Dermatology Practical & Conceptual

Unveiling Infantile Hemangiomas: A Comprehensive Study of Patterns, Presentations, and Complications

Prashansa Jaiswal[1], Jyoti Singh[1], Aishwarya Dua[2], Aaditya Sirohi[3], Febin Ashraf[1]

1 Department of Dermatology, All India Institute of Medical Sciences, Bhopal, India
2 Skin lab by Dr Jamuna Pai, Greater Kailash-2, New Delhi, India
3 Department of CTVS, All India Institute of Medical Sciences, Bhopal, India

Key words: Infantile hemangiomas, Clinical patterns, Presentations, Pediatric complications, Morphology

Citation: Jaiswal P, Singh J, Dua A, Sirohi A, Ashraf F. Unveiling Infantile Hemangiomas: A Comprehensive Study of Patterns, Presentations, and Complications. *Dermatol Pract Concept*. 2025;15(4):5515. DOI: https://doi.org/10.5826/dpc.1504a5515

Accepted: July 1, 2025; **Published:** October 2025

Copyright: ©2025 Jaiswal et al. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (BY-NC-4.0), https://creativecommons.org/licenses/by-nc/4.0/, which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.

Funding: None.

Competing Interests: None.

Authorship: All authors have contributed significantly to this publication.

Corresponding Author: Jyoti Singh, MBBS, MD (DVL). Department of Dermatology, All India Institute of Medical Sciences, C-214, Emerald Park city, Bagh Sewaniya, Bhopal, Madhya Pradesh, 462026. ORCID No : 0009-0000-9327-6476.
E-mail: jyotisingh1590@gmail.com

ABSTRACT

Background: Infantile hemangioma is the most common vascular tumor in infants, affecting 4% to 10% of this population. It typically appears as a solitary cutaneous hemangioma but can also be multifocal or segmental. The condition progresses through rapid growth, a plateau phase, and gradual involution. Key risk factors include low birth weight, prematurity, female sex, multiple gestations, and family history. Clinical presentation varies among individuals.

Objective: This study aimed to analyze the clinical characteristics of patients with infantile hemangioma at our hospital, focusing on age at onset, presentation, location, size, type, and complications.

Methods: A retrospective analysis of medical records of infants diagnosed with infantile hemangioma was conducted. Data were collected for statistical analysis on demographics, lesion characteristics, and complications.

Results: The study reviewed 694 hemangiomas in 500 patients, with 50% having a precursor lesion at birth. A significant female predominance (72%) was noted, with most patients (72%) delivered at term. The strawberry mass was the most common morphology (74%), primarily located in the head and neck (42%). Of the hemangiomas, 45% were superficial, and 88% showed progressive growth. Ten patients with periocular hemangiomas experienced amblyopia, while other complications included PHACES syndrome, ipsilateral breast hypertrophy, and arteriovenous malformations.

Conclusion: This study highlights the diverse manifestations, anomalies, and risk factors associated with infantile hemangioma in a tertiary care setting.

Introduction

Infantile hemangiomas (IH) represent the most frequently observed benign tumors in infants, with an incidence rate ranging from 4% to 10% [1]. These tumors originate from a benign proliferation of vascular endothelial cells (VECs) within the mesoderm and can manifest anywhere on the body [2]. The natural progression of infantile hemangiomas is characterized by a triphasic pattern, which includes a rapid growth phase, a plateau phase, and a subsequent slow involution phase. This distinct progression differentiates them from vascular malformations [3]. Nonetheless, certain severe cases of proliferative IH may lead to functional or organic complications such as bleeding, infections, ulcers, external ear obstruction, and airway obstruction [4]. While IH is typically not present at birth, approximately one third of cases can be detected at that time. In 40% of instances, the tumor appears early in infancy, specifically between two to seven weeks of age, while the remaining third develops by six months of age [5]. The proliferation phase lasts from four to 18 months, followed by a gradual involution over three to nine years, often resulting in a fibrofatty remnant in 50% to 70% of cases, along with telangiectasia and excess skin. Key risk factors for IH include female sex, prematurity, low birth weight, European ancestry, multiple gestations, maternal progesterone therapy, and a family history of the condition [4]. Various antenatal factors have also been linked to an elevated risk of IH, including maternal vaginal bleeding during the first trimester, progesterone use, preeclampsia, advanced maternal age, placenta previa, and in vitro fertilization [6]. In contrast, a study examining the incidence of IH in monozygotic and dizygotic twins found no significant difference between the two groups, suggesting that environmental factors may play a more substantial role [7].

