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Clinical characteristics and treatment response of infantile hemangioma patients treated with oral propranolol

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Abstract

Background: Infantile hemangioma (IH) is the most common benign vascular tumor in infancy. Most lesions undergo spontaneous involution, however, some cases may require treatment due to the risk of functional impairment, ulceration, or permanent disability. Oral propranolol is the current first-line treatment for IH due to its efficacy and good safety profile. However, data on the clinical characteristics and treatment response of IH patients receiving oral propranolol in Indonesia remain limited.

Objective: To describe the clinical characteristics and treatment response of IH patients treated with oral propranolol at Dr. Soetomo General Academic Hospital, Surabaya.

Methods: A descriptive retrospective study using the medical records of patients with IH who were treated with oral propranolol at Dr. Soetomo General Teaching Hospital in Surabaya from 2018 to 2023 was conducted. The collected data consisted of gender, age at the first medical visit, age of onset, lesion location, lesion morphology, propranolol dosage, duration of treatment, and response to treatment.

Results: Eight patients met the inclusion criteria. Most patients were female (87.5%) and presented during the post-neonatal period (87.5%). All patients had disease onset before one year of age. Facial involvement was the most common lesion location (62.5%), while plaque was the predominant lesion morphology (50.0%). The median propranolol dose was 1.5 mg/kg/day (range 1.0–2.3 mg/kg/day), and the median treatment duration was 5 months (range 1–20 months). Clinical improvement was observed in seven patients (87.5%), while one patient (12.5%) showed no improvement.

Conclusion: Most IH patients treated with oral propranolol showed clinical improvement. Female sex, onset before one year of age, facial involvement, and plaque-type lesions were the most frequently observed characteristics in this study.

Keywords: Infantile Hemangioma; Oral Propranolol; Treatment Response; Clinical Characteristics; Retrospective Study

1. Introduction

Infantile hemangioma (IH) is the most commonly occurring benign vascular tumor in infancy, which affects approximately 4–5% of infants globally. This condition is characterized by rapidly proliferating endothelial cells during infancy, followed by gradually spontaneous involution. Although many lesions resolve without intervention, some may

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cause functional impairment, ulceration, bleeding, or permanent cosmetic abnormalities, thus requiring medical treatment. [1,2]

Various therapeutic options have been used for the management of IH, including topical therapy, laser therapy, surgery, and systemic medications. Among these modalities, oral propranolol has emerged as the treatment of choice due to its superior efficacy and favorable safety profile. Since its introduction for IH treatment in 2008, propranolol has demonstrated significant clinical benefits and is the only drug that has been approved by the U.S. Food and Drug Administration (FDA) for the treatment of IH. [3,4]

The therapeutic effects of propranolol are thought to result from multiple mechanisms, including vasoconstriction, angiogenesis inhibition, and induction of apoptosis in capillary endothelial cells. These mechanisms contribute to the reduction of lesion size, color intensity, and overall disease progression. Despite the widespread use of propranolol, treatment responses may vary among patients, and data regarding the clinical characteristics and outcomes of patients receiving propranolol therapy in Indonesia remain limited. [5,6]

Therefore, this study aimed to describe the clinical characteristics and treatment response of IH patients treated with oral propranolol at Dr. Soetomo General Academic Hospital, Surabaya.

2. Material and methods

2.1. Study Design and Setting

This study was a retrospective descriptive study conducted at the Dermatology and Venereology Outpatient Clinic of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Medical records from January 2018 to December 2023 were reviewed.

2.2. Study Population

The study population consists of patients diagnosed with IH who were treated with oral propranolol during the study period. Patients will be included in the study if they have been diagnosed with IH, are receiving oral propranolol, and have complete medical records containing the variables required for this study. Patients with incomplete medical records will be excluded.

2.3. Data Collection

Data was compiled using a standardized data collection form. Variables recorded included sex, age at presentation, age of onset, lesion location, lesion morphology, propranolol dosage (mg/kg/day), treatment duration (months), and treatment response.

