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Original Article

Clinicopathological Spectrum and Imaging Features of Non-lymphadenopathic Superficial Masses in Children: A Retrospective Cohort Study

Çocuklarda Lenfadenopatik Olmayan Yüzeyel Kitlelerin Klinikopatolojik Özellikleri ve Görüntüleme Bulguları: Retrospektif Bir Kohort Çalışması

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ABSTRACT

Objective: Superficial mass lesions in children encompass a broad spectrum of congenital, benign, and, rarely, malignant entities. Despite their predominantly benign nature, overlapping clinical and imaging features may complicate establishment of preoperative diagnosis. This study aimed to evaluate the clinicopathological spectrum, anatomical distribution, and imaging characteristics of non-lymphadenopathic superficial masses in children, with additional analysis of diagnostic concordance among isolated neck lesions.

Method: This retrospective cohort study population consisted of children aged 0-18 years who underwent surgical excision of superficial mass lesions between 2018 and 2026. Lymphadenopathic lesions and non-excisional cases were excluded, except for 5 cases with benign aspiration cytology results who were treated with bleomycin. Histopathological diagnoses were standardized into major groups. Clinical, anatomical, and imaging data were analyzed descriptively and comparatively. In the isolated neck mass subgroup, clinicoradiologic prediagnosis was compared with final histopathology findings.

Results: A total of 201 patients were included (median age, 8 years; 55.2% female). Adnexal/keratinous benign lesions (50.0%) and congenital/developmental lesions (26.5%) were the most common groups. Pilomatrixoma, epidermal-type keratinous cyst, and thyroglossal duct cyst were the leading diagnoses. Lesions were most frequently located in the head and neck. Vascularity was predominantly observed in vascular/lymphatic lesions, whereas calcification was largely confined to adnexal/keratinous lesions, particularly in cases with pilomatrixoma ($p<0.001$). In isolated neck masses, diagnostic concordance was highest between clinical and histopathological diagnoses in cases with pilomatrixoma (91.7%) and thyroglossal duct cyst (75.7%), but lower among cases with branchial cyst and dermoid/epidermoid cyst ($p=0.001$).

Conclusion: Pediatric superficial mass lesions are predominantly benign, with characteristic anatomical and imaging patterns that may help refine preoperative assessment. Diagnostic concordance was highest for cases with pilomatrixoma and thyroglossal duct cyst, whereas prediagnoses of branchial cyst and dermoid/epidermoid cyst showed greater heterogeneity, particularly among neck lesions.

Keywords: Pediatrics, soft tissue neoplasms, head and neck masses, ultrasonography, magnetic resonance imaging, pathology

ÖZ

Amaç: Çocuklarda yüzeyel kitle lezyonları, konjenital, benign ve nadiren malign oluşumlardan oluşan geniş bir spektrumu kapsar. Çoğunlukla benign olmalarına rağmen, örtüşen klinik ve görüntüleme bulguları preoperatif tanıyı güçleştirebilir. Bu çalışmada, çocuklarda lenfadenopatik olmayan yüzeyel kitlelerin klinikopatolojik spektrumu, anatomik dağılımı ve görüntüleme özelliklerinin değerlendirilmesi ve izole boyun lezyonlarında tanısal uyumun analiz edilmesi amaçlandı.

Yöntem: Bu retrospektif kohort çalışmaya, 2018-2026 yılları arasında yüzeyel kitle nedeniyle cerrahi eksizyon uygulanan 0-18 yaş arası çocuklar dahil edildi. Lenfadenopatik lezyonlar ve eksizyon uygulanmayan olgular, cerrahi dışı izlenen sınırlı sayıda lenfatik lezyon dışında dışlandı. Histopatolojik tanılar ana gruplar halinde

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standardize edildi. Klinik, anatomik ve görüntüleme verileri tanımlayıcı ve karşılaştırmalı olarak analiz edildi. İzole boyun kitlesi alt grubunda klinik-radyolojik ön tanılar ile nihai histopatoloji karşılaştırıldı.

Bulgular: Toplam 201 hasta dahil edildi (medyan yaş: 8 yıl; %55,2 kız). En sık görülen gruplar adneksiyal/keratinöz benign lezyonlar (%50,0) ve konjenital/gelişimsel lezyonlardı (%26,5). En sık tanılar pilomatriksoma, epidermal tip keratinöz kist ve tiroglossal kanal kistiydi. Lezyonlar en sık baş-boyun bölgesinde yerleşmişti. Vaskülarite çoğunlukla vasküler/lenfatik lezyonlarda izlenirken, kalsifikasyon özellikle pilomatriksoma olmak üzere adneksiyal/keratinöz lezyonlarla ilişkiliydi (p<0,001). İzole boyun kitlelerinde tanısal uyum pilomatriksoma (%91,7) ve tiroglossal kanal kistinde (%75,7) yüksek, brankial kist ve dermoid/epidermoid kistlerde daha düşüktü (p=0,001).