Most individuals experience regression without the necessity of intervention; however, around 10%, which can vary by site, may lead to significant complications that necessitate treatment. Complications associated with IH can be classified into several categories: life-threatening, obstructive, ulcerative, or disfiguring. Life-threatening complications encompass airway and hepatic IHs. Functional complications that obstruct essential structures or hinder functionality include periocular, nasal, labial, parotid, auricular, and breast IHs. Local complications typically result from ulceration or occur in areas that are cosmetically sensitive [8].

Infantile hemangiomas (IHs) can be associated with several syndromes, particularly when large or segmental hemangiomas are present. These include PHACES syndrome, an acronym for Posterior fossa malformations, Hemangioma, Arterial anomalies, Cardiac defects, Eye abnormalities, and Sternal clefting or supraumbilical raphe. It is associated with large, segmental hemangiomas, particularly those on the face and neck [9]. Other syndromes involving the lower body are LUMBAR, PELVIS and SACRAL syndrome [2]. LUMBAR stands for lower body hemangioma and other cutaneous defects, Urogenital anomalies, Myelopathy, Bony deformities, Anorectal malformations, and Renal anomalies. PELVIS syndrome [10] stands for Perineal Hemangioma, External genital malformations, Lipomyelomeningocele, Vesicorenal abnormalities, Imperforate anus, and Skin tag. SACRAL syndrome stands for Spinal dysraphism, Anogenital anomalies, Cutaneous hemangioma, Renal anomalies, and Angioma of Lumbosacral localization [11].

Objective

The objective of our study was to analyze the demographic and clinical characteristics such as age at onset, clinical presentation, site, size, type (based on depth), and associated complications in patients who visited our hospital retrospectively and also to compare our data with those obtained from the literature.

Materials and Methods

Study Design

This hospital-based retrospective observational cross-sectional study was conducted in the Department of Dermatology at a tertiary care pediatric hospital. The study reviewed medical records of patients with infantile hemangiomas (IH) treated in the outpatient clinic.

Study Population

The study population comprised patients aged less than 6 years at the time of enrollment who presented with one or more infantile hemangiomas at any stage of evolution. Inclusion criteria involved all patients with clinically diagnosed hemangiomas regardless of size, number, or anatomical location. Patients with other types of vascular anomalies were excluded.

Sample Size

A total of 500 patients were enrolled, and 694 hemangiomas were documented and analyzed.

Study Period

The data were collected retrospectively from medical records from the years 2013 to 2023

Data collected included demographic details, birth history, age at onset, lesion characteristics, and any associated complications.

The primary variables measured included:

- Age at onset and presentation of the hemangiomas
- Lesion characteristics: morphology (papule, macule, plaque, nodule), site (head and neck, trunk, genitalia, limbs, mucosal involvement), size, and number of hemangiomas
- Progression of hemangiomas: gradual, rapid, or stable
- Complications: ulceration, erythema, soft tissue hypertrophy, bleeding, and associations like PHACES syndrome and amblyopia
- Birth history: term or preterm delivery and birth weight
- Associated conditions: amblyopia, PHACES syndrome, and arterio-venous malformations

All clinical assessments were conducted in the outpatient dermatology department by dermatologists trained in pediatric dermatology. Initial evaluations were performed by one of three senior consultants, and data were retrospectively extracted from their standardized clinical documentation. To ensure consistency in diagnosis, a departmental protocol was followed for classifying hemangiomas based on established dermatological descriptors such as lesion depth (superficial, deep, mixed) and morphology (e.g., strawberry vs. bluish lesions).

In cases where classification was ambiguous, diagnostic decisions were refined through consensus discussions held during routine departmental clinical meetings. Although efforts were made to maintain uniformity, we acknowledge that no formal inter-rater reliability testing or use of standardized diagnostic checklists was undertaken, given the retrospective nature of the study.

