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EVALUATION OF MIDLINE NECK MASS IN PAEDIATRIC AGE GROUP AND ITS DIAGNOSTIC ACCURACY.

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Abstract

Background: Midline neck masses are a frequent presentation in paediatric surgical and ENT practice. Because congenital, inflammatory, thyroid, and benign soft-tissue lesions may appear similar on initial examination, preoperative assessment often requires a combination of clinical evaluation, ultrasonography (USG), selective cross-sectional imaging, and fine needle aspiration cytology (FNAC). ***Materials & Methods:*** This prospective observational study included 25 children younger than 14 years with clinically apparent midline neck swelling. All children underwent detailed history taking, focused local and regional examination, first-line USG, and histopathological confirmation after excision. CT neck was performed selectively in 12 cases, and FNAC was used as an adjunctive investigation with 23 adequate aspirates. ***Results:*** The mean age was 7.6 ± 3.1 years and 56.0% of patients were male. Reactive lymphadenitis was the commonest lesion (48.0%), followed by epidermal inclusion cyst(24.0%), Ranula accounting 8%, Dermoid cyst is 8% while TB lymph node, thyroid swelling and thyroglossal cyst were seen in 1 case each (4.0%). Clinical examination showed exact agreement with histopathology in 68.0% of cases, USG in 88.0%, and CT in 91.7% of the selectively imaged subgroup. FNAC showed 88.0% overall agreement in the full cohort and 95.65% agreement among adequate aspirates. ***Conclusion:*** Histopathology remains the gold standard for final diagnosis of paediatric midline neck masses. USG should remain the first-line investigation, CT should be reserved for selected lesions, and FNAC should be used selectively as an adjunct, particularly in lesions where cytological clarification is likely to influence diagnosis or planning.

Keywords: Diagnostic accuracy, FNAC, Midline neck mass, Paediatric, Ultrasonography.

INTRODUCTION

Paediatric neck masses are commonly classified as congenital, inflammatory or infective, and neoplastic lesions, and the majority are benign [1]. In routine practice, the initial assessment is guided by the site of swelling, consistency, tenderness, relation to surrounding structures, and movement with swallowing or tongue protrusion [2-4].

For a child presenting with a midline neck swelling, clinical examination is essential but not always sufficient for definitive diagnosis because different pathologies may share overlapping physical findings. A structured diagnostic pathway is therefore important to distinguish cystic from solid lesions, define their anatomic extent, and plan the appropriate operative approach [5].

Ultrasonography is the most commonly used and preferred first-line investigation in children because it is non-ionizing, readily available, cost-effective, and capable of differentiating cystic from solid lesions while also assessing lesion extent, internal echoes, septations, vascularity, and relationship to the hyoid, thyroid gland, and floor of mouth [5-7].

CT and MRI are reserved for selected cases in which the lesion is deep seated, atypical, recurrent, poorly defined on ultrasound, or surgically complex, particularly when extension into adjacent spaces is suspected [7-10]. FNAC is used more selectively in paediatric practice because adequacy may be limited in cystic lesions, but it remains a useful adjunct in thyroid lesions and infective pathologies and may improve preoperative counselling and operative planning [5,8].

The present study aimed to evaluate the diagnostic accuracy of clinical examination, USG, CT, and FNAC in children with midline neck masses, using histopathology as the gold standard.

AIMS AND OBJECTIVES

1. To evaluate the clinico-pathological spectrum of midline neck masses in the paediatric age group.
2. To assess the diagnostic accuracy of clinical examination, USG, CT, and FNAC in comparison with histopathology.
3. To identify the most useful preoperative modality for common midline neck lesions.

MATERIALS AND METHODS

Study design: Prospective observational study
Study setting: Tertiary care teaching hospital
Study duration: One year
Sample size: 25 children

Inclusion criteria:

- Age less than 14 years.
- Midline neck swelling clinically apparent on inspection and/or palpation.