Sonuç: Çocukluk çağı yüzeyel kitleleri çoğunlukla benign olup, karakteristik anatomik ve görüntüleme özellikleri preoperatif değerlendirmeyi yönlendirebilir. Tanısal uyum pilomatriksoma ve tiroglossal kanal kistinde yüksekken, brankiyal ve dermoid/epidermoid kistlerde daha heterojen seyretmektedir.

Anahtar kelimeler: Pediyatri, yumuşak doku kitlesi, baş ve boyun kitleleri, ultrasonografi, manyetik rezonans görüntüleme, patoloji

INTRODUCTION

Superficial mass lesions of childhood comprise a heterogeneous group that includes congenital/developmental lesions, benign cutaneous and subcutaneous tumors, vascular and lymphatic anomalies, inflammatory/reactive processes, and, less commonly, malignant neoplasms. Although most of these lesions are benign, they have overlapping clinical and imaging findings may complicate preoperative diagnosis. Ultrasonography is usually the first-line imaging modality for superficially located lesions, whereas magnetic resonance imaging (MRI) is generally reserved for larger, deeper, or more complex masses[1-3]. Unlike many previous pediatric reports that focused on a single diagnosis, a single anatomical region, or an imaging-centered perspective, the present study evaluates a broader clinicopathological spectrum of non-lymphadenopathic superficial mass lesions and includes a dedicated isolated neck mass subgroup analysis.

The present study was designed to evaluate the histopathological spectrum, anatomical distribution, and imaging characteristics of non-lymphadenopathic superficial mass lesions in children treated in a pediatric surgery unit over an extended period. In addition, because the neck mass lesions represented a clinically important subset within the cohort, an isolated subgroup of these lesions was analyzed separately to examine the relationship between clinicoradiologic prediagnosis and final histopathology. By integrating clinical, anatomical, imaging, and pathological data within a standardized classification framework, we aimed to provide a practical overview of these lesions.

MATERIALS and METHODS

Study Design and Patients

This retrospective cohort study was approved by the Non-Interventional Clinical Research Ethics Committee of University of Health Sciences Türkiye, Dr. Behçet Uz Pediatric Diseases and Surgery Training and Research Hospital (protocol number: GOA-335, approval number: 2026/06-10, date: 26.03.2026), and was conducted in accordance with the principles of the Declaration of Helsinki.

This retrospective observational study was conducted in the department of pediatric surgery of a university hospital and included children evaluated for superficial mass lesions between 2018 and 2026. Medical records, operative notes, pathology reports, and available imaging studies were reviewed. For this study, a superficial mass lesion was defined as a palpable lesion arising from the skin, subcutaneous tissue, or superficial fascia, and managed surgically or, in selected lymphatic lesions, by a documented minimally invasive therapeutic approach. Among patients aged 0-18 years having at least basic clinical data and a final pathology result but without lymphadenopathic lesions, those who were evaluated in the pediatric surgery clinic for a superficial mass lesion, and underwent surgical excision of the mass lesions that were submitted for histopathological examination were included in the study. Patients having lymphadenopathy, abscesses managed by drainage alone, markedly incomplete records, lesions originating from bone, intrathoracic structures, or intra-abdominal organs, and deeply located lesions not meeting the definition of a superficial mass, and those undergoing only incisional or diagnostic biopsy without complete excision or lymph node excision were excluded from the study. Lymphatic lesions that were evaluated based on only histological examination of their aspiration cytology material rather than their tissue excision specimens were also generally excluded from the analyses. However, five superficially located lymphatic lesions managed with bleomycin without total excision were retained in the descriptive cohort because aspiration cytology was benign and the clinicoradiologic findings were considered sufficiently characteristic. Thus, among the lymphatic lesions included in the final cohort, some underwent complete excision,

whereas a small subset of lesions with benign aspiration cytology results managed non-excisionally.

Data Collection and Imaging

Demographic and clinical variables recorded included age at surgery, sex, presenting complaint, lesion multiplicity, anatomical location, and laterality, where applicable. Preoperative imaging data were also collected, including the availability of ultrasonography and MRI, the maximum lesion diameter reported on ultrasonography, and descriptive imaging features such as vascularity and calcification when documented. Because imaging reports were not uniformly diagnostic in all cases, imaging was not analyzed as a standalone diagnostic test. Instead, preoperative diagnosis was defined as the working clinicoradiologic impression based on physical examination and available imaging test results, and it was evaluated in relation to the final histopathological diagnosis.

