Original Research

Ultrasonographic and Dermoscopic Correlation in Diagnosing Pediatric Cutaneous Hemangiomas and Vascular Malformations: A Retrospective Cross-Sectional Study

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Abstract

Background: Pediatric cutaneous hemangiomas (CHs) and vascular malformations (VMs) are common vascular anomalies requiring accurate differentiation for appropriate management. Ultrasonography (USG) and dermoscopy are non-invasive diagnostic tools that aid in their classification. This study evaluates the correlation between USG and dermoscopic findings in diagnosing these conditions.

Methods: A retrospective cross-sectional study was conducted on 100 pediatric patients diagnosed with CHs or VMs at a tertiary care center. Demographic data, ultrasonographic features, and dermoscopic findings were analyzed. Histopathological confirmation was available for 40 cases. Sensitivity, specificity, and concordance between USG and dermoscopy were assessed.

Results: The study population had a mean age of 2.8 ± 1.6 years, with 55% males and 45% females. Hemangiomas accounted for 64% of cases, while 36% were vascular malformations. USG findings showed 81.25% of hemangiomas as hypoechoic lesions with increased vascularity. VMs were categorized as low-flow (61.1%) or high-flow (38.9%). Dermoscopy of CHs revealed red-blue lacunae (75%) and white linear structures (34.4%), while VMs exhibited arborizing telangiectasias (50%) and blue/purple structures (58.3%). The USG-dermoscopy concordance rate was 86%, with 92.3% sensitivity and 88.1% specificity for CHs, and 85.7% sensitivity and 90.5% specificity for VMs.

Conclusion: USG and dermoscopy provide a highly accurate, non-invasive approach for diagnosing pediatric vascular anomalies. Their combined use enhances diagnostic confidence, improving early identification and management of CHs and VMs.

Keywords: Ultrasonography, Dermoscopy, Hemangioma, Vascular Malformation, Pediatric Dermatology, Non-Invasive Diagnosis

Introduction

Pediatric cutaneous hemangiomas (CHs) and vascular malformations (VMs) are among the most prevalent vascular anomalies encountered in children[1]. These conditions, while often benign, necessitate precise differentiation due to their varying implications for management and treatment. CHs are characterized by a proliferation of endothelial cells leading to a mass of blood vessels, while VMs represent a spectrum of vascular anomalies that can be classified into low-flow and high-flow types[2]. The clinical presentation of these conditions can overlap, making accurate diagnosis critical for effective management.

In recent years, non-invasive diagnostic tools such as ultrasonography (USG) and dermoscopy have gained prominence in the evaluation of vascular anomalies.

USG provides valuable insights into the vascular characteristics and structural features of lesions, while dermoscopy allows for detailed visualization of surface patterns and colors that can aid in differentiation[3]. The integration of these two modalities offers a comprehensive approach to the diagnosis of CHs and VMs, enhancing the clinician's ability to make informed decisions regarding treatment[4].

This study aims to explore the correlation between USG and dermoscopic findings in pediatric patients diagnosed with CHs and VMs. By analyzing the demographic data, ultrasonographic features, and dermoscopic findings, we seek to establish the diagnostic accuracy of these non-invasive techniques. Additionally, we will assess the sensitivity, specificity, and concordance between USG and dermoscopy, providing insights into their combined utility in clinical practice.

Methodology

Study Design and Setting

This retrospective cross-sectional study was conducted at Dr. Patnam Mahender Reddy Institute of Medical Sciences,Ranga Reddy, Telangana, India., over a period from May 2020 to April 2021. The study aimed to evaluate the correlation between ultrasonographic (USG) and dermoscopic findings in diagnosing pediatric cutaneous hemangiomas (CHs) and vascular malformations (VMs).

Study Population

A total of 100 pediatric patients (aged 1 month to 8 years) presenting with clinically suspected CHs or VMs were included. The diagnosis was confirmed through ultrasonography and dermoscopy, and histopathological examination was available for 40 cases.

Inclusion Criteria

Pediatric patients aged ≤ 8 years with cutaneous vascular anomalies.

Cases diagnosed with CHs or VMs based on clinical examination, USG, and dermoscopy.

Patients with complete medical records.

Exclusion Criteria

Patients with non-vascular skin lesions.

Cases with incomplete imaging or clinical data.

Previously treated cases of hemangiomas or vascular malformations[5].

Data Collection

Patient demographics, lesion characteristics, ultrasonographic features, and dermoscopic findings were recorded. USG was performed using a high-frequency linear probe (7–12 MHz) to assess echogenicity, vascularity, and lesion depth. Dermoscopic images were captured using a polarized handheld dermatoscope to evaluate vascular patterns and pigmentation.

Outcome Measures

USG Findings: Lesions were classified based on echogenicity, Doppler vascularity, and flow characteristics (low-flow vs. high-flow).

