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ORIGINAL ARTICLE

Comparative study of treatment option for pediatric Lymphangioma in head neck region

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ABSTRACT

Background: *Pediatric lymphangioma (cystic hygroma) is a congenital lymphatic malformation commonly affecting the head and neck region and may cause functional and cosmetic morbidity. Optimal management remains debated, particularly in resource-limited settings.* ***Aim of the study:*** *To compare the outcomes, recurrence rates, and complications of different treatment modalities for pediatric head-and-neck lymphangioma.* ***Methods & Materials:*** *This prospective comparative study was conducted at a tertiary pediatric surgical center in Bangladesh from August 2023 to August 2025. Sixty children (≤5 years) with clinically and radiologically confirmed lymphangioma were managed by complete surgical excision, intralesional sclerotherapy, or a combination of both. Treatment outcomes, recurrence, and procedure-related complications were recorded and analyzed descriptively.* ***Result:*** *Macrocystic lesions were the most common (56.67%), followed by microcystic (26.67%) and mixed types (16.67%). Sclerotherapy alone was the most frequently used treatment (50.00%). No recurrence was observed following complete surgical excision or surgery after sclerotherapy, whereas sclerotherapy alone showed a recurrence rate of 43.33%. Surgical treatment was associated with wound infection (10.00%), seroma (15.00%), and temporary nerve weakness (5.00%), while sclerotherapy-related complications included fever/pain (13.33%) and skin necrosis (6.67%).* ***Conclusion:*** *Both surgery and sclerotherapy are effective treatment options for pediatric head-and-neck lymphangioma. Complete surgical excision offers excellent disease control with no recurrence, while sclerotherapy provides a less invasive alternative with acceptable safety but higher recurrence. Treatment selection should be individualized based on lesion type, extent, and available resources.*

Keywords: *Pediatric lymphangioma; Cystic hygroma; Head and neck; Sclerotherapy; Surgery*

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INTRODUCTION

Pediatric lymphangioma is a congenital lymphatic malformation, usually in the head and neck, presenting as slow-growing cystic masses that may lead to functional and cosmetic problems [1]. Globally, lymphangiomas account for about 4% of all vascular tumors and approximately 25% of benign vascular growths in children [2]. In Bangladesh, non-surgical sclerotherapy appears to successfully resolve around 80–90% of pediatric head/neck cystic hygroma cases without the risks inherent to surgery [3]. The development and presentation of pediatric lymphangioma in the head and neck region are influenced by congenital malformations of the lymphatic system, with most cases presenting as obvious masses at birth or early childhood [4]. The most common locations include the submandibular region, parotid gland, neck, cheek, tongue, and floor of the mouth, with macrocystic lesions typically found in the lateral neck and microcystic lesions more common in the tongue and floor of the mouth [5]. Head-and-neck cystic hygromas pose unique functional challenges because they can obstruct the airway, cause swallowing difficulties, and infiltrate vital structures. Cosmetic challenges arise from visible deformities and tissue infiltration that affect facial appearance [6]. Macrocystic lesions generally have better functional outcomes and respond well to surgical resection or sclerotherapy, whereas microcystic and mixed lesions are more infiltrative, associated with higher morbidity, and often require more complex or repeated treatments [4]. Traditional surgical excision of lymphangiomas near vital structures is limited by the risk of incomplete removal due to lesion infiltration, leading to high recurrence rates and potential damage to nerves and critical tissues, which can cause significant morbidity [7]. Surgery in complex or infiltrative lesions, especially those involving the tongue, floor of mouth, or parapharyngeal spaces, carries risks of nerve injury and functional deficits, although careful techniques like radiofrequency ablation can reduce

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invasiveness [8]. Minimally invasive sclerotherapy offers a safer, low-complication alternative, especially for macrocystic lesions, reducing the need for tracheostomy, while combination therapy with agents like sirolimus enhances outcomes in complex or recurrent cases [9]. Combined therapy may be beneficial for microcystic or mixed lesions, though it often requires multiple treatments and has variable recurrence rates; individualized, multidisciplinary approaches yield the best balance of resolution, safety, and recurrence control [10]. Resource availability and clinical expertise critically shape treatment choices for pediatric lymphangioma in low-and middle-income countries, where limited infrastructure, diagnostic tools, and specialized personnel often restrict access to advanced surgical or sclerotherapy options [11]. Economic constraints, travel difficulties, and healthcare system capacity further influence whether curative or palliative treatments are feasible, with providers balancing potential benefits against risks and resource limitations. Understanding local determinants of delayed care and treatment abandonment, including socioeconomic and cultural factors, is vital to improving adherence and survival rates in pediatric lymphatic malformations [12]. Ultimately, integrating clinical expertise with resource-adapted strategies and comparative evidence supports more equitable and effective management of pediatric lymphangiomas in low-resource environments [13]. This study aimed to compare the outcomes and safety of different treatments for pediatric head-and-neck lymphangioma/cystic hygroma.