2.4. Outcome Measurement

Treatment response was evaluated based on clinical assessments documented in the medical records. Patients were classified as having an improved response when there was documented clinical improvement, including reduction in lesion size, color intensity, or elevation during follow-up. Patients without documented clinical improvement were classified as not improved.

2.5. Data Analysis

Data were analyzed descriptively. Categorical variables were presented as frequencies and percentages, while numerical variables were summarized using medians and ranges.

2.6. Ethical Considerations

Ethical approval was issued as a letter of exemption by the Health Research Ethics Committee of Dr. Soetomo General Hospital, Surabaya, with reference number 2237/LOE/301.4.2/I/2026, valid from 7 January 2026 to 7 January 2027.

3. Results and discussion

A total of eight patients met the inclusion criteria and were included in the analysis.

3.1. Sex

Table 1 Distribution of Patients by Sex

Sex	n	%
Female	7	87.5%
Male	1	12.5%
Total	8	100

Seven patients (87.5%) were female, while one patient (12.5%) was male. The predominance of female patients in this study is consistent with previous studies reporting a higher incidence of IH among female infants, with a female-to-male ratio ranging from approximately 2:1 to 5:1. Although the exact mechanism underlying this sex predominance has not been fully elucidated, several studies have suggested that estrogen may contribute to the pathogenesis of IH by promoting endothelial cell proliferation and angiogenesis. Estrogen has been shown to enhance the expression of angiogenic factors, including vascular endothelial growth factor (VEGF), which plays an essential role in the proliferation of endothelial cells during the early growth phase of IH. [7,8]

3.2. Age at Presentation

Table 2 Distribution of Patients by Age at Presentation

Age Group	n	%
Post-neonatal	7	87.5
1-<5 years	1	12.5
Total	8	100

Most of the patients were diagnosed during the post-neonatal stage (87.5%), while one patient (12.5%) was between one and five years old. These findings support previous research reporting that IH is often first clinically observed during the early weeks and first few months of life and reaches its fastest growth rate during early infancy. The predominance of post-neonatal presentation in this study may be related to the natural progression of IH. Although most lesions are absent or minimally visible at birth, they typically undergo rapid proliferation within the first few months of life, resulting in increased size, elevation, and color intensity[9]. As the lesions become more noticeable during this period, parents are more likely to seek medical evaluation and treatment. In addition, concerns regarding cosmetic appearance and potential functional complications may further contribute to earlier healthcare consultation [4].

3.3. Age of Onset

Table 3 Distribution of Patients by Age of Onset

Age Group	n	%
Post-neonatal	7	87.5
1-<5 years	1	12.5
Total	8	100

All patients (100%) had disease onset before one year of age. Similar findings have been reported by several studies, which found that IH most commonly develops during infancy. Most IH lesions become clinically apparent within the first few weeks after birth and the proliferative phase predominantly occurs during the first year of life. The predominance of onset before one year of age in this study is likely related to the natural course of IH. Infantile hemangioma typically appears not long after birth and rapidly proliferating during the early months of life before

gradually entering the involution phase. This characteristic distinguishes IH from congenital hemangioma, which is already fully formed at birth and does not undergo a postnatal proliferative phase. [10,11]

3.4. Lesion Location

Table 4 Distribution of Patients by Lesion Location

Lesion Location	n	%
Facial	5	62.5
Non-facial	3	37.5
Total	8	100

Facial involvement was the most common lesion location, accounting for 62.5% of cases, while non-facial lesions accounted for 37.5%. This finding is consistent with previous studies reporting the head and neck region as the most frequent anatomical site of IH. [12] The predominance of facial lesions may be associated with the rich vascular network and complex embryological development of the craniofacial region. In addition, facial lesions are generally more noticeable to parents and caregivers because of cosmetic concerns and the potential risk of functional impairment involving structures such as the eyes, nose, lips, and ears. Consequently, these lesions are more likely to receive medical evaluation and treatment. [13]

