Original Research Article

Diagnostic concordance of ultrasound and histopathology in pediatric neck masses

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ABSTRACT

Background: Ultrasonography has become the most accessible, safe, and cost-effective imaging modality for evaluating pediatric neck masses, especially in resource-limited settings. The purpose of the study was to assess the diagnostic concordance between ultrasound findings and histopathological results in pediatric neck masses. The aim of the study was to evaluate the diagnostic concordance between ultrasound findings and histopathological results in pediatric neck masses.

Methods: This observational diagnostic study was conducted at Bangladesh Shishu hospital and institute from October 2023 to March 2025, involving 550 children (0-12 years) with palpable neck masses. All cases underwent ultrasound and confirmatory histopathological examination. Diagnoses were made independently by radiologists and blinded pathologists. Concordance was defined as an exact diagnostic match. Data were analyzed using SPSS v28 with descriptive statistics.

Results: Among 550 pediatric patients with neck masses, most were aged >2-5 years (50.9%) with a balanced gender distribution. Lymphadenitis was the most common ultrasound (40.6%) and histopathological (34.2%) finding. Congenital lesions like cystic hygromas, thyroglossal duct cysts, and haemangiomas were also frequent. Ultrasound showed high diagnostic concordance, particularly for cystic hygromas (98.0%), thyroglossal duct cysts (97.7%), and branchial cleft cysts (96.2%), with an overall concordance rate of 90.0%.

Conclusions: Ultrasound demonstrates high concordance with histopathology, reinforcing its value as a reliable, non-invasive first-line diagnostic tool for pediatric neck masses.

Keywords: Ultrasound, Histopathology, Neck masses, Pediatric

INTRODUCTION

Neck masses are commonly observed in children, and although the majority are benign, careful evaluation is crucial since malignancies are responsible for about 12% to 15% of pediatric neck masses.[1,2] These masses represent a broad spectrum of conditions, ranging from self-limiting inflammatory processes to congenital anomalies and neoplastic diseases. The appearance of a neck mass often causes significant concern among parents due to fears of cancer, although the majority are non-neoplastic.[3,4] Causes may include congenital or benign lesions present from birth, or acquired neoplastic lesions developing later in childhood.[5-7] Overall, most pediatric neck masses are benign, yet the potential for malignancy necessitates careful evaluation.[8]

Among the various imaging modalities, ultrasonography (USG) has emerged as the most accessible, safe, and cost-effective technique-particularly well-suited for evaluating superficial soft-tissue swellings in children. USG is non-invasive, free from ionizing radiation, and provides real-

time imaging at a relatively low cost. These features are especially valuable in pediatric care, where minimizing radiation exposure is a priority.[9] Its portability and ease of use also make it ideal for rural or resource-limited settings where advanced imaging such as CT or MRI may not be available. When combined with clinical examination, ultrasound findings often enable accurate differential diagnosis by detailing the mass's location, size, shape, internal structure, vascularity, and anatomical relationships. Although CT and MRI offer valuable diagnostic information, they are generally less accessible and involve higher costs.[10-12]

Although histopathology remains the definitive gold standard for diagnosing pediatric neck masses-particularly when fine-needle aspiration cytology (FNAC) is inconclusive-emerging evidence suggests that ultrasonography can closely approximate histopathological findings when performed by skilled practitioners. Earlier studies reported modest concordance between imaging and histopathology, but advances in ultrasound technology and interpretation have improved its diagnostic performance.[13] Therefore, while histopathological confirmation remains indispensable in ambiguous or high-risk cases, high-resolution ultrasound is increasingly demonstrating strong diagnostic agreement, supporting its growing role as a frontline evaluation tool.

Despite its widespread use, few studies have systematically evaluated the diagnostic accuracy of ultrasound compared with histopathology in pediatric neck masses. Much of the existing literature focuses on adults or lacks sufficient pediatric sample sizes for robust analysis. Moreover, data on ultrasound's effectiveness in resource-constrained settings remain limited-an important consideration where access to advanced imaging or immediate histopathological review may be unavailable. This gap in evidence highlights the need to evaluate how reliably ultrasound can guide diagnosis and management in pediatric patients presenting with neck swellings. This study aimed to determine how closely ultrasound evaluations correspond with histopathological findings in diagnosing neck masses among pediatric patients.