In patients with large segmental facial hemangiomas, evaluation for PHACES syndrome was guided by the 2009 consensus criteria by Metry et al. [12] Screening investigations included MRI/MRA of the brain and neck, echocardiography, and ophthalmologic examination. PHACES syndrome was diagnosed when a segmental facial hemangioma >5 cm was accompanied by one major or two minor anomalies across the defined domains. Genetic testing and multidisciplinary review were not routinely employed

Statistical Analysis

Data were analyzed using software SPSS 28.0.1. Descriptive statistics were used to summarize demographic data and clinical features. Categorical variables are expressed as frequencies and percentages, while continuous variables are summarized using means or medians as appropriate. Associations between variables were evaluated using chi-square tests or Fisher's exact test. A p-value of <0.05 was considered statistically significant.

Results

A total of 694 hemangiomas were observed in 500 patients recruited from Out Patient Department In 50% (250) of patients, their guardians reported a precursor lesion presenting at birth, while in 46 % (230) of patients, the precursor lesion appeared by three months of age. In the remaining 4% (20), lesions appeared by six months of age at the latest. The majority (44%) of patients presented to the hospital within three months of developing lesions (Figures 1–2).

In our study population, most of the patients 72% (N=360) were born at term, while 25% (N=125) were preterm. Of the 500 patients recruited, 72% (N=360) were females, and the remaining 28% (N=140) were males (Figure 3). Twenty-three percent (N=115) of newborns had low birth weight.

In majority of the patients, the precursor lesion was papule (56%), followed by macule (34%), plaque (6%), nodule (4%).

Head and neck were found to be most common sites (42%), followed by the trunk (15%), genitalia (11%), upper limb (10%), lower limb (7%), and mucosa (5%). Multiple sites were involved in 7% patients (Figure 4).

Forety-four percent (N=305) of hemangiomas ranged in size from 2–5 cm, while 40% (N=277) hemangiomas were <2 cm. Large hemangiomas (>5 cm) were seen in 16% (N=111) of patients. Majority of the patients (87%, N=435) had a solitary hemangioma. Two percent (N=10) of patients had >5 hemangiomas (Figure 5).

The most common morphology observed was strawberry mass (74%, N=514 lesions); bluish discoloration was seen in 28% (N=194) of patients. Twenty-eight percent (N=194) of lesions were ulcerated. On stratified analysis, ulceration was most commonly observed in mixed-type hemangiomas (45.9%, 118/257), compared to superficial (20%, 62/312) and deep (13.6%, 17/125) lesions. Anatomically, facial hemangiomas had the highest incidence of ulceration (31%, 91/294), followed by extremities (28%, 50/180) and trunk (22%, 23/105) (Figure 6). Erythema was seen in 17% (118) of hemangiomas. Associated soft tissue hypertrophy was seen in 12% (N=83) of patients, while bleeding was present in 6% (N=42).

Out of 694 hemangiomas, 45% were superficial (N=312), 18% were deep (N=125), and 37% (N=257) were mixed hemangiomas. The majority of hemangiomas were sessile (89%). Localized hemangiomas were the most common (78%), followed by multifocal (15%) and segmental (7%).

Amblyopia was noted exclusively in patients with periocular hemangiomas, affecting 10 out of 25 patients. On detailed examination, three patients with large segmental hemangiomas over the face were found to have PHACES syndrome. Three patients had associated arterio-venous malformation. A single patient with hemangioma over the chest had associated ipsilateral breast hypertrophy.