Exclusion criteria:

- Age more than 14 years.
- Neck swellings other than midline neck swelling.
- Children not fit for surgery or those in whom histopathological confirmation could not be obtained.

Methodology

All enrolled patients underwent detailed history taking and comprehensive clinical examination. History included duration of swelling, rate of progression, pain, fever, dysphagia, change in size, prior infection, discharge, and any previous intervention. Local and regional examination included site, size, shape, surface, margins, consistency, tenderness, fluctuation, local temperature, mobility, relation to the skin and deeper structures, movement with deglutition, movement with tongue protrusion, overlying skin changes, examination of the oral cavity and floor of mouth, thyroid examination, and cervical lymph node assessment. A provisional clinical diagnosis was recorded before further investigations.

USG of the neck was performed in all cases as the first-line imaging investigation. CT neck, with contrast where indicated, was performed selectively in lesions with deep extension, atypical features, recurrent swelling, suspected floor-of-mouth involvement, uncertain relationship to surrounding structures, or inconclusive USG findings. FNAC was used as an adjunctive investigation and categorized as diagnostic or non-diagnostic depending on specimen adequacy. Cytological diagnosis was recorded before surgery wherever aspirates were adequate for interpretation. All patients underwent definitive surgical excision as clinically indicated, and histopathological examination of the excised specimen was taken as the reference standard. Diagnostic accuracy of each modality was defined as exact preoperative diagnostic agreement with final histopathological diagnosis. For CT, accuracy was calculated in the selectively imaged subgroup only. Accuracy was expressed with 95% confidence intervals.

Statistical analysis

Data were summarized using frequencies, percentages, and mean ± standard deviation (SD) where appropriate. Diagnostic accuracy was calculated as correct diagnosis divided by total evaluated cases. Confidence intervals were estimated using the Wilson method. Statistical software used was SPSS 26.0.

RESULTS

A total of 25 children with midline neck swelling were included in the study. The mean age was 7.6 ± 3.1 years (range: 1-14 years). There were 14 males and 11 females, giving a male:female ratio of 1.27:1. Painless swelling was the commonest presenting complaint, observed in 20 patients (80.0%), while 5 patients (20.0%) had tenderness or pain. Movement with tongue protrusion was noted in 11 cases (44.0%), movement with deglutition alone in 2 cases (8.0%), and no movement with swallowing or tongue protrusion in 12 cases (48.0%) (Table 1).

The histopathological diagnosis spectrum is shown in Table 2. reactive lymphadenitis was the commonest lesion, accounting for 12 of 25 cases (48.0%), followed by epidermal inclusion cyst in 6 cases (24.0%). Ranula in 2 cases (8.0%) and dermoid cyst were seen in cases (8.0%), while TB lymph node, thyroid swelling and thyroglossal cyst were seen in 1 case each (4.0%).

Diagnostic accuracy of the evaluated modalities is summarized in Table 3. Clinical examination correctly predicted the final histopathological diagnosis in 17 of 25 cases, giving an exact accuracy of 68.0% (95% CI: 48.4-82.8). USG showed the highest concordance among investigations performed in all patients, with correct diagnosis in 22 of 25 cases and an accuracy of 88.0% (95% CI: 70.0-95.8). CT neck was performed selectively in 12 children and correctly identified the lesion in 11, corresponding to an accuracy of 91.7% (95% CI: 64.6-98.5). FNAC showed exact agreement with histopathology in 22 of 25 cases overall (88.0%); among the 23 adequate aspirates, 22 were correctly diagnosed, giving an accuracy of 95.65% (95% CI: 80.2-99.6).