Histopathological and Anatomical Classification

Histopathological diagnoses were standardized and grouped into seven major categories for analysis: Congenital/developmental lesions, adnexal/keratinous benign lesions, vascular/lymphatic lesions, benign mesenchymal/neural lesions, fibroblastic/myofibroblastic lesions, inflammatory/reactive lesions, and malignant lesions. Standardized diagnostic labels were used to harmonize minor terminology differences across pathology reports. Anatomical distribution was classified into five major regions: head and neck, trunk, upper extremity, lower extremity, and perineal/genital region. For subgroup analysis, an isolated neck mass subgroup was additionally defined, comprising lesions localized to the neck region without concomitant lesions at other anatomical sites. In this subgroup, clinicoradiologic prediagnosis, final histopathology, and laterality were evaluated in greater detail to assess concordance patterns, particularly for lesions initially considered to be thyroglossal duct cysts, branchial cysts, dermoid/epidermoid cysts, pilomatrixomas, and vascular/lymphatic lesions.

The primary outcome of the study was the distribution of standardized histopathological diagnoses and major histopathological groups in children with non-lymphadenopathic superficial mass lesions. Secondary outcomes included the anatomical distribution of lesions across the major histopathological groups, ultrasonographic dimensions of the lesion, preoperative imaging patterns, and ultrasonographic features such as vascularity and calcification. In the isolated neck mass subgroup, additional secondary outcomes were the concordance between clinicoradiologic prediagnosis and final histopathology and the laterality pattern of the lesions. Continuous variables were summarized as medians and interquartile ranges (IQRs) because the distributions of age and lesion size were not assumed to be normal. Categorical variables were expressed as numbers and percentages. Percentages for standardized histopathological diagnoses were calculated both within each major histopathological group and, where appropriate, relative to the total cohort.

Statistical Analysis

Continuous variables were summarized as medians and IQRs, whereas categorical variables were expressed as numbers and percentages. Comparisons of age across major histopathological groups were performed using the Kruskal-Wallis test. Categorical variables, including sex, lesion multiplicity, anatomical distribution, vascularity, calcification, and clinicoradiologic-histopathologic concordance in the isolated neck mass subgroup, were compared using Pearson's chi-square test. A two-sided p-value<0.05 was considered statistically significant. Given the small sizes of some groups, inferential results were interpreted cautiously and used primarily to support key descriptive findings.

RESULTS

A total of 201 children with non-lymphadenopathic superficial mass lesions were included in the final cohort. The median age of the children at surgery was 8 years (IQR, 5-11), and 111 patients (55.2%) were female. Histopathologically, the largest category included adnexal/keratinous benign lesions (100/201, 50.0%), followed by congenital/developmental (53/201, 26.5%), vascular/lymphatic (23/201, 11.5%), and benign mesenchymal/neural lesions (16/201, 8.0%). In contrast, fibroblastic/myofibroblastic, inflammatory/reactive, and malignant lesions were uncommon (Table 1). There were no significant between-group differences in terms of age, sex distribution, or lesion multiplicity across the major histopathological groups (p=0.139, p=0.268, and p=0.178, respectively). Among the standardized diagnoses, pilomatrixoma (55 cases) and keratinous cyst (epidermal type) (43 cases) were the two most frequent individual entities in the entire cohort. Among congenital/developmental lesions, thyroglossal duct cyst was the most common diagnosis (31/53, 58.5%), followed by dermoid cyst (11/53, 20.8%) and branchial cyst (7/53, 13.2%). In the vascular/lymphatic group, lymphangioma

(10/23, 43.5%) and capillary hemangioma (7/23, 30.4%) were the most common diagnoses (Table 2).

Anatomical distribution varied substantially, and statistically significant across the major histopathological

Table 1. Demographic and lesion characteristics according to major histopathological groups

Histopathological groups	n (%)	Age, median (IQR), years	Male, n (%)	Female n (%)	Solitary lesions, n (%)	Cystic lesions, n (%)	Multiple lesions, n (%)
Congenital/developmental lesions	53 (26.5%)	7 (4-9)	29 (55%)	24 (45%)	8 (15%)	45 (85%)	0 (0%)
Adnexal/keratinous benign lesions	100 (50%)	8 (6-11)	37 (37%)	63 (63%)	57 (57%)	43 (43%)	3 (3%)
Vascular/lymphatic lesions	23 (11.5%)	8 (5.5-10.5)	12 (52.1%)	11 (47.9%)	13 (56.5%)	10 (43.5%)	3 (13%)
Benign mesenchymal/neural lesions	16 (8%)	7.5 (5-10.3)	7 (43.7%)	9 (56.3%)	13 (81.2%)	3 (18.8%)	1 (6%)
Fibroblastic/myofibroblastic lesions	5 (2.5%)	12 (8-13)	2 (40%)	3 (60%)	3 (60%)	2 (40%)	0 (0%)
Inflammatory/reactive lesions	2 (1%)	7 (6-8)	2 (100%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
Malignant lesions	2 (1%)	4.5 (4-5)	1 (50%)	1 (50%)	2 (100%)	0 (0%)	0 (0%)
Total	201 (100%)	8 (5-11)	90 (44.8%)	111 (55.2%)	98 (48.7%)	103 (51.3%)	7 (3.5%)