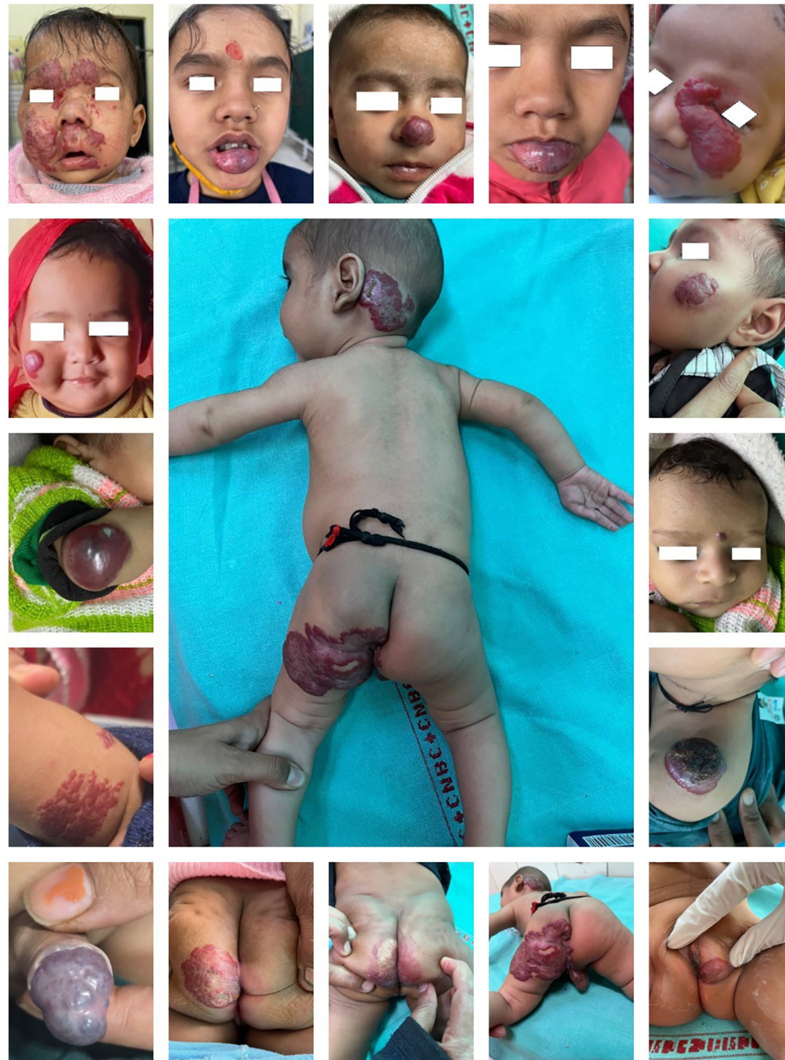

Figure 1. Clinical pictures of IH patients showing varied clinical presentations.

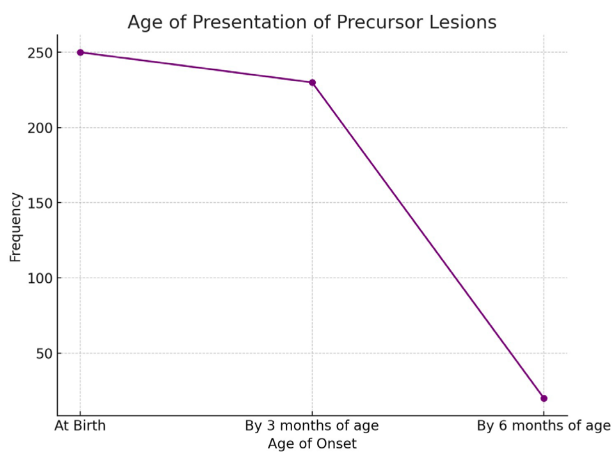

Figure 2. Age at presentation of precursor lesions of infantile hemangioma in the study.

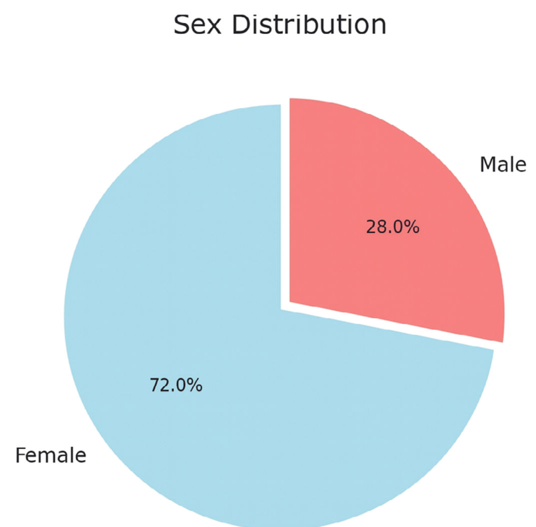

Figure 3. Showing sex distribution: Female (72%) (Blue) vs Male (28%) Red.