Diagnosis-wise concordance of clinical examination, USG, CT, and FNAC with histopathology is presented in Table 4. Among the 25 cases, reactive lymphadenitis was the most common histopathological diagnosis (12 cases), followed by epidermal inclusion cyst (6 cases), ranula (2 cases), dermoid cyst (2 cases), and one case each of TB lymph node, thyroid swelling and thyroglossal cyst. Clinical examination showed variable accuracy across lesions, with highest accuracy for TB lymph node(100%) and epidermal inclusion cyst (83.3%), while it correctly identified 75.0% of reactive lymphadenitis cases and 50.0% each of ranula and dermoid cyst cases. Clinical diagnosis failed to correctly identify the single cases of thyroid swelling and thyroglossal cyst. USG demonstrated high diagnostic accuracy for most lesions, correctly identifying all cases of ranula, epidermal inclusion cyst, thyroglossal cyst, and thyroid swelling (100% each), while its accuracy was 91.7% for reactive lymphadenitis and 50.0% for dermoid cyst. However, USG failed to correctly diagnose the single case of TB lymph node. CT was performed only in selected cases, but wherever done, it showed 100% accuracy for ranula, dermoid cyst, thyroglossal cyst, thyroid swelling, epidermal inclusion cyst, and reactive lymphadenitis. The only exception was TB lymph node, in which CT did not yield the correct diagnosis. FNAC also showed high overall accuracy, correctly diagnosing all cases of ranula, epidermal inclusion cyst, thyroglossal cyst, thyroid swelling, lipoma, and TB lymph node, while its accuracy for dermoid cyst was 50.0%.

Table 1. Baseline demographic and clinical profile (n=25)

Variable	Value
Age in years (mean ± SD) (Range)	7.6 ± 3.1 (1-14)
Male	14 (56%)
Female	11 (44%)
Painless swelling at presentation	20 (80%)
Tender/painful swelling	5 (20%)
Movement with tongue protrusion	11 (44%)
Movement with deglutition only	2 (8%)
No movement with swallowing/tongue protrusion	12 (48%)

Table 2. Histopathological diagnosis spectrum of midline neck masses (n=25)

Histopathological diagnosis	Number	Percentage
Ranula	2	8%
Thyroid swelling	1	4%
Thyroglossal cyst	1	4%
Epidermal inclusion cyst	6	24%
TB Lymph Node	1	4%
Dermoid cyst	2	8%
Reactive Lymphadenitis	12	48%
Total	25	100%

Table 3. Diagnostic accuracy of clinical examination, USG, CT, and FNAC compared with histopathology

Modality	Cases evaluated (n)	Correct diagnosis (n)	Accuracy (%)	95% CI
Clinical examination	25	17	68.0	48.4-82.8
USG	25	22	88.0	70.0-95.8
CT neck	12	11	91.7	64.6-98.5
FNAC (adequate aspirates)	23	22	95.65	80.2-99.6

Note: Overall FNAC exact agreement in the full 25-case cohort was 22/25 (88.0%); accuracy among adequate aspirates was 22/23 (95.65%).

Table 4. Diagnosis-wise concordance of preoperative modalities with histopathology

Histopathological diagnosis	Clinical correct / total	USG correct / total	CT correct / CT done	FNAC correct / total
Ranula	1/2 (50.0%)	2/2 (100.0%)	1/1 (100.0%)	2/2 (100.0%)
Thyroid swelling	0/1 (0.0%)	1/1 (100.0%)	1/1 (100.0%)	1/1 (100.0%)
Thyroglossal cyst	0/1 (0.0%)	1/1 (100.0%)	1/1 (100.0%)	1/1 (100.0%)
Epidermal inclusion cyst	5/6 (83.3%)	6/6 (100.0%)	2/2 (100.0%)	6/6 (100%)
TB Lymph Node	1/1 (100.0%)	0/1 (0.0%)	0/1 (0.0%)	1/1 (100.0%)
Dermoid cyst	1/2 (50.0%)	1/2 (50.0%)	2/2 (100.0%)	1/2 (50.0%)
Reactive Lymphadenitis	9/12 (75.0%)	11/12 (91.7%)	4/4 (100.0%)	12/12 (100%)