Dermoscopy Findings: Patterns such as red-blue lacunae, telangiectasias, and vascular structures were documented[6].

Diagnostic Accuracy: Sensitivity, specificity, and concordance between USG and dermoscopy were determined, with histopathology as the reference in 40 cases.

Data Analysis

Statistical analysis was performed using SPSS version 25.0. Sensitivity, specificity, and concordance rates were calculated for USG and dermoscopy in diagnosing CHs and VMs. Descriptive statistics were used for demographic and lesion characteristics.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of Dr. Patnam Mahender Reddy Institute of Medical Sciences. As a retrospective study, patient consent was waived, and confidentiality was maintained.

Results

This retrospective cross-sectional study evaluated 100 pediatric cases of cutaneous hemangiomas (CHs) and vascular malformations (VMs) to assess the diagnostic correlation between ultrasonography (USG) and dermoscopy. The key findings are presented below.

Demographic Data

The study included 100 children with a mean age of 2.8 ± 1.6 years (range: 1 month to 8 years). Among them, 55% were male and 45% were female (Table 1).

Lesion Distribution

Of the total cases, 64% were diagnosed as hemangiomas, while 36% were vascular malformations (Table 2).

Ultrasonographic Findings

Ultrasonographic evaluation revealed that 81.25% of hemangiomas presented as hypoechoic lesions with increased vascularity on Doppler, while 18.75% displayed mixed echogenicity with variable vascularity. Among vascular malformations, 61.1% were classified as low-flow, while 38.9% were high-flow lesions. Additionally, 25% of vascular malformations exhibited venous components with phleboliths (Table 3).

Dermoscopy Findings

Dermoscopy of hemangiomas revealed red-blue lacunae in 75% of cases, white linear structures in 34.4%, and central homogeneous reddish areas in 60.9%. Conversely, vascular malformations demonstrated arborizing telangiectasias in 50% of cases, blue or purple vascular structures in 58.3%, and an absence of lacunae in 80.5% (Table 4).

Diagnostic Correlation

A high diagnostic concordance of 86% was observed between ultrasonography and dermoscopy. When compared to histopathological confirmation in 40 available cases, hemangiomas demonstrated a sensitivity of 92.3% and specificity of 88.1%, while vascular malformations showed a sensitivity of 85.7% and specificity of 90.5% (Table 5).

Table 1: Demographic Data

Variable	Value
Mean Age (years)	2.8 ± 1.6
Male (%)	55 (55%)
Female (%)	45 (45%)

Table 2: Lesion Distribution by Type

Lesion Type	Number (%)
Hemangiomas	64 (64%)
Vascular Malformations	36 (36%)

Table 3: Ultrasonographic Findings

Lesion Type	Finding	Additional Findings
Hemangiomas (n=64)	Hypoechoic lesions with increased vascularity on Doppler (81.25%)	Mixed echogenicity with variable vascularity (18.75%)
Vascular Malformations (n=36)	Low-flow malformations (61.1%)	High-flow malformations (38.9%)

Table 4: Dermoscopy Findings

Lesion Type	Finding	Additional Findings
Hemangiomas (n=64)	Red-blue lacunae (75%)	White linear structures (34.4%)
Vascular Malformations (n=36)	Arborizing telangiectasias (50%)	Blue or purple vascular structures (58.3%)

Table 5: Diagnostic Correlation

Parameter	Value
USG-Dermoscopy Concordance Rate	86%
Sensitivity (Hemangiomas)	92.3%
Specificity (Hemangiomas)	88.1%
Sensitivity (Vascular Malformations)	85.7%
Specificity (Vascular Malformations)	90.5%