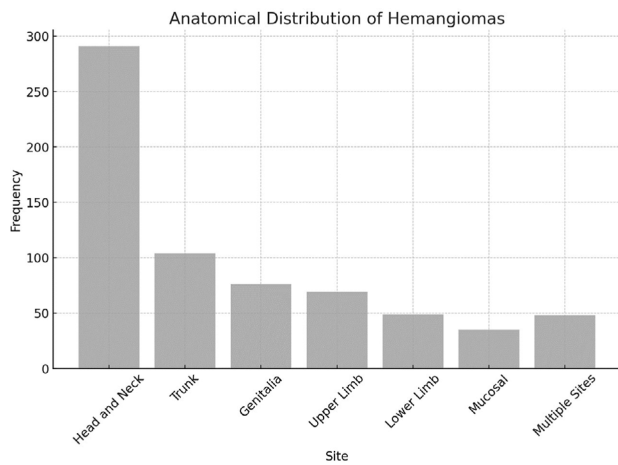

Figure 4. Anatomical sites of distribution of infantile hemangioma found in the study.

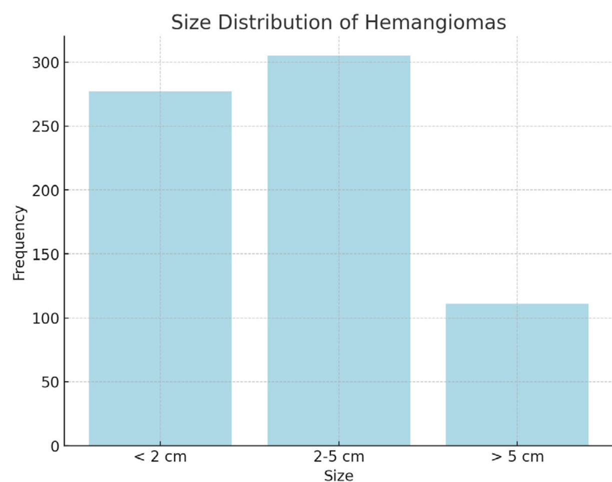

Figure 5. Size distribution of infantile hemangioma in the study.

Discussion

This retrospective cross-sectional observational study comprehensively analyzed the demographic and clinical characteristics of infantile hemangiomas of 500 patients. The findings reveal significant insights into the age at onset, clinical presentation, and associated complications of these vascular lesions, contributing to the existing literature on this prevalent condition.

Our findings reveal a predominance of female patients (72%) ,which is consistent with the findings of the study done by Munden et al. [3], with 53% of female and 47% of male infants presenting with infantile hemangioma. This sex bias is likely influenced by hormonal factors, although the exact mechanisms remain unclear. However in a study done by Sandru et al. [13], more male patients with hemangioma were identified than females (57.14% vs. 42.85%).

In our study, 50% of patients exhibited a precursor lesion at birth, while 46% developed the lesion by age three

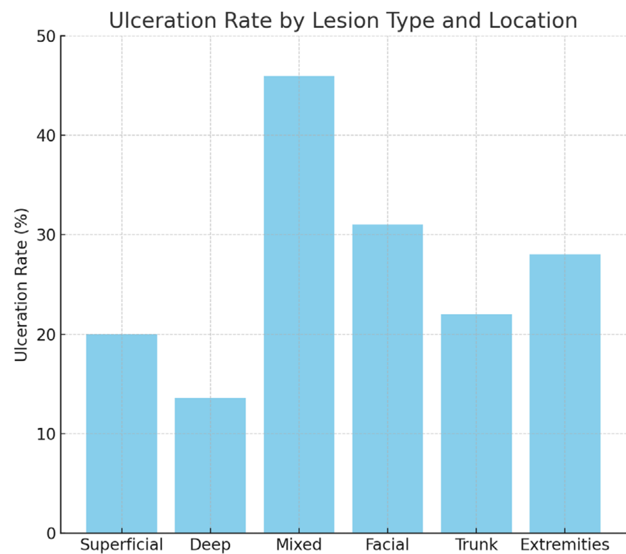

Figure 6. A bar chart showing ulceration rates across lesion types and anatomical locations.

months. This finding is consistent with findings from a prior study done by Chang et al. that highlighted the early onset of infantile hemangiomas by three months of age, indicating a crucial period for observation and possible intervention [14]. Furthermore, in our study, 44% of patients sought hospital care within three months of lesion appearance, which emphasizes the urgency often felt by caregivers regarding these vascular anomalies. This finding is also consistent with the finding from Chang et al., where the mean age at the first visit was five months.