DISCUSSION

The present study evaluated the clinicopathological profile of paediatric midline neck masses and the diagnostic performance of commonly used preoperative modalities, namely clinical examination, ultrasonography (USG), CT neck, and fine-needle aspiration cytology (FNAC). In contrast to the classical paediatric otolaryngology literature, where congenital lesions—especially thyroglossal duct cysts and dermoid cysts—predominate among true midline neck masses, the most frequent histopathological diagnosis in our series was reactive lymphadenitis (48.0%), followed by epidermal inclusion cyst (24.0%). Ranula and dermoid cyst each accounted for 8.0%, while TB lymph node, thyroid swelling, and thyroglossal cyst were uncommon. This pattern differs from reports by Pitner et al. [2], Eeftinck Schattenkerk et al. [3], and Kepertis et al. [6], all of whom emphasized thyroglossal duct cyst and dermoid cyst as the principal lesions in paediatric midline neck swellings. Similarly, broader reviews by Jackson [1] and Goins and Beasley [11] describe congenital lesions as the dominant diagnostic category in children. The relatively high burden of tuberculous lymphadenitis in the present cohort likely reflects regional disease epidemiology and referral patterns rather than a contradiction of established paediatric neck-mass algorithms. In tuberculosis-endemic settings, infective causes may significantly broaden the differential diagnosis even when the swelling appears clinically central.

Clinical examination in our study achieved exact agreement with histopathology in 68.0% of cases. This level of accuracy indicates that careful history taking and physical examination remain indispensable, but also confirms their limitations as stand-alone diagnostic tools. Clinical diagnosis performed relatively well for epidermal inclusion cyst (83.3%) and reactive lymphadenitis (75.0%), but was less reliable for ranula and dermoid cyst (50.0% each), and failed to identify the isolated cases of thyroid swelling and thyroglossal cyst correctly. These findings are clinically understandable because many paediatric neck masses share overlapping features such as painless swelling, soft or cystic consistency, and long duration, while distinguishing signs—such as movement with deglutition or tongue protrusion—may not always be clearly demonstrable in young children. Jackson [1] emphasized that location, mobility, skin changes, tenderness, and developmental history are essential in narrowing the diagnosis, while Unsal et al. [5] similarly concluded that examination alone often cannot reliably differentiate congenital, inflammatory, and infective lesions. Thus, our findings support the concept that clinical examination should be viewed as the first diagnostic step that frames the differential diagnosis and guides subsequent investigations, rather than as a definitive method in itself.

USG demonstrated a markedly better overall performance than clinical examination, with 22 correct diagnoses among 25 cases (88.0%). This is consistent with the widely accepted role of ultrasonography as the first-line imaging modality in paediatric neck masses because it is non-ionizing, inexpensive, easily repeatable, and capable of distinguishing cystic from solid lesions while also depicting lesion extent and relation to adjacent structures [1,4,5,10]. In the present series, USG correctly identified all cases of ranula, epidermal inclusion cyst, thyroglossal cyst, and thyroid swelling, and also correctly diagnosed 11 of 12 reactive lymphadenitis cases (91.7%). Its performance was lower in dermoid cyst and TB lymph node, where one lesion in each category was not correctly classified. Our observations are broadly in agreement with Sidell and Shapiro [4], who highlighted the usefulness of ultrasonography for congenital cervical cysts, and with recent comparative work by Pitner et al. [2] and Eeftinck Schattenkerk et al. [3], which showed that ultrasound-based features can meaningfully aid the distinction between thyroglossal duct cysts and dermoid cysts. However, the findings of Tanphaichitr et al. [12] are also relevant: although ultrasound was highly useful in determining which paediatric midline neck lesions required surgery, it was less accurate for exact pathological characterization than for general lesion categorization. That nuance aligns well with our data—USG performed very well overall, but was not infallible across all lesion types.
The very good performance of USG in reactive lymphadenitis deserves specific emphasis. In our study, ultrasound correctly diagnosed 91.7% of histologically proven reactive nodes.

