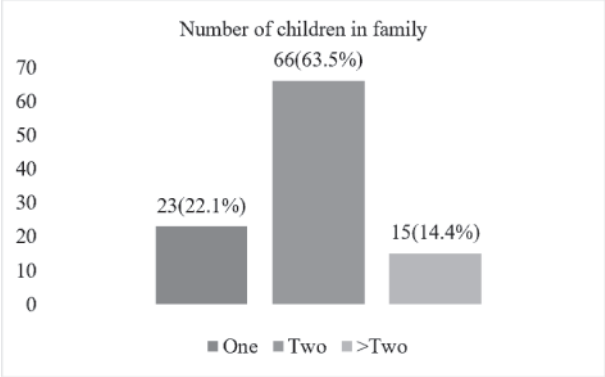


Figure 9: Number of children in a family (n=104)

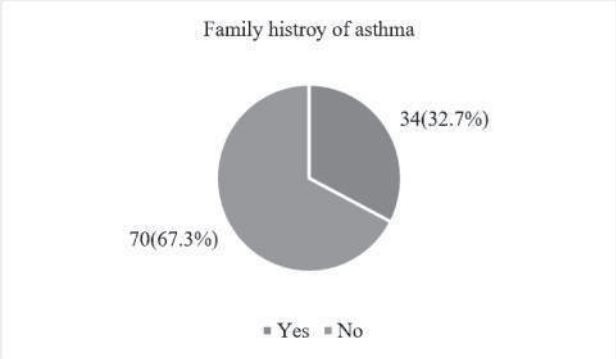


Figure 10: Family history of asthma in the study participants (n=104).

Discussion

This observational study describes the sociodemographic and early-life characteristics of children with asthma attending a tertiary care hospital in Bangladesh. The findings indicate that childhood asthma in this cohort was more common among school-aged children, males, urban residents, and middle-income families, with notable proportions having cesarean birth history, absence of exclusive breastfeeding, and positive family history of asthma.

In the present study, the mean age of affected children was approximately eight years, with the highest proportion (43.3%) belonging to the 8–<10 years age group. This aligns with global epidemiological data indicating that asthma prevalence peaks during school age, when environmental exposure and school-related triggers become more prominent.[4] Male predominance (55.8%) was observed, consistent with previous reports suggesting higher asthma prevalence in boys during childhood, potentially due to smaller airway caliber relative to lung size and hormonal influences. [4, 14]

Urban residence accounted for 70.2% of cases, supporting evidence that urbanization is associated with higher asthma prevalence. Studies have demonstrated that exposure to air pollution, traffic-related nitrogen dioxide (NO_2), indoor allergens, and lifestyle changes contribute to increased asthma incidence in urban populations. [10, 11] In Bangladesh, rapid urbanization and environmental pollution may similarly contribute to this observed distribution.

Regarding parental sociodemographic status, most parents were aged 30–40 years and had secondary to higher secondary education. Although this study was descriptive, previous literature suggests that parental education and socioeconomic status can influence health-seeking behavior, environmental exposure, and disease recognition. [2]

The high rate of cesarean delivery (58.7%) among asthmatic children in this cohort is noteworthy. Several studies have reported an association between cesarean section and increased risk of asthma and allergic diseases, potentially mediated by altered neonatal gut microbiota and immune development. [12, 15] The lack of exposure to maternal vaginal flora during cesarean birth may affect immune maturation and predispose children to atopic disorders.

Exclusive breastfeeding was reported in only 38.5% of cases. Breastfeeding has been shown to confer immunological protection and may reduce the risk of respiratory infections and allergic diseases. A systematic review and meta-analysis demonstrated a protective association between breastfeeding and reduced asthma risk in early childhood. [13] Although causality cannot be inferred from this study, the relatively low rate of exclusive breastfeeding highlights a potentially modifiable early-life factor.