METHODS & MATERIALS

This was a hospital-based prospective comparative study conducted in the Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Bangladesh. The study was carried out over a 19-month period from August 2023 to August 2025. A total of 60 pediatric patients diagnosed with lymphangioma (cystic hygroma) of the head and neck region were enrolled consecutively during the study period.

Inclusion Criteria:

- Pediatric patients (≤5 years) with clinically and radiologically confirmed lymphangioma of the head and neck
- Patients receiving treatment with surgery, sclerotherapy, or a combination of both

Exclusion Criteria:

- Previously treated or recurrent cases at presentation
- Patients with associated severe congenital anomalies or incomplete clinical data

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Review Board of Bangladesh Shishu Hospital & Institute. Written informed consent was obtained from the parents or legal guardians of all participants prior to enrollment.

Treatment Protocol

Patients were managed based on lesion type, size, anatomical location, and surgeon preference. Treatment approaches included complete primary surgical excision, surgical excision following sclerotherapy, and intralesional sclerotherapy alone. Complete primary surgical excision was performed with the objective of achieving total removal of the lesion whenever anatomically feasible. In selected cases, intralesional sclerotherapy was administered initially to reduce lesion size and extent, followed by definitive surgical excision. For patients managed non-surgically, intralesional sclerotherapy was carried out using tetracycline or sodium tetradecyl sulfate under appropriate clinical monitoring. Multiple treatment sessions were administered when necessary to achieve adequate lesion regression.

Data Collection

Data were collected prospectively using a structured pre-designed proforma. Information recorded included demographic characteristics, clinical findings, lesion size, site and extent, radiological classification, and selected treatment modality. Post-treatment data included treatment outcomes, recurrence, and procedure-related complications such as wound infection, seroma formation, nerve weakness, skin necrosis, and fever or pain. Follow-up findings were documented during scheduled outpatient visits, and imaging results were recorded when performed.

Statistical Analysis

Collected data were compiled and analyzed using SPSS version 26.0. Variables were summarized as frequencies and percentages and presented in tabular and graphical formats. Outcomes and complication patterns were compared across different treatment modalities based on observed trends, without applying formal inferential statistical tests.

RESULT

Among all, those aged 1–2 years were the most frequent at 36.67%, followed by 3–5 years at 33.33% and infants at 30.00%. Males cover 66.67% of the population and females represented the remaining (33.33%) of the study (Table I).

Table – I: Demographic characteristics of the study population (*n*=60)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
<1	18	30.00
1–2	22	36.67
3–5	20	33.33
Gender		
Male	40	66.67
Female	20	33.33

The posterior triangle of the neck was the primary site at 36.67% and the anterior triangle at 23.33%. The submandibular region represented 15.00%, parotid region 10.00%, floor of mouth 8.33%, and multiple sites identified 6.67% (Table II).

Table – II: Anatomical distribution of lymphangioma in head and neck region (*n*=60)

Site of lesion	Frequency (n)	Percentage (%)
Posterior triangle of neck	22	36.67
Anterior triangle of neck	14	23.33
Submandibular region	9	15.00
Parotid region	6	10.00
Floor of mouth	5	8.33
Multiple sites	4	6.67

Macrocystic lesions were the most prevalent at 56.67% and microcystic types represent (26.67%). The remaining 16.67% of cases were classified as mixed (Table III).

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Table – III: Radiological classification of lymphangioma (*n*=60)

Lesion type	Frequency (n)	Percentage (%)
Macrocystic	34	56.67
Microcystic	16	26.67
Mixed	10	16.67

Figure 1 demonstrates that intra-lesional sclerotherapy only was the most frequent modality at 50.00%. Complete primary surgical excision followed at 33.33%, where surgical excision after sclerotherapy represented (16.67%). Combined, surgical interventions accounted for 50.00% of the total.