The correlation between infantile hemangiomas (IH) and prematurity has been extensively established, with numerous studies demonstrating a greater occurrence of IH in preterm infants relative to those born at term. One such study is by Suzen Orhan et al., who found IH in 26.6% of preterm infants [15]. We also found a significant portion of preterm infants (25%) developing infantile hemangioma. This connection is believed to arise from common pathophysiological processes, especially those related to hypoxia and vascular growth factors. The case-control study done by Chehad et al. [16], on clinical and epidemiological risk factors for infantile hemangioma indicates that the occurrence of infantile hemangioma (IH) is significantly elevated in low birth weight (LBW) infants, with odds ratios suggesting a 4.5-fold increased risk for LBW infants in comparison to those of normal weight. This finding is congruous with our study, where a significant 23% of newborns with low birth weight developed IH.

In our study, most patients (56%) with IH presented with papule as precursor lesion, followed by macules (34%), plaques (6%), and nodules (4%). These findings are consistent with the previous study done by Lydiawati et al., who also noted that macules were the most frequent skin lesions

(35.36%), with about 28.13% of patients exhibiting a combination of macular and nodular lesions [17]. These findings suggest that the majority of cases begin with a papular stage, highlighting the importance of early recognition and monitoring of these precursor lesions in infants.

Head and neck were found to be the most common sites (42%), followed by the trunk (15%), genitalia (11%), upper limb (10%), lower limb (7%), and mucosa (5%). Multiple sites were involved in 7% of patients in our study. This corroborates with the study by Otaibi et al., who found that the most common site of hemangioma was the face (36.4%), followed by the upper limbs (18.3%), lower limbs (12.7%), chest (12.7%), and scalp (9.1%). The site preference could be justified by the anatomical factors as well as by the timing of vasculature development of different sites. It has been found that the head and neck are the most common sites as they have a higher density of blood vessels, making them more susceptible to vascular tumors like IH. It can also be seen that IHs typically manifests within the first few weeks of life, which coincide with the rapid vascular development in the head and neck areas [18].

The size distribution of hemangiomas in our study, with 44% ranging from 2–5 cm^2 and 16% exceeding 5 cm^2, is consistent with the findings of the study done by Lydiawati et al. [17], with 14.29% of IH in their study being ≥5 cm^2. The size of the lesion is an important factor to observe since it can determine the likelihood of the complications. The predominance of focal hemangiomas (87%), with 15% multifocal and 7% segmental in our study, is in accordance with the findings from the study done by Hung et al.[19] and Chiller et al.[5].In this study we observed that 45% of lesions were superficial (N=312) and 18% lesions were deep (N=125); 37% (N=257) were mixed hemangiomas, among which 74% were strawberry mass and 28% were bluish discoloration, morphologically. This is in accordance with the existing literature by Sturb et al.[20], who found that the most common presentation was superficial hemangiomas characterized by bright red or "strawberry mass" that involves the upper dermis. While deep lesions have a more bluish hue, mixed lesions have both characteristics.

The observation that 88% of hemangiomas exhibited progressive growth, with a notable 40% showing rapid progression, raises important considerations for clinical practice. The growth patterns of hemangiomas can significantly influence management strategies, as rapid growth may necessitate early intervention to prevent complications [21]. The stable size observed in 12% of cases may suggest a subset of hemangiomas that can be monitored without immediate treatment, emphasizing the importance of individualized patient assessment.

Our post hoc stratified analysis revealed that mixed-type hemangiomas had the highest rate of ulceration (45.9%), followed by superficial (20%) and deep lesions (13.6%). This aligns with the findings of Mariani et al., who reported increased complication rates in mixed and larger hemangiomas due to their rapid proliferative phase and greater tissue involvement, which can predispose to breakdown and ulceration [8]. Among anatomical sites, facial lesions showed the highest ulceration rate (31%), consistent with a study by Chang et al. highlighting that hemangiomas in exposed or high-motion areas (such as the face and extremities) are at higher risk of mechanical irritation and breakdown [14].

Moreover, periocular hemangiomas were strongly associated with amblyopia, observed in 100% of cases (10/10). This supports earlier studies by Haggstrom et al. and Frieden et al., who emphasized the importance of early ophthalmologic evaluation in infants with periocular hemangiomas due to the risk of visual axis obstruction, astigmatism, and anisometropia [22,23]. Our findings reinforce the need for clinicians to monitor mixed-type and facial hemangiomas closely for early signs of ulceration and to promptly refer periocular hemangiomas for ophthalmologic evaluation, ideally within the first few weeks of life.