Family history of asthma was present in 32.7% of cases, supporting the role of genetic predisposition. Asthma is recognized as a multifactorial disease influenced by both genetic susceptibility and environmental exposure. [14] The presence of familial clustering reinforces the need for early monitoring in children with positive family history. [16]

Monthly family income in most participants ranged between 10,000–20,000 BDT, representing a middle-income group. Socioeconomic status may influence living conditions, environmental exposures, indoor pollution, and access to healthcare. However, both low and high socioeconomic settings have been associated with asthma through

different mechanistic pathways, including hygiene hypothesis, pollution exposure, and lifestyle factors. [10, 17, 18]

Taken together, this study highlights identifiable sociodemographic patterns in childhood asthma within a Bangladeshi tertiary-care setting. Urban residence, male sex, cesarean birth, limited exclusive breastfeeding, and positive family history appear as prominent characteristics. While the cross-sectional nature of this study prevents causal inference, the findings are consistent with international literature and underscore the importance of early-life and environmental influences in asthma epidemiology.

Conclusion

Childhood asthma in this Bangladeshi tertiary-care population was predominantly observed among urban, school-aged male children from middle-income families. High cesarean delivery rates and low exclusive breastfeeding prevalence were notable early-life characteristics. These findings provide baseline sociodemographic evidence that may inform national pediatric asthma risk profiling and preventive interventions.

Limitations

This study has several limitations that should be acknowledged. First, as a single-center investigation, the findings may not be fully generalizable to the broader pediatric population. Second, the relatively small sample size may limit the statistical power of the results. Finally, because data were collected using self-administered questionnaires, the possibility of recall bias cannot be entirely excluded.

Recommendations

Future research should incorporate multicenter approaches with larger sample sizes and population-based study designs to validate these findings. Such investigations would facilitate a more comprehensive understanding of the observed associations and assist in developing appropriate prevention strategies suited to the Bangladeshi population.

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Original Article

Cytomorphological Spectrum of Fine Needle Aspiration Cytology at Jashore Medical College Hospital, Bangladesh: A Retrospective Study

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Abstract

Background: Fine needle aspiration cytology (FNAC) is a rapid, minimally invasive, and cost-effective diagnostic technique widely used for the evaluation of superficial masses and organ lesions. It plays a crucial role in differentiating benign, inflammatory, and malignant conditions, thereby guiding clinical management and reducing the need for unnecessary surgical procedures. **Objective:** To evaluate the cytomorphological spectrum of lesions diagnosed by FNAC in a tertiary care hospital and analyze their demographic and site distribution. **Methods:** This retrospective study included 186 FNAC cases performed in the Department of Pathology at Jashore Medical College. Data regarding patient age, sex, site of aspiration, and cytological diagnosis were retrieved and analyzed. Lesions were categorized into benign, inflammatory, malignant, and suspicious groups. Statistical analysis was performed using descriptive statistics and contingency tables. **Results:** The majority of patients belonged to the 21–40 years age group, and a female predominance was observed. The most frequently involved organ system was the thyroid, followed by lymph nodes, soft tissue lesions and breast. Most lesions were benign, while inflammatory lesions formed a significant proportion. Malignant lesions constituted a small but clinically important percentage of cases. A statistically significant association was observed between the organ system involved and the cytological diagnostic category. **Conclusion:** FNAC remains an invaluable diagnostic modality for the evaluation of superficial lesions. Its simplicity, rapid turnaround time, and high diagnostic accuracy make it an essential first-line investigation in routine clinical practice.

Keywords: Fine needle aspiration cytology; Cytomorphology; Superficial lesions; Thyroid lesions; Retrospective study.

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Introduction

Fine needle aspiration cytology (FNAC) is a widely accepted diagnostic technique for evaluating palpable and superficial lesions. Since its introduction into routine clinical practice, FNAC has gained popularity because of its simplicity, minimal invasiveness, rapid results, and cost-effectiveness. It is particularly useful in the initial assessment of lesions involving the thyroid, breast, lymph nodes, salivary glands, and soft tissues. By providing cytological diagnosis with minimal patient discomfort, FNAC helps clinicians determine the need for further investigations or surgical intervention. [1] The diagnostic utility of FNAC lies in its ability to distinguish between inflammatory, benign, and malignant lesions, which is essential for appropriate patient management and can significantly reduce the number of unnecessary surgical biopsies. Numerous studies have demonstrated that FNAC has high sensitivity and specificity for diagnosing a wide range of lesions, especially those involving superficial organs. [2]