Data are presented as n (%) unless otherwise indicated. Age is presented as median (IQR). Multiple lesions refer to patients with more than one lesion. Cystic lesions were classified according to the final histopathological diagnosis. IQR: Interquartile ranges

Table 2. Standardized histopathological diagnoses within the major histopathological groups

Major histopathological groups	Standardized histopathological diagnosis	n	% within group	% of total cohort
Congenital/developmental lesions	Thyroglossal duct cyst	31	58.5	15.4
	Branchial cyst	7	13.2	3.5
	Dermoid cyst	11	20.8	5.5
	Median raphe cyst	1	1.9	0.5
	Subcutaneous bronchogenic cyst	1	1.9	0.5
	Accessory tragus	2	3.8	1.0
Adnexal/keratinous benign lesions	Pilomatrixoma	55	55.0	27.4
	Keratinous cyst (epidermal type)	43	43.0	21.4
	Follicular cyst	1	1.0	0.5
	Eccrine spiradenoma	1	1.0	0.5
Vascular/lymphatic lesions	Capillary hemangioma	7	30.4	3.5
	Cavernous hemangioma	4	17.4	2.0
	Lymphangioma	10	43.5	5.0
	Lobular capillary hemangioma	1	4.3	0.5
	Masson tumor (intravascular papillary endothelial hyperplasia)	1	4.3	0.5
Benign mesenchymal/neural lesions	Lipoma	8	50.0	4.0
	Neurofibroma	3	18.8	1.5
	Leiomyoma	1	6.2	0.5
	Neurothekeoma	1	6.2	0.5
	Soft tissue chondroma (extraskeletal chondroma)	1	6.2	0.5
	Benign chondroid lesion	2	12.5	1.0
Fibroblastic/myofibroblastic lesions	Nodular fasciitis	2	40.0	1.0
	Desmoid fibromatosis	1	20.0	0.5
	Myofibroblastic proliferation	1	20.0	0.5
	Pleomorphic fibroma	1	20.0	0.5
Inflammatory/reactive lesions	Calcified nodule	1	50.0	0.5
	Subcutaneous granuloma annulare	1	50.0	0.5
Malignant lesions	Low-grade fibromyxoid sarcoma	1	50.0	0.5
	Alveolar rhabdomyosarcoma	1	50.0	0.5

Percentages in the fourth column are calculated within each major histopathological group; percentages in the fifth column are based on the total cohort (n=201). Histopathological diagnoses were standardized for analysis

groups (p<0.001) (Table 3, Figure 1). Congenital/developmental lesions were strongly concentrated in the head and neck region (46/53, 86.8%). In contrast, adnexal/keratinous benign lesions showed a broader distribution, involving the head and neck (44.0%), trunk (25.0%), and upper extremities (23.0%). Vascular/lymphatic lesions were distributed more evenly between the head, neck and trunk (each 39.1%), whereas benign mesenchymal/neural lesions were predominantly located on the trunk (50.0%). Fibroblastic/myofibroblastic lesions were confined to the head, neck and trunk, while the two malignant lesions were located on the trunk and lower extremities, respectively. Lesion size on ultrasonography also differed across histopathological groups. Congenital/developmental lesions and adnexal/keratinous benign lesions tended to be relatively small, with median maximum diameters of 1.5 cm (IQR, 1.1-2.2) and 1.4 cm (IQR, 0.8-1.6), respectively. Vascular/lymphatic lesions were generally larger, with a median maximum diameter of 2.5 cm (IQR, 1.0-5.0), whereas benign mesenchymal/neural lesions had the

Table 3. Anatomical distribution and ultrasonographic lesion size according to major histopathological groups

Major histopathological groups	Head and neck, n (%)	Trunk, n (%)	Upper extremity, n (%)	Lower extremity, n (%)	Perineal/genital, n (%)	Max lesion diameter on USG, median (IQR), cm
Congenital/developmental lesions	46 (86.8)	6 (11.3)	-	-	1 (1.9)	1.5 (1.1-2.2)
Adnexal/keratinous benign lesions	44 (44.0)	25 (25.0)	23 (23.0)	-	8 (8.0)	1.4 (0.8-1.6)
Vascular/lymphatic lesions	9 (39.1)	9 (39.1)	3 (13.0)	2 (8.7)	-	2.5 (1.0-5.0)
Benign mesenchymal/neural lesions	6 (37.5)	8 (50.0)	1 (6.2)	-	1 (6.2)	4.0 (2.0-5.3)
Fibroblastic/myofibroblastic lesions	3 (60.0)	2 (40.0)	-	-	-	2.3 (1.5-2.4)
Inflammatory/reactive lesions	1 (50.0)	-	1 (50.0)	-	-	2.1 (1.2-3.0)*
Malignant lesions	-	1 (50.0)	-	1 (50.0)	-	4.8 (4.0-5.5)*