Additionally, we observed associations with syndromic conditions such as PHACES syndrome and arteriovenous malformations in three patients, along with ipsilateral breast hypertrophy noted in one patient with infantile hemangioma located on the chest. These findings echo the concerns raised in a previous study done by Haggstrom et al. regarding the potential for IH to be associated with significant morbidity, particularly when located in critical areas [23]. The incidence of ulceration (28%) and bleeding (6%), which corroborate the findings of Sun et al. [18], further emphasizes the need for comprehensive management strategies to address both the aesthetic and functional implications of IH.

Limitations

This study has several limitations inherent to its retrospective design. First, no a priori power calculation was performed. The sample size of 500 patients was based on feasibility and represents a consecutive cohort over a 10-year period at a single tertiary care center. While adequate for descriptive analysis, the study is likely underpowered to detect statistically significant associations for rare outcomes such as PHACES syndrome or amblyopia. A post hoc estimate suggests a larger sample size would be required to detect these events reliably. Future studies should incorporate prospective power planning.

Second, the referral bias associated with conducting the study at a tertiary care pediatric hospital may have led to an overrepresentation of severe, atypical, or treatment-resistant infantile hemangiomas. This could limit the generalizability of findings to general pediatric or primary care settings. We recommend that future research include community-based

populations or birth cohorts to provide a more representative epidemiological profile of infantile hemangiomas across clinical contexts.

Third, while lesion assessments were performed by dermatologists following a standardized departmental protocol, evaluations were conducted by multiple providers over the study period. Although diagnostic classification relied on established morphological descriptors and consensus discussions were held for ambiguous cases, we acknowledge that no formal inter-rater reliability testing or structured diagnostic checklist was used. This introduces the potential for inter-observer variability in lesion classification and complication reporting.

Lastly, due to the retrospective nature of the study, imaging and diagnostic protocols (e.g., MRI, echocardiography for PHACES syndrome) were selectively applied to patients with clinical indications (e.g., large segmental facial hemangiomas). While we adhered to the 2009 PHACES diagnostic consensus guidelines for these cases, the absence of uniform screening limited our ability to comment on true syndrome prevalence in the cohort.

Conclusion

In conclusion, our study provides a comprehensive analysis of the demographic and clinical characteristics of infantile hemangiomas, contributing valuable data to the existing literature. The findings underscore the need for heightened awareness among healthcare providers regarding the presentation and management of IH, particularly in vulnerable populations. Future research should focus on longitudinal studies to better understand the long-term outcomes of IH and the impact of early intervention on associated complications.