Among the commonly aspirated sites, thyroid lesions constitute a significant proportion of FNAC samples worldwide. The introduction of standardized reporting systems such as the Bethesda

System for Reporting Thyroid Cytopathology has further improved diagnostic consistency and communication between pathologists and clinicians. [3] In addition to thyroid lesions, FNAC also plays an important role in evaluating lymphadenopathy, breast lumps, salivary gland masses, and various soft tissue swellings. [4] Several studies conducted in different regions have reported variations in the distribution of cytological diagnoses based on demographic factors, prevalence of inflammatory diseases, and regional patterns of malignancy. Therefore, evaluating the cytomorphological spectrum of FNAC cases in a specific population is important for understanding disease patterns and improving diagnostic services. [5] The present study was undertaken to analyze the cytomorphological spectrum of lesions diagnosed by FNAC in a tertiary care hospital and to assess their demographic distribution and site-specific patterns.

Materials and Methods

This retrospective cross-sectional study was conducted in the Department of Pathology at Jashore Medical College, Jashore, Bangladesh. The study included 186 cases of fine needle aspiration cytology (FNAC) performed for evaluation of palpable swellings and superficial lesions during the period from November 2024 to March 2026. Cases with complete demographic and cytological information were included, while cases with incomplete records or inadequate smears were excluded. FNAC was performed using a 22–23-gauge needle attached to a 10 mL disposable syringe under aseptic precautions. The aspirated material was expelled onto clean glass slides and smears were prepared. The smears were immediately fixed in 95% ethanol and stained with Hematoxylin and Eosin (H&E). All stained smears were examined under light microscopy, and cytological diagnoses were made based on established cytomorphological criteria. Patient information including age, sex, site of aspiration, and cytological diagnosis was retrieved from the cytology records. For analysis, age was grouped into five categories: 0–10, 11–20, 21–40, 41–60, and >60 years. Lesions were also categorized according to the organ system involved, including thyroid, lymph node, breast, soft tissue, salivary gland, vascular, and musculoskeletal lesions. Cytological diagnoses were further classified as benign, inflammatory, malignant, suspicious, or indeterminate. Data were entered into Microsoft Excel and analyzed using Jamovi statistical software. Descriptive statistics were used to determine frequencies and percentages of variables. Associations between categorical variables were analyzed using the Chi-square test, and a p-value <0.05 was considered statistically significant. Ethical approval for this study was obtained from the Institutional Ethical Review Board (IERB) of Jashore Medical College Teachers' Association, Jashore, Bangladesh (Ref No: IERB/JMCTA/2026/003, Date: 10/04/26). As this was a retrospective study based on laboratory records, informed consent from individual patients was waived. All patient information was kept confidential and anonymized during data collection and analysis.

Result

A total of 186 FNAC cases were analyzed in the present study. The patients ranged in age from infancy to over 60 years, with a mean age of 33.45 ± 17.38 years. The majority belonged to the 21–40 years age group (40.3%), followed by the 41–60 years group (27.4%). The detailed age distribution of cases is shown in Table I and Figure 1. Among the study population, 120 patients (64.5%) were female and 66 patients (35.5%) were male, demonstrating a clear female predominance (Figure 2).

Regarding the site of aspiration, the thyroid gland was the most frequently involved organ system (28.5%), followed by lymph nodes (24.2%) and soft tissue lesions (23.7%). Breast lesions accounted for 17.2% of cases, whereas salivary gland, vascular, and musculoskeletal lesions were comparatively less common (Table II, Figure 3). Cytological evaluation showed that 112 cases (60.2%) were benign, 57 cases (30.6%) were inflammatory, 11 cases (5.9%) were malignant, 5 cases (2.7%) were suspicious, and 1 case (0.5%) was indeterminate. Benign and inflammatory lesions were classified as separate categories, with the inflammatory category comprising non-neoplastic inflammatory conditions (Figure 3).