Data are presented as n (%) unless otherwise indicated. Ultrasonographic lesion size is presented as median (IQR) in centimeters: For groups with very small sample sizes (n=2), lesion size is presented as median (range). IQR: Interquartile range, USG: Ultrasonography

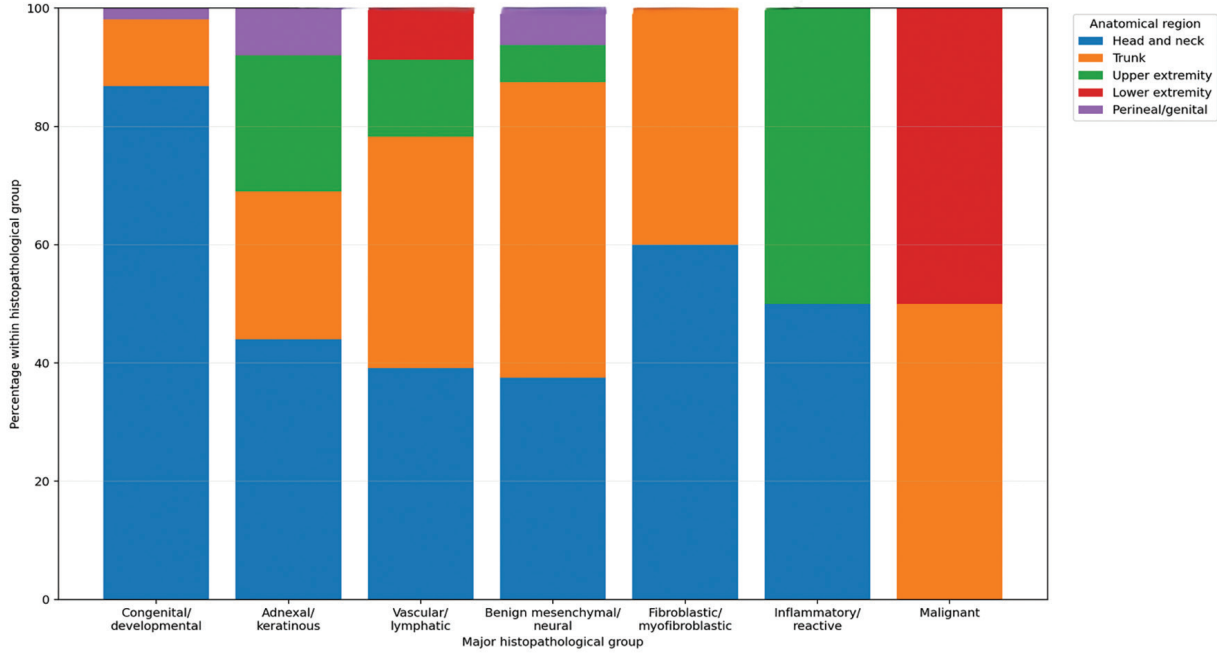

Figure 1. Anatomical distribution across major histopathological groups

A hundred percent stacked bar chart showing the proportional anatomical distribution of lesions within each major histopathological group (n=201). Anatomical regions were classified as head and neck, trunk, upper extremity, lower extremity, and perineal/genital region. Major histopathological groups comprised congenital/developmental lesions, adnexal/keratinous benign lesions, vascular/lymphatic lesions, benign mesenchymal/neural lesions, fibroblastic/myofibroblastic lesions, inflammatory/reactive lesions, and malignant lesions

greatest median diameter (4.0 cm; IQR, 2.0-5.3) among the common benign groups. The two malignant lesions measured 4.8 cm (range, 4.0-5.5) on ultrasonography.

Preoperative imaging results were available in 183 of 201 patients (91.0%). Ultrasonography alone was performed in 138 patients (68.7%), whereas both ultrasonography and MRI were performed in 45 patients (22.4%). While 18 patients (9.0%) had not undergone preoperative imaging tests. Frequency of MRI use varied by lesion category. In relative terms, MRI was most frequently performed in the malignant group (2/2) and in patients with benign mesenchymal/neural lesions (7/16, 43.8%) and vascular/lymphatic lesions (9/23, 39.1%). In absolute numbers, however, congenital/developmental lesions accounted for the most MRI examinations n=16, followed by adnexal/keratinous benign lesions (n=11). Anatomically, most MRI examinations were performed for head and neck lesions (29/45, 64.4%), followed by trunk lesions (13/45, 28.9%), whereas each one of lower, upper extremity, and perineal/genital lesions had undergone MRI examinations only once (2.2% per se). Two notable ultrasonographic patterns emerged. The distribution of vascularity differed significantly across the major histopathological groups ($p<0.001$) which was most prominent among vascular/lymphatic lesions (n=6), while only a few additional vascularized lesions were detected in cases with benign mesenchymal/neural (n=2), fibroblastic/myofibroblastic n=1, and malignant (n=2) lesions. No vascularity was documented in congenital/developmental, adnexal/keratinous benign, or inflammatory/reactive lesions. Likewise, distribution of calcification differed significantly across groups ($p<0.001$) and was overwhelmingly concentrated in benign adnexal/keratinous lesions (44/48), particularly in pilomatrixomas n=39. Only isolated calcified lesions were observed in the vascular/lymphatic, benign mesenchymal/neural, fibroblastic/myofibroblastic, and inflammatory/reactive groups (1 case each).