Objectives

Objectives were to evaluate the diagnostic concordance between ultrasound findings and histopathological results in pediatric neck masses.

METHODS

This observational, comparative diagnostic study was conducted at the department of radiology and imaging, Bangladesh Shishu hospital and institute, Dhaka, Bangladesh between October 2023 and March 2025. A total of 550 pediatric patients with neck masses were included in the study, selected based on predefined inclusion criteria for evaluating the concordance between ultrasound and histopathological diagnoses.

Inclusion criteria

Children aged 0-12 years presenting with palpable neck masses, patients who underwent both diagnostic ultrasound and confirmatory histopathology (biopsy/excision) and complete clinical and imaging records available were included.

Exclusion criteria

Prior surgical or medical intervention for the neck mass and inadequate histopathology specimens for definitive diagnosis. Cases without histopathological confirmation, such as non-biopsied thyroid gland lesions, were excluded from diagnostic concordance analysis.

All patients underwent high-resolution ultrasound evaluation of neck masses using standardized imaging protocols. Histopathological confirmation was obtained through biopsy or surgical excision. Ultrasound diagnoses were made by experienced radiologists, while histopathological assessments were conducted by certified pathologists blinded to imaging findings. Data collected included demographic variables, anatomical location of the mass, ultrasound impressions, and final histopathological diagnoses. Concordance was defined as an exact match between the two modalities. Statistical analysis was performed using SPSS version 28, with descriptive statistics (frequencies and percentages) used to evaluate diagnostic agreement rates.

RESULTS

The majority of patients were aged >2-5 years (280 patients, 50.9%), followed by those aged 0-2 years (180 patients, 32.7%) and 6-12 years (90 patients, 16.4%). The gender distribution was nearly equal, with a slight female predominance: 280 females (50.9%) and 270 males (49.1%). Regarding anatomical location, the anterior cervical chain was the most commonly involved site (120 cases, 21.8%), followed closely by the posterior cervical chain (115 cases, 20.9%) and the submandibular region (100 cases, 18.2%). Other affected areas included the carotid area (85 cases, 15.5%), midline neck (76 cases, 13.8%), and miscellaneous sites such as the parotid and supraclavicular regions (54 cases, 9.8%).

The most frequently identified ultrasound diagnosis was lymphadenitis, observed in 223 cases (40.6%), followed by abscesses in 86 cases (15.6%) and cystic hygromas in 55 cases (10.0%). Among congenital anomalies, thyroglossal duct cysts were the most common (43 cases, 7.8%), followed by branchial cleft cysts (26 cases, 4.7%), neonatal fibromatosis colli (17 cases, 3.1%), and dermoid cysts (9 cases, 1.6%). Thyroid gland lesions, including nodules or inflammatory changes, were identified in 4 cases (0.7%). Haemangiomas accounted for 87 cases (15.8%), representing a significant portion of the benign vascular lesions.

Table 1: Demographic and clinical characteristics of the study population (n=550).

Variables		N	Percentage (%)
Age group (in years)	0-2	180	32.7
	>2-5	280	50.9
	6-12	90	16.4
Gender	Male	270	49.1
	Female	280	50.9
Mass location	Anterior cervical chain	120	21.8
	Posterior cervical chain	115	20.9
	Submandibular	100	18.2
	Carotid area	85	15.5
	Midline	76	13.8
	Other (parotid, supraclavicular, etc.)	54	9.8

Table 2: Ultrasound-based diagnosis of pediatric neck masses (n=550).

Diagnosis	Ultrasound cases	Percentage (%)
Lymphadenitis	223	40.6
Abscess	86	15.6
Neonatal fibromatosis colli	17	3.1
Branchial cleft cyst	26	4.7
Thyroglossal duct cyst	43	7.8
Thyroid gland lesion	4	0.7
Cystic hygroma	55	10.0
Dermoid cyst	9	1.6
Haemangioma	87	15.8
Total	550	100.0

Table 3: Histopathological diagnosis of pediatric neck masses (n=550).