A statistically significant association was observed between the organ system involved and the cytological diagnostic category ($\chi^2 = 116$, $p < 0.001$) (Table III), indicating that the distribution of diagnostic categories differed significantly according to the aspiration site. The spectrum of individual cytological diagnoses observed in the study is summarized in Table IV, with lipoma, reactive lymphadenitis, fibroadenoma, and fibrocystic change being among the most frequent diagnoses. Among the 53 thyroid FNAC cases, the majority were benign Bethesda category II lesions, with nodular goiter with cystic degeneration being the most common diagnosis (35.8%), followed by nodular goiter with thyroiditis (17.0%) and nodular/colloid goiter (15.1%) (Table V).

Table I: Age distribution of patients (n = 186).

Age group (years)	Frequency n (%)
0–10	25 (13.4)
11–20	21 (11.3)
21–40	75 (40.3)
41–60	51 (27.4)
>60	14 (7.5)

Mean age ± SD: 33.45 ± 17.38 years.

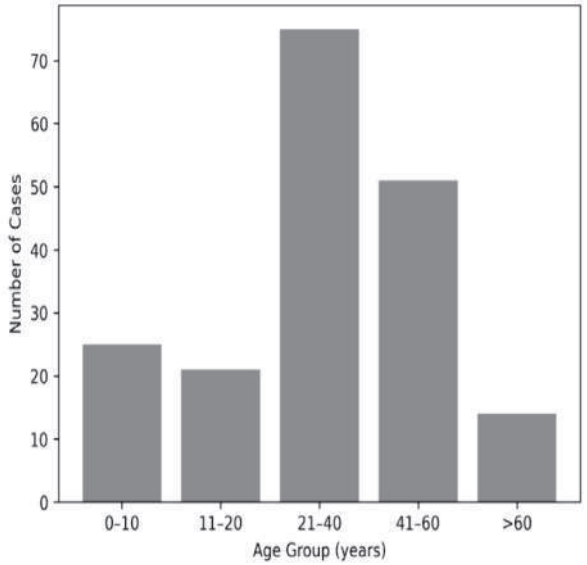


Figure 1: Bar chart showing age group distribution of FNAC cases (n=186).

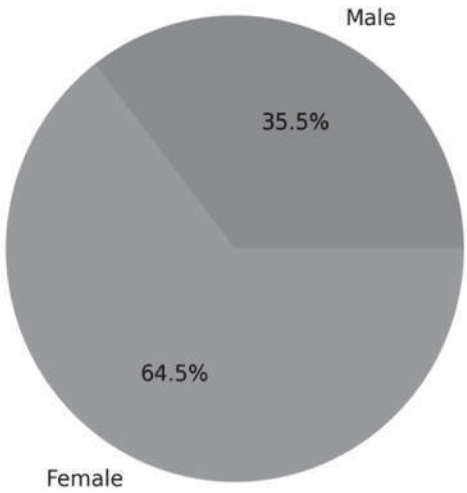


Figure 2: Pie chart showing sex distribution of FNAC cases (n=186).

Table II: Distribution of FNAC cases according to organ system (n=186).

Organ system	Frequency n (%)
Thyroid	53 (28.5)
Lymph node	45 (24.2)
Soft tissue	44 (23.7)
Breast	32 (17.2)
Salivary gland	6 (3.2)
Vascular	4 (2.2)
Musculoskeletal	2 (1.1)

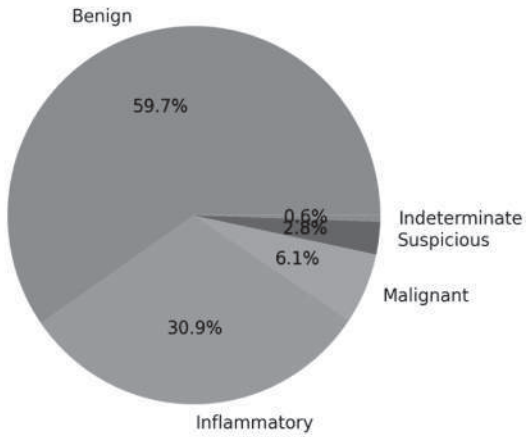


Figure 3: Pie chart showing distribution of cytological diagnoses (n=186).