3.5. Lesion Morphology

Table 5 Distribution of Patients by Lesion Morphology

Lesion Location	n	%
Plaque	4	50.0
Nodule	3	37.5
Macule	1	12.5
Total	8	100

Plaque was the most common lesion morphology, accounting for 50.0% of cases, followed by nodules (37.5%) and macules (12.5%). Similar findings have been previously reported in studies describing superficial IH as the predominant clinical subtype encountered in clinical practice. The predominance of plaque lesions in this study may be related to the proliferative phase of IH, during which rapid endothelial cell proliferation results in elevated erythematous lesions. Superficial IH commonly present as bright-red plaques because the abnormal vascular proliferation primarily occurs within the superficial dermis. As the lesion continues to enlarge and extend deeper into the skin, nodular components may develop depending on the depth and extent of vascular involvement. [14,15]

3.6. Oral Propranolol Treatment Profile and Treatment Response

Table 6 Oral Propranolol Treatment Profile

Variable	Result
Median dose	1.5 mg/kg/day
Dose range	1.0–2.3 mg/kg/day
Median treatment duration	5 months
Duration range	1–20 months

Table 7 Treatment Response Following Oral Propranolol Therapy

Variable	n	%
Improved	7	87.5
Not improved	1	12.5
Total	8	100

Oral propranolol is the first-line treatment for IH due to its well-established efficacy and good safety profile. In this study, the median dose of propranolol was 1.5 mg/kg/day, with treatment duration varying from one to twenty months. Clinically improved outcomes were reported in seven patients (87.5%), which indicates a good response in most cases.

The therapeutic effect of propranolol is believed to result from several mechanisms. In the early phase of treatment, propranolol induces vasoconstriction, leading to reduced blood flow within the lesion and a subsequent decrease in erythema. Long-term effects include inhibition of angiogenesis through suppression of vascular endothelial growth factor (VEGF) and induction of endothelial cell apoptosis. Collectively, these mechanisms contribute to lesion regression and clinical improvement. [15] One patient did not demonstrate clinical improvement during therapy. However, further analysis of the relationship between propranolol dosage, treatment duration, and treatment response could not be performed because of the limited sample size and the absence of a consistent pattern. For example, improvement was observed in some patients after one month of therapy, whereas another patient with the same treatment duration did not demonstrate improvement.

Although most patients demonstrated clinical improvement, the relationship between propranolol dosage, treatment duration, and treatment response could not be further evaluated in this study. The limited sample size and the absence of a consistent response pattern restricted such assessment. For example, clinical improvement was observed in some patients after only one month of therapy, whereas another patient receiving treatment for a similar duration did not demonstrate improvement. Likewise, patients receiving different propranolol doses showed variable treatment outcomes. Therefore, no clear association between propranolol dosage, treatment duration, and clinical improvement could be identified from the available data.

This study has several limitations. First, its retrospective design relied on the completeness of medical record documentation. Second, the sample size was small, limiting the ability to perform analytical statistical assessments. Third, this study was conducted at a tertiary referral center, which may limit the ability to generalize these findings.

4. Conclusion

Most IH patients treated with oral propranolol at Dr. Soetomo General Academic Hospital showed clinical improvement. The patients were predominantly female, presented during the post-neonatal period, and had disease onset before one year of age. Facial involvement was the most common lesion location, while plaque was the predominant lesion morphology. Oral propranolol was administered at a median dose of 1.5 mg/kg/day for a median treatment duration of 5 months. Clinical improvement was observed in 87.5% of patients following treatment. Although favorable treatment outcomes were observed in most patients, the relationship between propranolol dosage, treatment duration, and treatment response could not be determined due to the limited sample size and the absence of a consistent response pattern. Further studies involving larger populations are required to better evaluate factors associated with treatment outcomes in IH patients receiving oral propranolol therapy.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare there is no conflict of interest in this study.

Statement of ethical approval

This study received a letter of exemption from the Health Research Ethics Committee of Dr. Soetomo General Hospital, Surabaya with reference number 2237/LOE/301.4.2/I/2026, valid from 7 January 2026 to 7 January 2027.

Statement of informed consent

Not applicable. This study was conducted retrospectively using anonymized medical record data.

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