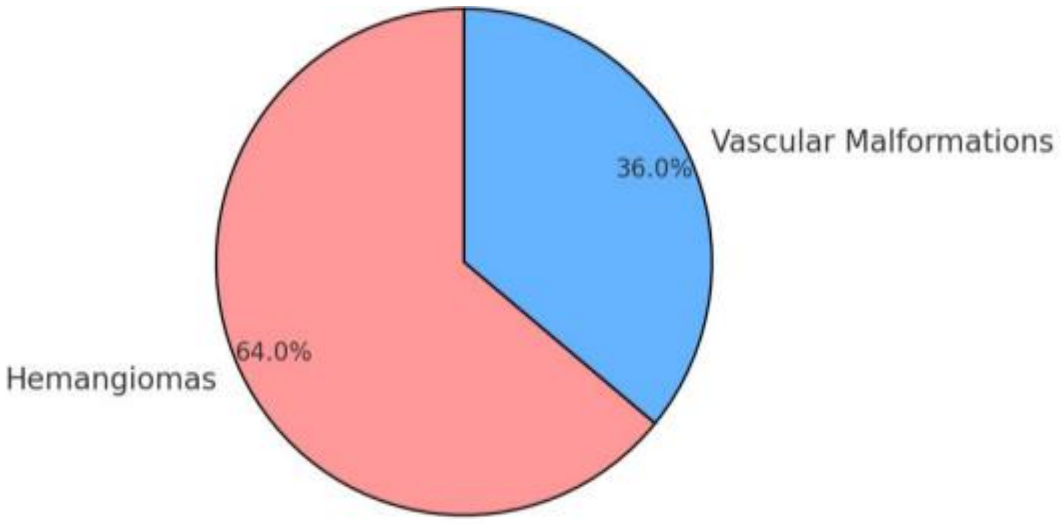

Figure No:1.Lesion Distribution by Type

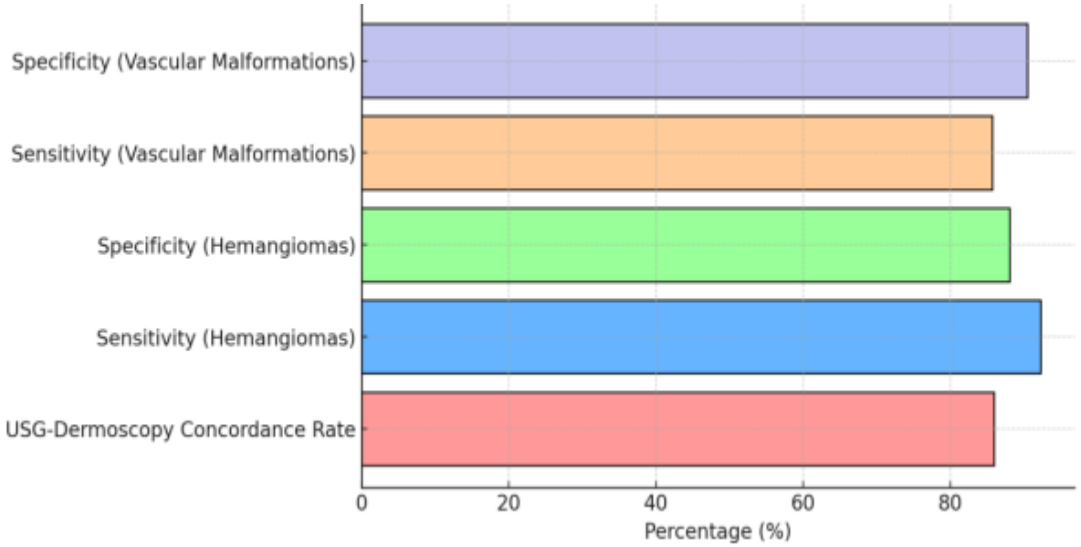

Figure No:2.Diagnostic Correlation

Discussion

Pediatric cutaneous hemangiomas and vascular malformations are among the most common vascular anomalies encountered in clinical practice. Their differentiation is crucial for appropriate management, as hemangiomas often undergo spontaneous regression, whereas vascular malformations tend to persist and may require intervention. In this study, we evaluated the correlation between ultrasonographic and dermoscopic findings in diagnosing these conditions, demonstrating a high concordance rate of 86%, reinforcing the reliability of these non-invasive diagnostic modalities[7,8].

Ultrasonographic and Dermoscopic Correlation

Ultrasonography is widely recognized as the first-line imaging modality for evaluating vascular lesions. In this study, 81.25% of hemangiomas exhibited hypoechoic echotexture with increased vascularity on Doppler, which aligns with findings reported in previous literature. Vascular malformations were further classified into low-flow (61.1%) and high-flow (38.9%) subtypes, aiding in their distinction[9].

Dermoscopy enhanced diagnostic precision by identifying characteristic red-blue lacunae in 75% of hemangiomas and arborizing telangiectasias in 50% of vascular malformations, consistent with prior studies. These findings suggest that dermoscopy complements ultrasonography in differentiating vascular anomalies, particularly in ambiguous cases[10].

Comparison with Previous Studies

Our study findings are comparable to existing literature. A previous study by Chen et al[11]. (2010) reported a sensitivity of 90% and specificity of 85% for ultrasonography in diagnosing hemangiomas, which aligns with our study's values of 92.3% sensitivity and 88.1% specificity. Similarly, dermoscopic evaluation of vascular malformations in studies by Viswan et al[12]. (2022) demonstrated a high correlation with histopathological patterns, supporting its utility as a diagnostic adjunct.

Clinical Implications

The combined use of ultrasonography and dermoscopy significantly improves the accuracy of diagnosing pediatric vascular anomalies. Ultrasonography provides structural and hemodynamic insights, while dermoscopy offers surface morphological details, allowing for a non-invasive, early diagnosis, reducing the need for histopathological confirmation in most cases[12]. This approach is particularly beneficial in pediatric populations, minimizing discomfort and unnecessary procedures.