Table III: Distribution of cytological diagnostic categories across different organ systems (n = 186).

Organ System	Benign n (%)	Indeterminate n (%)	Inflammatory n (%)	Malignant n (%)	Suspicious n (%)	Total
Thyroid	42 (79.2%)	1 (1.9%)	5 (9.4%)	2 (3.8%)	3 (5.7%)	53
Lymph node	0 (0%)	0 (0%)	35 (77.8%)	9 (20.0%)	1 (2.2%)	45
Soft tissue	33 (75.0%)	0 (0%)	10 (22.7%)	0 (0%)	1 (2.3%)	44
Breast	29 (90.6%)	0 (0%)	3 (9.4%)	0 (0%)	0 (0%)	32
Salivary gland	2 (33.3%)	0 (0%)	4 (66.7%)	0 (0%)	0 (0%)	6
Vascular	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4
Musculoskeletal	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2
Total	**112(60.2%)**	**1 (0.5%)**	**57 (30.6%)**	**11 (5.9%)**	**5 (2.7%)**	**186**

A statistically significant association was observed between the organ system involved and the cytological diagnostic category ($\chi^2 = 116$, $p < 0.001$) (Table IV), indicating that the distribution of cytological diagnoses varied significantly according to the site of aspiration.

Benign lesions and inflammatory lesions were analyzed as separate categories. “Benign” refers to cytologically benign, non-inflammatory lesions, whereas “inflammatory” refers to non-neoplastic inflammatory conditions.

Table IV: Spectrum of Cytological Diagnoses in FNAC Cases (n = 186).

Cytological Diagnosis	Frequency n (%)
Lipoma	17 (9.1)
Reactive lymphadenitis	15 (8.1)
Fibroadenoma	12 (6.5)
Fibrocystic change	11 (5.9)
Abscess / Suppurative inflammation	11 (5.9)
Chronic nonspecific lymphadenitis	10 (5.4)
Nodular goiter with thyroiditis	9 (4.8)
Cystic goiter	8 (4.3)
Epidermal inclusion cyst	6 (3.2)
Nodular goiter (Bethesda II)	6 (3.2)
Benign mesenchymal lesion	6 (3.2)
Thyroglossal duct cyst	4 (2.2)
Suspicious for papillary thyroid carcinoma (TBS-V)	3 (1.6)
Chronic sialadenitis	3 (1.6)
Metastatic poorly differentiated carcinoma	3 (1.6)
Nodular goiter with cystic degeneration	3 (1.6)
Benign cystic lesion	3 (1.6)
Gynecomastia	3 (1.6)
Papillary thyroid carcinoma (TBS-VI)	1 (0.5)
Anaplastic carcinoma of thyroid (TBS-VI)	1 (0.5)
Other individual diagnoses*	25 (13.4)
Total	**186 (100)**

*Other individual diagnoses included various rare benign and malignant lesions such as giant cell tumors, hemangioma, granulomatous and tubercular lymphadenitis, salivary gland tumors, metastatic carcinomas, cystic lesions, and other uncommon conditions.

Table V: Cytological diagnosis of thyroid lesions (n = 31).

Thyroid Diagnosis	Bethesda Category	Frequency n (%)
Nodular goiter / colloid goiter	II	8 (15.1)
Nodular goiter with thyroiditis	II	9 (17)
Nodular goiter with cystic degeneration	II	19 (35.8)
Lymphocytic / Hashimoto thyroiditis	II	5 (9.4)
Granulomatous thyroiditis	II	1 (1.9)
Atypia of undetermined significance (AUS)	III	1 (1.9)
Suspicious for papillary thyroid carcinoma	V	3 (5.7)
Papillary thyroid carcinoma	VI	1 (1.9)
Anaplastic carcinoma	VI	1 (1.9)
Other thyroid lesions	II	5 (9.4)
Total		**53 (100)**