Among 103 patients with isolated neck masses, the most frequent clinicoradiologic prediagnoses were thyroglossal duct cyst (n=37), dermoid/epidermoid cyst (n=21), branchial cyst (n=15), and pilomatrixoma (n=12). While vascular/lymphatic lesions accounted for 5 cases, and the remaining 13 cases were grouped as other clinicoradiologic prediagnoses (Table 4, Figure 2). Histopathologic confirmation rates differed significantly across these prediagnostic categories ($p=0.001$). Thyroglossal duct cyst showed a relatively high clinicoradiologic-pathologic concordance, with histopathological confirmation in 28 of 37 cases (75.7%). These lesions were overwhelmingly localized at midline (35/37), with only 2 left-sided cases. In contrast, branchial cysts were histopathologically confirmed preoperatively in only 6 of 15 cases (40.0%) and showed greater heterogeneity, with 5 lesions proving to be epidermal/dermoid cysts and 4 cases falling into other pathological categories. Lesions initially considered branchial cysts were characteristically lateral, with a slight right-sided predominance (8 right, 5 left, and 2 midline). Prediagnosis of dermoid/epidermoid cyst was confirmed in 8 of 21 cases (38.1%), whereas 8 lesions were ultimately diagnosed as pilomatrixoma, highlighting substantial overlap between these entities in routine preoperative assessment. By contrast, pilomatrixoma showed the highest concordance

Table 4. Clinicoradiologic prediagnosis and final histopathology in the isolated neck mass subgroup

Clinicoradiologic prediagnoses	Patient, n	Histopathologic confirmation, n (%)	Alternative final histopathology	Laterality
Thyroglossal duct cyst	37	28 (75.7)	Dermoid cyst (3); epidermal cyst (6)	Midline (35); left-sided, (2)
Branchial cyst	15	6 (40.0)	Epidermal/dermoid cystic lesions (5); other (4)	Right-sided (8); left-sided(5); midline(2)
Dermoid/epidermoid cyst	21	8 (38.1)	Pilomatrixoma (8); other (5)	Right-sided (5); left-sided (11); midline (5)
Pilomatrixoma	12	11 (91.7)	Hemangioma (1)	Right-sided (7); left-sided (2); midline (3)
Vascular/lymphatic lesion	5	5 (100.0)	None	Left-sided (5)
Other clinicoradiologic prediagnoses	13	—	Heterogeneous	—

Histopathologic confirmation was defined as concordance between the clinicoradiologic prediagnosis and the final histopathologic diagnosis. Laterality was classified as midline, right-sided, or left-sided. Histopathologic confirmation was not calculated for the "other clinicoradiologic prediagnoses" category because it comprised heterogeneous infrequent diagnostic impressions grouped for tabular simplicity

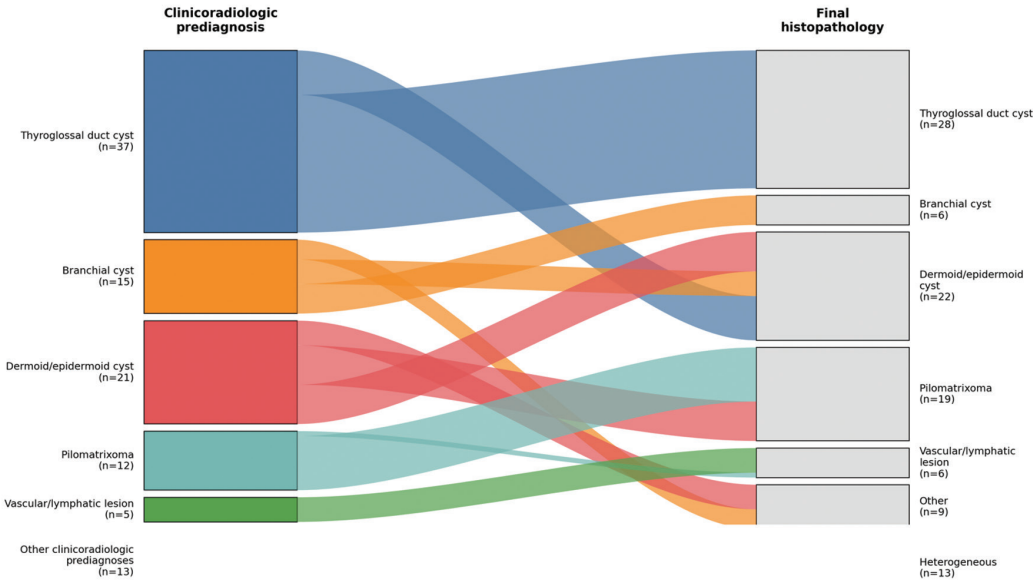

Figure 2. Alluvial plot of clinicoradiologic prediagnosis and final histopathology in the isolated neck mass subgroup