Histopathological diagnosis	N	Percentage (%)
Lymphadenitis	188	34.2
Reactive	164	29.8
Granulomatous (TB)	24	4.4
Abscess	78	14.2
Neonatal fibromatosis colli	17	3.1
Branchial cleft cyst	30	5.5
Thyroglossal duct cyst	42	7.6
Thyroid gland lesions	3	0.5
Cystic hygroma	54	9.8
Dermoid cyst	13	2.4
Malignancies	36	6.5
Haemangioma	89	16.2
Total	550	100.0

Table 3 presents the histopathological diagnoses of pediatric neck masses in a cohort of 550 patients. The most common diagnosis was lymphadenitis, found in 188 cases (34.2%), which included reactive changes in 164 cases (29.8%) and granulomatous (tubercular) lymphadenitis in 24 cases (4.4%). Abscesses were diagnosed in 78 cases (14.2%), while haemangiomas accounted for 89 cases (16.2%).

Malignancies were identified in 36 cases (6.5%). Among congenital lesions, cystic hygromas were the most frequent (54 cases, 9.8%), followed by thyroglossal duct cysts (42 cases, 7.6%), branchial cleft cysts (30 cases, 5.5%), neonatal fibromatosis colli (17 cases, 3.1%), and dermoid cysts (13 cases, 2.4%). Thyroid gland lesions were found in 3 cases (0.5%).

Table 4: Diagnostic concordance between ultrasound and histopathology in pediatric neck masses.

Ultrasound diagnosis	Concordant	Total ultrasound	Concordance rate (%)
Lymphadenitis	188	223	84.3
Abscess	76	86	88.4
Neonatal fibromatosis colli	16	17	94.1
Branchial cleft cyst	25	26	96.2
Thyroglossal duct cyst	42	43	97.7
Cystic hygroma	54	55	98.0
Dermoid cyst	8	9	88.9
Haemangioma	83	87	95.4
Overall	495	550	90.0

Table 4 presents the diagnostic concordance between ultrasound and histopathological findings in 550 pediatric neck mass cases. The highest concordance rates were observed in cystic hygromas (98.0%), thyroglossal duct cysts (97.7%), and branchial cleft cysts (96.2%). Haemangiomas also showed high agreement at 95.4%, followed by neonatal fibromatosis colli at 94.1%.

Concordance was slightly lower for dermoid cysts (88.9%). Lymphadenitis, the most common diagnosis, demonstrated a concordance rate of 84.3%, while abscesses were correctly identified in 88.4% of cases. Overall, ultrasound achieved a concordance rate of 90.0%, supporting its role as a reliable, non-invasive first-line diagnostic modality for evaluating pediatric neck masses.

DISCUSSION

This study highlights the diagnostic concordance between ultrasonography and histopathology in evaluating pediatric neck masses at a tertiary care hospital in Bangladesh. Pediatric neck masses encompass a broad range of congenital, inflammatory, and neoplastic conditions, making accurate diagnosis essential for timely and effective management. The findings underscore the role of ultrasonography as a safe, accessible, and reliable initial diagnostic modality. The substantial agreement observed with histopathological outcomes supports its use in routine clinical assessment, particularly in settings where advanced imaging or immediate biopsy may not be feasible.

In this study, most pediatric patients presenting with neck masses were aged between >2 and 5 years (50.9%), followed by those aged 0-2 years (32.7%) and 6-12 years (16.4%), emphasizing that neck masses are most common in early childhood. Unlike earlier studies that reported male predominance, our cohort showed a nearly equal gender distribution, with a slight female predominance (50.9% females vs. 49.1% males).[14] The anterior (21.8%) and posterior cervical chains (20.9%) were the most commonly affected anatomical locations, followed closely by the submandibular region (18.2%). This pattern underscores the frequent involvement of cervical lymph nodes in pediatric neck masses, consistent with common presentations in early childhood. Overall, these findings reinforce that pediatric neck masses are most common in younger children and predominantly involve the cervical lymphatic regions.