Discussion

Fine needle aspiration cytology (FNAC) has become an indispensable diagnostic modality for the evaluation of palpable and superficial lesions. It is widely used because it is simple, minimally invasive, cost-effective, and provides rapid results with minimal patient discomfort. FNAC plays an important

role in differentiating benign, inflammatory, and malignant lesions and often serves as the first-line investigation before more invasive procedures such as biopsy or surgical excision. Several studies have demonstrated the high diagnostic accuracy and clinical utility of FNAC in the evaluation of lesions involving the thyroid, lymph nodes, breast, salivary glands, and soft tissues. [1-4]

In the present study, the majority of patients belonged to the 21–40 years age group, which is comparable to findings reported in many previous studies. Kumar et al. and Patel et al. also observed that most FNAC cases occurred in the third and fourth decades of life. [2,5] This age distribution may reflect the higher prevalence of benign thyroid nodules, breast lesions, and inflammatory lymph node conditions in this age group. A female predominance was also noted in our study, which is consistent with the observations of Hirachand et al., Bukhari et al., and Tariq et al. [3, 6, 7] The predominance of female patients is largely attributed to the higher frequency of thyroid and breast diseases among women.

In terms of site distribution, the thyroid was the most commonly aspirated organ, followed by lymph nodes and soft tissue lesions. Similar findings have been reported in several FNAC studies where thyroid lesions accounted for the largest proportion of cases. [8, 9] Thyroid nodules are common in the general population, and FNAC is considered the most reliable and cost-effective initial investigation for evaluating these lesions. The diagnostic approach to thyroid cytology has been further standardized with the introduction of the Bethesda System for Reporting Thyroid Cytopathology, which improves communication between cytopathologists and clinicians and helps guide patient management. [10]

The majority of lesions in the present study were benign, followed by inflammatory lesions, while malignant lesions constituted a relatively small proportion of cases. This pattern is consistent with findings from many other FNAC studies where benign and inflammatory conditions accounted for the majority of diagnoses. [6, 7, 11] Among individual diagnoses, nodular goiter and related thyroid lesions were the most common, followed by reactive lymphadenitis, fibroadenoma, and lipoma. Reactive lymphadenitis represented the most frequent lymph node pathology, which is in agreement with previous studies reporting inflammatory lymph node conditions as the predominant cause of lymphadenopathy. [12, 13] Malignant lesions were relatively infrequent in our study and mainly included metastatic carcinoma and thyroid malignancies. Statistical analysis demonstrated a significant association between the organ system involved and the cytological diagnostic category, further emphasizing the usefulness of FNAC as a reliable diagnostic tool for the evaluation of superficial lesions. [14, 15]

Conclusion

The present study highlights the important role of fine needle aspiration cytology (FNAC) as a reliable, rapid, and minimally invasive diagnostic technique for the evaluation of superficial lesions. The majority of cases in this study were benign, with thyroid lesions representing the most frequently aspirated organ system, followed by lymph node and soft tissue lesions. FNAC proved to be an effective diagnostic tool for distinguishing benign, inflammatory, and malignant conditions, thereby facilitating early diagnosis and appropriate clinical management. Owing to its simplicity, cost-effectiveness, and high diagnostic yield, FNAC remains an invaluable first-line investigation in routine clinical practice.

Limitations of the Study

This study had certain limitations. First, it was a single-center retrospective study, which may limit the generalizability of the findings to other populations. Second, histopathological correlation was not available for all cases, which could have further validated the cytological diagnoses. The study included both palpable and clinically suspected deep-seated lesions; however, image-guided FNAC could not be performed due to logistic limitations in our setting. The availability of image-guided FNAC might have improved sampling adequacy and overall diagnostic accuracy, particularly for deep-seated lesions. Future multicenter studies with larger sample sizes, incorporation of image-guided FNAC, and routine histopathological

correlation would help provide a more comprehensive evaluation of the diagnostic utility of FNAC.

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