Alluvial plot showing the relationship between clinicoradiologic prediagnosis and final histopathological diagnosis in children with isolated neck masses (n=103). The width of each flow is proportional to the number of cases within each diagnostic pathway. Infrequent prediagnostic categories were grouped under "Other clinicoradiologic prediagnoses" for visual clarity

among the main prediagnostic categories, with histopathological confirmation in 11 of 12 cases (91.7%). All of 5 left-sided clinicoradiologically suspected vascular/lymphatic lesions were histopathologically confirmed.

DISCUSSION

In the present series, the clinicopathological spectrum of non-lymphadenopathic superficial mass lesions in children was clearly dominated by benign lesions, with adnexal/keratinous benign lesions forming the largest histopathological group, followed by congenital/developmental lesions. While pilomatrixoma, epidermal-type keratinous cyst, and thyroglossal duct cyst were the most frequently encountered entities, and the head and neck was the most commonly involved anatomical region. These findings are broadly consistent with those of previous pediatric studies showing that most superficial and neck masses encountered in childhood are benign, and that developmental lesions, along with benign cutaneous and subcutaneous tumors, account for a substantial proportion of surgically treated cases[1,2,4,5]. The predominance of the head and neck region in our cohort is also consistent with those indicated in earlier reports that emphasized this region as the most common site involved in a large proportion of pediatric congenital and superficial soft-tissue lesions[3,6,7]. In addition, the prominence of thyroglossal duct cyst and pilomatrixoma in our series is consistent with the relevant literature data, which identifies thyroglossal duct cyst as one of the most frequent congenital neck lesions in children and pilomatrixoma as one of the most common superficial head and neck tumors in the pediatric age group[8-12].

The anatomical distribution in our cohort was not random. It differed significantly across the major histopathological groups, with congenital/developmental lesions showing a marked predominance on the head and neck region. In contrast, adnexal/keratinous benign lesions and benign mesenchymal/neural lesions demonstrated a broader distribution involving the trunk and extremities. This pattern is clinically plausible and consistent with the known embryologic concentration of congenital lesions in the cervical region and the broader somatic distribution of cutaneous, adnexal, and mesenchymal superficial lesions in childhood[2,6,7,13]. Our imaging findings also followed recognizable lesion-specific patterns. Calcification was overwhelmingly concentrated in the adnexal/keratinous benign group, particularly in cases with pilomatrixoma, which is in keeping with the well-established sonographic appearance of pilomatrixoma as a superficially located lesion frequently associated with internal calcification or echogenic foci[14-16]. In contrast, given the biological nature of these aforementioned lesions and their known imaging behavior, vascularity was most prominent in the vascular/lymphatic group, as expected[2,17-19]. Similarly, the more frequent use of MRI in cases with vascular/lymphatic, benign mesenchymal/neural, and malignant lesions likely

reflects the need for better delineation of lesion extent, tissue planes, and possible deep extension in larger or more complex mass lesions. In contrast, ultrasonography was sufficient as the primary imaging modality for the delineation of most small, clearly superficial lesions[2,13,17].

Pilomatrixoma deserves particular emphasis in our cohort, not only because it was the single most frequently revealed individual diagnosis, but also because it showed a high clinicoradiologic-pathologic concordance in the isolated neck mass subgroup, with histopathological confirmation in 11 of 12 cases. This finding is clinically important, as pilomatrixoma has repeatedly been identified as one of the most common benign superficial head and neck tumors in children. Yet, it is still a preoperatively underrecognized or misdiagnosed entity as other benign cystic or subcutaneous lesions[10,11,20]. In our series, the substantial overlap between the prediagnostic category of dermoid/epidermoid cyst and the final diagnosis of pilomatrixoma further supports our assertion, suggesting that pilomatrixoma should be considered more actively in the differential diagnosis of superficially located pediatric head and neck masses. The relatively high concordance observed in our cohort may reflect increasing familiarity with its characteristic clinicoradiologic profile, particularly its superficial location, firm consistency, and frequent association with internal calcification detected on ultrasonograms[14,15]. From a practical standpoint, our findings suggest that heightened awareness of pilomatrixoma may improve preoperative diagnostic accuracy and reduce misclassification, especially in lesions initially thought to represent dermoid or epidermoid cysts[16].