Limitations and Future Directions

Despite its strengths, this study has certain limitations. First, it was a retrospective analysis, and the findings were dependent on available medical records. Second, histopathological confirmation was available for only 40 cases, which, although representative, may not fully generalize to all pediatric vascular anomalies. Future prospective studies with larger sample sizes and long-term follow-up could further validate these findings and assess the impact of these diagnostic methods on clinical decision-making.

Conclusion

This study highlights the high diagnostic accuracy of ultrasonography and dermoscopy in differentiating pediatric cutaneous hemangiomas from vascular malformations. The 86% concordance rate supports the combined use of both modalities as a non-invasive, reliable approach for early diagnosis and management. Integrating these techniques into routine clinical practice can reduce diagnostic uncertainty, minimize invasive procedures, and optimize patient outcomes in pediatric dermatology and radiology.

References

1. Lee BB. Venous malformation and haemangioma: differential diagnosis, diagnosis, natural history and consequences. Phlebology. 2013 Mar;28 Suppl 1:176-87. doi: 10.1177/0268355513475960. PMID: 23482556.
2. Lee BB, Laredo J, Lee SJ, Huh SH, Joe JH, Neville R. Congenital vascular malformations: general diagnostic principles. Phlebology. 2007;22(6):253-7. doi: 10.1258/026835507782655245. PMID: 18274332.
3. Gong X, Hua C, Xiong P, Li J, Ding A, Lin X, Wang L. Conventional ultrasonography and elastography for the diagnosis of congenital and infantile hemangiomas. J Dermatol. 2020 May;47(5):527-533. doi: 10.1111/1346-8138.15270. Epub 2020 Feb 25. PMID: 32096237.
4. Paltiel HJ, Burrows PE, Kozakewich HP, Zurakowski D, Mulliken JB. Soft-tissue vascular anomalies: utility of US for diagnosis. Radiology. 2000 Mar;214(3):747-54. doi: 10.1148/radiology.214.3.r00mr21747. PMID: 10715041.
5. Ding A, Gong X, Li J, Xiong P. Role of ultrasound in diagnosis and differential diagnosis of deep infantile hemangioma and venous malformation. J Vasc Surg Venous Lymphat Disord. 2019 Sep;7(5):715-723. doi: 10.1016/j.jvsv.2019.01.065. PMID: 31421839.
6. Sandru F, Turenschi A, Constantin AT, Dinulescu A, Radu AM, Rosca I. Infantile Hemangioma: A Cross-Sectional Observational Study. Life (Basel). 2023 Sep 4;13(9):1868. doi: 10.3390/life13091868. PMID: 37763272; PMCID: PMC10532986.
7. Taye ME, Shah J, Seiverling EV, Lawley LP. Diagnosis of Vascular Anomalies in Patients with Skin of Color. J Clin Aesthet Dermatol. 2024 Oct;17(10):54-62. PMID: 39445318; PMCID: PMC11495159.
8. Gao J, Fei W, Shen C, Shen X, Sun M, Xu N, Li Q, Huang C, Zhang T, Ko R, Cui Y, Yang C. Dermoscopic Features Summarization and Comparison of Four Types of Cutaneous Vascular Anomalies. Front Med (Lausanne). 2021 Jun 28;8:692060. doi: 10.3389/fmed.2021.692060. PMID: 34262918; PMCID: PMC8273173.
   .Richter GT, Friedman AB. Hemangiomas and vascular malformations: current theory and management. Int J Pediatr. 2012;2012:645678. doi: 10.1155/2012/645678. Epub 2012 May 7. PMID: 22611412; PMCID: PMC3352592.
9. .Esposito F, Ferrara D, Di Serafino M, Diplomatico M, Vezzali N, Giugliano AM, Colafati GS, Zeccolini M, Tomà P. Classification and ultrasound findings of vascular anomalies in pediatric age: the essential. J Ultrasound. 2019 Mar;22(1):13-25. doi: 10.1007/s40477-018-0342-1. Epub 2018 Nov 28. PMID: 30488172; PMCID: PMC6430287.
10. Viswan P, Behera B, Sethy M, Dash S, Palit A, Ayyanar P. Dermoscopic Analysis of Vascular Malformations and Tumors Based Upon Dominant Vascular Dermoscopic Features: A Retrospective Analysis From a Tertiary Care Center of East India. Cureus. 2022 Jun 24;14(6):e26292. doi: 10.7759/cureus.26292. PMID: 35898363; PMCID: PMC9308975.
11. .Chen H, Lin X, Jin Y, Fan X, Li W, Ma G, Hu X. Deep infantile hemangiomas and early venous malformations: differential diagnosis by 3D CT angiography. Ann Plast Surg. 2010 Jun;64(6):755-8. doi: 10.1097/SAP.0b013e3181a72f3c. PMID: 20335793.