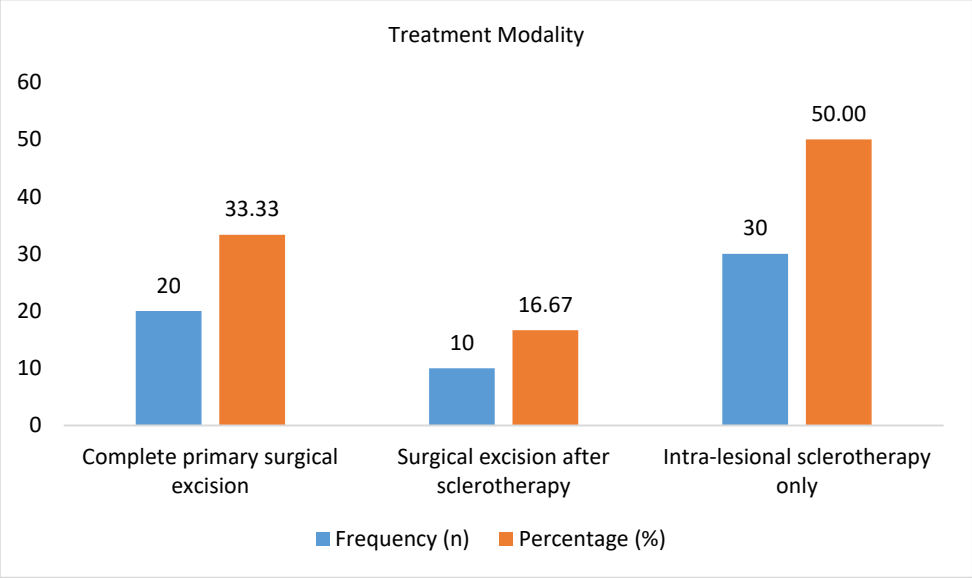

Figure – 1: Distribution of treatment modalities (*n*=60)

For macrocystic lesions, sclerotherapy alone was most frequent at 52.94%, with surgery alone at 29.41% and combined therapy at 17.65%. Microcystic types showed equal distribution between surgery alone and sclerotherapy alone at 43.75% each. Mixed lesions were primarily treated with sclerotherapy alone at 50.00%, leading to surgery alone at 30.00% and combined approaches at 20.00% (Table IV).

Table – IV: Treatment modality according to lesion type (*n*=60)

Lesion type	Surgery alone, n (%)	Surgery + sclerotherapy, n (%)	Sclerotherapy alone, n (%)
Macrocystic (n = 34)	10 (29.41)	6 (17.65)	18 (52.94)
Microcystic (n = 16)	7 (43.75)	2 (12.50)	7 (43.75)
Mixed (n = 10)	3 (30.00)	2 (20.00)	5 (50.00)

Complete primary surgical excision and surgery after sclerotherapy showed no recurrence. In contrast, intra-lesional sclerotherapy only resulted in a 43.33% recurrence rate (Table V).

Table – V: Recurrence rate according to treatment modality (*n*=60)

Treatment modality	Recurrence (n)	Recurrence (%)
Complete primary surgical excision	0	0.00
Surgical excision after sclerotherapy	0	0.00
Intra-lesional sclerotherapy only	13	43.33

Surgery alone resulted in 15.00% seroma, 10.00% infection, and 5.00% nerve weakness. Combined therapy showed 10.00% of infection and 10.00% seroma. Sclerotherapy alone led to 13.33% fever/pain, 6.67% skin necrosis, and 3.33% seroma. Notably, sclerotherapy recorded no wound infections and nerve weakness, whereas surgery similarly revealed no skin necrosis and fever (Table VI).

Table – VI: Post-treatment complications by treatment modality (*n*=60)

Complication	Surgery alone (n = 20), n (%)	Surgery + sclerotherapy (n = 10), n (%)	Sclerotherapy alone (n = 30), n (%)
Wound infection	2 (10.00)	1 (10.00)	0 (0.00)
Seroma	3 (15.00)	1 (10.00)	1 (3.33)
Temporary nerve weakness	1 (5.00)	0 (0.00)	0 (0.00)
Skin necrosis	0 (0.00)	0 (0.00)	2 (6.67)
Fever/pain	0 (0.00)	0 (0.00)	4 (13.33)