References

1. Dickison P, Christou E, Wargon O. A prospective study of infantile hemangiomas with a focus on incidence and risk factors. *Pediatr Dermatol*. 2011;28:663–669. DOI:10.1111/j.1525-1470.2011.01568.x | PMID:21995808.
2. Macca L, Altavilla D, Di Bartolomeo L, et al. Update on treatment of infantile hemangiomas: what's new in the last five years? *Front Pharmacol*. 2022;13:879602. DOI:10.3389/fphar.2022.879602 | PMID:35721150.
3. Munden A, Butschek R, Tom WL, et al. Prospective study of infantile haemangiomas: incidence, clinical characteristics and association with placental anomalies. *Br J Dermatol*. 2014;170:907–913. DOI:10.1111/bjd.12804 | PMID:24641194.
4. Ding Y, Zhang JZ, Yu SR, Xiang F, Kang XJ. Risk factors for infantile hemangioma: a meta-analysis. *World J Pediatr*. 2020;16:377–384. DOI:10.1007/s12519-019-00327-2 | PMID:31853885.
5. Chiller KG, Passaro D, Frieden IJ. Hemangiomas of infancy: clinical characteristics, morphologic subtypes, and their relationship to race, ethnicity, and sex. *Arch Dermatol*. 2002;138:1567–1576. DOI:10.1001/archderm.138.12.1567 | PMID:12472344.
6. Chen TS, Eichenfield LF, Friedlander SF. Infantile hemangiomas: an update on pathogenesis and therapy. *Pediatrics*. 2013;131: 99–108. DOI:10.1542/peds.2012-1128 | PMID:23266916.
7. Greco MF, Frieden IJ, Drolet BA, et al. Infantile hemangiomas in twins: a prospective cohort study. *Pediatr Dermatol*. 2016;33:178–183. DOI:10.1111/pde.12781 | PMID:26863906.
8. Mariani LG, Ferreira LM, Rovaris DL, et al. Infantile hemangiomas: risk factors for complications, recurrence and unaesthetic sequelae. *An Bras Dermatol*. 2022;97:37–44. DOI:10.1016/j.abd.2021.05.009 | PMID:34848114.
9. Siegel DH. PHACE syndrome: infantile hemangiomas associated with multiple congenital anomalies: clues to the cause. *Am J Med Genet C Semin Med Genet*. 2018;178:407–413. DOI:10.1002/ajmg.c.31676 | PMID:30267463.
10. Girard C, Bigorre M, Guillot B, Bessis D. PELVIS syndrome. *Arch Dermatol*. 2006;142:884–888. DOI:10.1001/archderm.142.7.884 | PMID:16847205.
11. Kardasevic M, Dinarevic SM. Infantile sacral region hemangioma and combination treatment with propranolol and topical timolol: case review and reference review. *Med Arch*. 2021;75:158–161.DOI:10.5455/medarh.2021.75.158-161|PMID:34219878.
12. Metry DW, Haggstrom AN, Drolet BA, et al. Consensus statement on diagnostic criteria for PHACE syndrome. *Pediatrics*. 2009;124:1447–1456. DOI:10.1542/peds.2009-0082 | PMID:19858157.
13. Sandru F, Turenschi A, Constantin AT, et al. Infantile hemangioma: a cross-sectional observational study. *Life (Basel)*. 2023;13:1868. DOI:10.3390/life13091868 | PMID:37763272.
14. Chang LC, Haggstrom AN, Drolet BA, et al. Growth characteristics of infantile hemangiomas: implications for management. *Pediatrics*. 2008;122:360–367. DOI:10.1542/peds.2007-2767 | PMID:18676554.
15. Suzen Orhan E, Unal EC, Tacyildiz N, Dincaslan H. Evaluation of age, gender, prenatal characteristics, and treatment results of 380 babies with infantile hemangioma. *J Clin Oncol*. 2021;39 (15_suppl):e22018. DOI:10.1200/JCO.2021.39.15_suppl.e22018.
16. Chehad AS, Hamza O, Mansoul T. Clinical and epidemiological risk factors for infantile hemangioma: a case-control study. *Pediatr Dermatol*. 2023;40:647–650. DOI:10.1111/pde.15363 | PMID:37314056.
17. Lydiawati E, Zulkarnain I. Infantile hemangioma: a retrospective study. *Berkala Ilmu Kesehatan Kulit dan Kelamin* (Universitas Airlangga). 2020;32(1):21–26. DOI:10.20473/bikk.V32.1.2020.21-26.
18. Sun Y, Zhao J, Meng Y, et al. The prevalence, complications, and risk factors for infantile hemangioma: a systematic review and meta-analysis. *Int J Dermatol*. 2024;63:737–746. DOI:10.1111/ijd.17062 | PMID:38329175.
19. Hung YT, Chung WH, Chen CB. A premonitory mark of segmental infantile hemangioma. *CMAJ*. 2022;194:E910. DOI:10.1503/cmaj.220336 | PMID:35817428.
20. Strub G, Sidbury R, Bauman N. Vascular tumors: infantile hemangioma. In: Perkins J, Balakrishnan K, eds. *Evidence-Based*

Management of Head and Neck Vascular Anomalies. Cham: Springer; 2018:37–45. Book DOI:10.1007/978-3-319-92306-2.

21. Leung AKC, Lam JM, Leong KF, Hon KL. Infantile hemangioma: an updated review. *Curr Pediatr Rev*. 2021;17:55–69. DOI:10.2174/1573396316666200508100038 | PMID:32384034.
22. Frieden IJ, Rogers M, Garzon MC. Conditions masquerading as infantile haemangioma: Part 1. *Australas J Dermatol*. 2009;50:77–97; quiz 98. DOI:10.1111/j.1440-0960.2009.00514_1.x | PMID:19397559.
23. Haggstrom AN, Lammer EJ, Schneider RA, Marcucio R, Frieden IJ. Patterns of infantile hemangiomas: new clues to hemangioma pathogenesis and embryonic facial development. *Pediatrics*. 2006;117:698–703. DOI:10.1542/peds.2005-1092 | PMID:16510649.