In this study group, ultrasound most frequently detected lymphadenitis in 223 cases (40.6%), consistent with the findings reported by Al Mayoof et al.[15] Abscesses were the second most common diagnosis, seen in 86 cases (15.6%), comparable to Al Mayoof et al and notably higher than the 8.8% reported by Lucumay et al.[15,16] Among congenital anomalies, thyroglossal duct cysts were identified in 43 cases (7.8%) and branchial cleft cysts in 26 cases (4.7%), figures that closely match those of Al Mayoof et al and align with Shuaibu et al branchial cleft cyst rate of 7.1%, though their reported prevalence of thyroglossal duct cysts was substantially higher at 41.4%.[15,17] Cystic hygromas were seen in 10.0% of patients (55 cases), exceeding Al Mayoof et al rate but below Lucumay et al 18.2%.[15,16] Neonatal fibromatosis colli (17 cases, 3.1%) and dermoid cysts (9 cases, 1.6%) were observed at rates comparable to the 3.4% and 4.1% reported by Lucumay et al.[16] Haemangiomas accounted for 15.8% (87 cases), highlighting the wide range of underlying causes associated with pediatric neck masses. These results reinforce ultrasound's value as a reliable first-line diagnostic modality.

In this study population, lymphadenitis emerged as the most common histopathological diagnosis, identified in 188 cases (34.2%), which included 164 cases (29.8%) of reactive lymphadenopathy and 24 cases (4.4%) of granulomatous (tubercular) lymphadenitis. These proportions are generally consistent with those reported by Gangwar et al (54% reactive and 13.3% granulomatous) and Gupta et al (36.2% reactive and 21.5% granulomatous), reflecting similar patterns in the histopathological distribution of lymphadenitis.[18,19] Suppurative lesions (abscesses) accounted for 78 cases (14.2%), comparable to the 14.7% and 10.7% reported by Gangwar et al and Gupta et al respectively.[18,19] Among congenital anomalies, cystic hygromas were found in 54 cases (9.8%)-considerably higher than Gupta et al 0.98%-while thyroglossal duct cysts appeared in 42 cases (7.6%), similar to Gupta et al (7.8%) and Gangwar et al (10%).[18,19] Branchial cleft cysts were identified in 30 cases (5.5%), while neonatal fibromatosis colli was observed in 17 cases (3.1%). Dermoid cysts were less common (13 cases, 2.4%) than previously reported (11.3%-12.7%).[18,19] Malignancies were identified in 36 cases (6.5%), exceeding lymphoma rates in earlier studies (2%-3.9%).[18,19] Haemangiomas comprised 89 cases (16.2%), underscoring their role among benign vascular tumors. These findings reaffirm lymphadenitis and congenital lesions as the main pediatric neck mass etiologies and illustrate variability in malignancy rates across different settings.

In this study, ultrasound demonstrated a high overall diagnostic concordance of 90.0% with histopathology in pediatric neck masses, supporting its role as a reliable first-line modality. Congenital and vascular lesions demonstrated the highest levels of concordance, with diagnostic agreement rates of 98.0% for thyroglossal duct cysts, 97.7% for cystic hygromas, 96.2% for branchial cleft cysts, and 95.4% for haemangiomas. Neonatal fibromatosis colli also exhibited excellent concordance (94.1%). Among inflammatory conditions, abscesses achieved 88.4% agreement, while lymphadenitis-the most prevalent diagnosis-had an 84.3% concordance rate, reflecting some sonographic overlap in reactive versus granulomatous nodes. Dermoid cysts also showed a high level of concordance at 88.9%, though this was somewhat lower compared to other lesions. These findings align with prior reports and underscore ultrasound's accuracy, particularly for congenital and infective neck masses in pediatric patients.[20]

Limitations

This study had some limitations: The study was conducted in a selected tertiary-level hospital. The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

CONCLUSION

This study highlights the high diagnostic concordance between ultrasound and histopathology in pediatric neck masses, especially for congenital and infective lesions. Ultrasound was particularly reliable in diagnosing cystic

hygromas, thyroglossal duct cysts, branchial cleft cysts, and haemangiomas, with strong concordance also observed in cases of lymphadenitis and abscesses. These findings reinforce the utility of ultrasound as a valuable, non-invasive, and accurate first-line tool for evaluating pediatric neck masses.

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