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DISCUSSION

This study demonstrates that both complete surgical excision and sclerotherapy provide effective management of pediatric lymphangioma/cystic hygroma, with minimal recurrence. Sclerotherapy offers a less invasive alternative with comparable functional and cosmetic outcomes, supporting its role as a first-line therapy in selected patients. In this study, the majority of patients were aged 1–2 years (36.67%), thereafter 3–5 years (33.33%) and infants below one year (30.00%). This age distribution reflects the congenital nature of lymphangioma, which typically presents in early childhood. Alqahtani et al. observed that most cases present within the first two years of life due to progressive enlargement and cosmetic or functional concerns [14]. Similarly, Smith et al. reported a comparable pediatric predominance, emphasizing early detection due to visible swelling in the head and neck region [15]. Male predominance (66.67%) observed in our study is also consistent with prior reports, where male-to-female ratios ranged from 1.3:1 to 2:1, suggesting a possible gender predisposition, although the exact biological mechanism remains unclear [15]. The posterior triangle of the neck was the most common anatomical site (36.67%), contributed to the anterior triangle (23.33%) and submandibular region (15.00%). Kennedy et al. reported posterior triangle involvement in approximately 40% of cervicofacial lymphatic malformations [16], whereas Zheng et al. documented similar distributions in pediatric studies [17]. The relatively lower involvement of the floor of the mouth (8.33%) and parotid region (10.00%) aligns with earlier studies, which report these sites as less common but clinically significant due to their greater treatment complexity and functional implications [16,17]. In our study, macrocystic lymphangiomas were the most prevalent subtype (56.67%), resulting in microcystic (26.67%) and mixed lesions of (16.67%). This predominance of macrocystic lesions is consistent with several radiological and clinical studies. Li et al. reported a higher proportion of mixed lesions (57.5%) and a lower percentage of macrocystic lesions (36.56%), examining variability across populations [18]. This discrepancy can attribute to differences in anatomical focus, imaging modalities, and diagnostic criteria. Our relatively higher microcystic proportion compared to some series which reflects to improve imaging resolution or inclusion of infiltrative lesions that were previously underdiagnosed. We found that intralesional sclerotherapy alone was the most frequently (50.00%) employed treatment modality, and subsequently complete primary surgical excision (33.33%) and combined surgery with sclerotherapy (16.67%). This distribution represents a growing global trend toward minimally invasive management of lymphangiomas, particularly macrocystic lesions. Ogita et al. reported increasing reliance on sclerotherapy as first-line treatment due to reduced morbidity and acceptable outcomes [19]. The equal overall contribution of surgical and non-surgical approaches in our study underscores the individualized treatment decision-making based on lesion type, size, and location. The present study identified a clear relationship between lesion type and treatment selection. Macrocystic lesions were predominantly managed with sclerotherapy alone (52.94%), consistent with existing evidence that macrocystic lymphangiomas respond favorably to sclerosants. Microcystic lesions showed equal distribution between surgery and sclerotherapy (43.75%), explaining the therapeutic challenge associated with infiltrative microcystic disease. Mixed lesions were most frequently treated with sclerotherapy alone 50.00%, though combined approaches were also utilized. These findings are comparable with study by Burrows et al., who emphasized that treatment choice is largely dictated by cyst morphology, with macrocystic lesions demonstrating better response rates to sclerotherapy compared to microcystic variants [20]. We found that recurrence was observed exclusively in patients treated with sclerotherapy alone 43.33%, where no recurrence was noted following complete primary surgical excision or surgery after sclerotherapy. Perkins et al., similarly reported lower recurrence rates following complete excision [21]. The higher recurrence after sclerotherapy in our study may be attributed to incomplete lesion regression, particularly in microcystic or mixed lesions, reinforcing the need for careful patient selection and long-term follow-up. Finally, surgical intervention was associated with wound infection 10.00%, seroma 15.00%, and temporary nerve weakness 5.00%, these findings consistent with earlier surgical series. Combined therapy showed comparable infection and seroma rates 10.00%, while sclerotherapy alone was associated with fever/pain (13.33%) and skin necrosis (6.67%). Importantly, sclerotherapy showed no wound infections or nerve injuries, supporting its safety profile. Similar complication patterns have been reported by Alqahtani et al. and Rozman et al., emphasizing that although sclerotherapy is less invasive, it is not devoid of adverse effects [14,22].

LIMITATIONS

- Formal inferential statistical tests were not applied; therefore, observed differences between treatment modalities were based on descriptive trends only.
- Treatment allocation was influenced by lesion characteristics and surgeon preference, introducing potential selection bias.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that both surgical excision and intralesional sclerotherapy are effective treatment modalities for pediatric lymphangioma of the head and neck. Complete primary surgical excision and surgery following sclerotherapy achieved excellent outcomes with no recurrence, while sclerotherapy alone offered a minimally invasive option with fewer surgical complications but a higher recurrence rate. Macrocystic lesions responded more favorably to sclerotherapy, whereas microcystic and mixed lesions often required surgical or combined approaches.

RECOMMENDATIONS

An individualized treatment strategy based on lesion type, anatomical location, and available expertise is essential for optimal outcomes. Sclerotherapy may be considered as a first-line treatment for selected macrocystic lesions, particularly in resource-limited settings, while surgery remains crucial for definitive management and recurrence prevention. Larger multicenter studies with longer follow-up and comparative statistical analysis are recommended to establish standardized treatment guidelines.

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