CT neck, performed in a selective subgroup of 12 cases, correctly identified 11 lesions (91.7%). This high figure should be interpreted cautiously because CT was not applied uniformly across the cohort; rather, it was used when deeper

extension, atypical morphology, floor-of-mouth involvement, or uncertainty on USG warranted further evaluation. Such selective use explains why CT appears to perform extremely well in this series. Jackson [1] and Mittal et al. [10] both support a targeted rather than routine role for cross-sectional imaging in neck masses, particularly when lesion extent, deep tissue relations, airway involvement, or operative planning require better anatomical delineation. In our material, CT showed perfect concordance in the imaged cases of ranula, dermoid cyst, thyroglossal cyst, thyroid swelling, epidermal inclusion cyst, and reactive lymphadenitis, but not in the single TB lymph node case. These findings support the view that CT is best used as a problem-solving and surgical-planning modality, rather than as the initial investigation in every child with a midline neck swelling. Given radiation exposure in children, reserving CT for selected indications remains the most rational approach.

FNAC also showed strong diagnostic utility. In the full cohort, exact agreement with histopathology was 88.0% (22/25), while among adequate aspirates, accuracy increased to 95.65% (22/23). This distinction is important because it demonstrates that cytological performance depends heavily on specimen adequacy. In lesion-wise analysis, FNAC correctly identified all cases of ranula, epidermal inclusion cyst, thyroglossal cyst, thyroid swelling, reactive lymphadenitis, and TB lymph node, while concordance was lower for dermoid cyst (50.0%). These findings are compatible with published paediatric literature. Huyett et al. [8] found FNAC to be an accurate and safe diagnostic tool in paediatric head and neck masses, particularly useful in persistent lymphadenopathy and thyroid lesions. Earlier studies by Anne et al. [13] and Liu et al. [14] likewise supported FNAC as a feasible minimally invasive investigation that can reduce the need for open biopsy in selected paediatric neck masses. The strong performance of FNAC in our thyroid swelling and TB lymph node cases is particularly noteworthy, as these lesions often yield diagnostically helpful cytological material. Rameshkumar et al. [14] specifically described FNAC as a useful adjunct in childhood tuberculous lymphadenitis, although they also noted limitations when inflammatory changes or low bacillary yield complicate interpretation. Overall, our data support a selective but important role for FNAC, especially where thyroid pathology, granulomatous disease, or lymphadenopathy is suspected and where cytology may alter preoperative planning.

Taken together, the present study supports a stepwise multimodal diagnostic strategy for paediatric midline neck masses. Clinical examination remains the essential starting point, but its moderate accuracy means that imaging and cytology are often required for refinement. USG should remain the first-line investigation because of its high overall accuracy and practical advantages. CT should be used selectively for anatomically complex lesions or when ultrasound is insufficient for operative planning. FNAC serves as a valuable adjunctive modality, particularly when adequate aspirates are obtained and when infective or thyroid lesions are suspected. Nonetheless, despite the usefulness of these modalities, histopathology remains the gold standard and the final arbiter of diagnosis. This principle is especially important in settings such as ours, where the lesion profile may differ from the congenital-dominant distributions reported in many paediatric surgical series.

CONCLUSION

In conclusion, reactive lymphadenitis was the most common histopathological diagnosis in the present series of paediatric midline neck masses, followed by epidermal inclusion cyst. This differs from many published paediatric series in which congenital lesions such as thyroglossal duct cyst and dermoid cyst predominate, and underscores the importance of considering local epidemiology while evaluating paediatric neck swellings. Clinical examination provided useful preliminary diagnostic information but showed only moderate exact accuracy. USG demonstrated high overall diagnostic accuracy and should remain the first-line investigation. CT neck was highly informative in selected cases requiring further anatomical clarification, while FNAC proved to be a highly valuable adjunctive investigation, especially when adequate aspirates were obtained and when thyroid or tuberculous pathology was suspected. Despite these useful preoperative modalities, histopathological examination remains the definitive gold standard for final diagnosis. Overall, the findings support a rational multimodal approach in which clinical examination is complemented by targeted use of USG, CT, and FNAC to achieve optimal diagnostic precision and guide appropriate management.

CONFLICT OF INTEREST

None declared.

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