In the isolated neck mass subgroup, thyroglossal duct cyst showed a substantially higher clinicoradiologic-histopathologic concordance than branchial cyst and dermoid/epidermoid cyst, and it was overwhelmingly associated with a midline location in our series. This finding is consistent with the well-established embryologic and clinical profile of thyroglossal duct cysts which are the most common congenital midline neck lesions in children, and supports the practical value of midline localization in narrowing the spectrum of preoperative differential diagnoses[6,7,9]. By contrast, lesions initially considered branchial cysts showed lower histopathologic confirmation and greater diagnostic heterogeneity, which is also in line with the broader literature data emphasizing that lateral pediatric neck masses may encompass a wider range of congenital and acquired cystic lesions, even when branchial anomaly is the leading preoperative impression[21]. Similarly, the relatively low confirmation rate observed in the dermoid/epidermoid cyst category suggests that this prediagnostic label often serves as a broad clinicoradiologic descriptor rather than a highly specific diagnosis, particularly for superficially located neck lesions[22,23]. Taken together, our findings indicate that clinicoradiologic assessment appears more reliable for thyroglossal duct cysts, particularly when a lesion is clearly midline. In contrast, branchial and dermoid/epidermoid prediagnoses should be interpreted more cautiously because of their broader pathological overlap[21,24].

Vascular/lymphatic lesions characterized by relatively larger lesion size, more frequent documentation of internal vascularity, and more selective use of MRI compared with the more common congenital/developmental and adnexal/keratinous benign lesions constituted a smaller but clinically distinctive subgroup in our cohort. These findings are consistent with the known biological and radiologic behavior of pediatric vascular and lymphatic anomalies, which often require more extensive preoperative characterization because of their infiltrative pattern, anatomical complexity, or uncertain deep extension[2,25]. In addition, our decision to retain a small number of superficially located lymphatic lesions managed with antineoplastic drug bleomycin despite the absence of total excision reflects contemporary practice, in which selected lymphatic malformations are increasingly treated with image-guided or minimally invasive approaches rather than primary surgery alone[25-28]. Although these five non-excised lymphatic lesions introduced minor heterogeneity into the cohort, their exclusion did not alter the overall anatomical distribution or the predominant role of vascular/lymphatic lesions within the cohort, supporting the robustness of our main findings.

A major strength of this study is that it examines a broad spectrum of non-lymphadenopathic superficial mass lesions in children rather than a single diagnosis. Histopathological diagnoses were standardized into clinically meaningful groups, allowing a structured analysis of a heterogeneous cohort. In addition, clinical, imaging, anatomical, and pathological findings were evaluated together, providing a practical overview of these lesions in routine pediatric surgical practice. The isolated neck mass subgroup also enabled a focused assessment of clinicoradiologic–pathologic concordance in a clinically relevant subset.

Study Limitations

This study has several limitations, including its retrospective, single-center design, potential selection

and documentation bias, and the fact that the cohort was composed mainly of surgically treated lesions rather than the full spectrum of superficially located pediatric masses. Preoperative imaging was not standardized and was not uniformly diagnostic, so clinicoradiologic impressions were evaluated descriptively rather than as formal test-accuracy measures. Some histopathological groups were represented by small numbers, limiting subgroup-level interpretation. In addition, a small number of superficial lymphatic lesions managed with bleomycin rather than total excision were retained in the descriptive cohort, introducing some heterogeneity into an otherwise excision-based series. Finally, histopathological terminology was standardized retrospectively for analysis.

CONCLUSION

In conclusion, superficial non-lymphadenopathic mass lesions in children were predominantly benign and most commonly involved the head and neck region. Pilomatrixoma, epidermal-type keratinous cyst, and thyroglossal duct cyst were the leading diagnoses. While clinicoradiologic prediagnosis showed relatively high concordance for thyroglossal duct cyst and pilomatrixomas, the prediagnoses of branchial cyst and dermoid/epidermoid cyst were more heterogeneous. In particular, pilomatrixoma should be actively considered in the differential diagnosis of firm, calcified superficial head and neck lesions in children, as it is frequently misclassified preoperatively as a dermoid or epidermoid cyst. A structured approach combining clinical, anatomical, imaging, and pathological assessment may facilitate more accurate assessment of these lesions in pediatric surgical practice.

Ethics

Ethics Committee Approval: Approved by the Non-Interventional Clinical Research Ethics Committee of University of Health Sciences Türkiye, Dr. Behçet Uz Pediatric Diseases and Surgery Training and Research Hospital (protocol number: GOA-335, approval number: 2026/06-10, date: 26.03.2026).

Informed Consent: Retrospective study.

Declaration of AI Use: Artificial intelligence-assisted technologies were used only for language editing during the preparation of this manuscript. All scientific content, data analysis, and interpretation were performed, reviewed, and approved by the authors, who take full responsibility for the content of the publication.

Footnotes

Author Contributions

Surgical and Medical Practices: Ö.O., H.E., M.C., Concept: Ö.O., Design: Ö.O., M.C., Data Collection or Processing: Ö.O., H.E., T.Y., M.C., Analysis or Interpretation: Ö.O., H.E., M.C., Literature Search: Ö.O., T.Y., Writing: Ö.O.

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