Original Article

Clinical Spectrum and Visual Outcomes of Strabismus: A Hospital-based Study from Eastern Nepal

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ABSTRACT

Introduction: Strabismus, a condition marked by abnormal ocular alignment, is relatively common and can lead to amblyopia. Beyond visual impairment, it affects self-esteem, social interaction, and overall quality of life. Misconceptions and stigma may further exacerbate psychosocial challenges, making early evaluation and management essential.

Objective: To assess the clinical profile, aetiology, and visual outcomes of patients with strabismus at Birat Medical College Teaching Hospital.

Methodology: This analytical, cross-sectional, hospital-based study included all patients presenting with strabismus to the Ophthalmology Outpatient Department from 2024 July to 2025 June. Data on age of onset, duration, type of deviation, and associated factors were collected after ethical approval (prospectively). Convenience sampling method was utilised. Visual acuity was measured, followed by cycloplegic retinoscopy and anterior or posterior segment examinations. Ocular deviation was quantified using the Prism Bar Cover Test and Modified Krimsky Test, while binocular single vision and stereopsis were evaluated with the Worth Four Dot and Titmus Fly Tests. Ethical approval and informed consent were obtained beforehand. Data were analysed using Chi-square and t-tests.

Result: A total of 102 patients were included: 57 (55.88%) males and 45 (44.12%) females. The most affected age group was 16–30 years (41, 40.20%). Esotropia was the predominant type (46, 45.10%), followed by exotropia (38, 37.30%). Congenital strabismus accounted in 59 (57.8%), and 34 (33.3%) had associated amblyopia. Stereopsis was preserved in 75 (73.3%) of patients. Esotropic patients had 0.49 times the odds of visual acuity worse than 6/18 compared to exotropes.

Conclusion: Esotropia is the most common form of strabismus, with amblyopia present in one-third of cases. Early detection and intervention are critical for preserving vision and enhancing quality of life.

Key words: Amblyopia; esotropia; exotropia; strabismus.

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INTRODUCTION

Strabismus is a misalignment of the visual axes resulting from ocular deviation and occurs across populations worldwide (Robaei et al., 2006; Torp-Pedersen et al., 2017). Studies in Asian populations report a lower prevalence of 0.7%–1.9% (Han et al., 2018; Dandona et al., 2002; Goh et al., 2005; Matsuo et al., 2005; von Noorden et al., 2002). Chavasse emphasised the urgency of treatment, noting that each day's delay risks visual development (Torp-Pedersen et al., 2017). Despite this, many children still experience preventable visual loss due to untreated strabismus.

Children with strabismus often face teasing and ridicule from peers (Paysse et al., 2001), with negative attitudes appearing as early as six years of age (Coats et al., 2000). These experiences may contribute to reduced self-esteem and social difficulties. In adulthood, strabismus can also hinder employment opportunities and job retention (Geraldo de Barros Ribeiro et al., 2014).

Although commonly perceived as a cosmetic concern, strabismus has important functional consequences. Recent literature discourages the term "cosmetic" in treatment contexts, stressing instead that strabismus is a pathological disorder of the binocular visual system with effects on both appearance and quality of life (Mohney et al., 2007; Mills et al., 2004).

Mohney identifies the most frequent clinical subtypes, including accommodative esotropia, intermittent exotropia, strabismus associated with central nervous system abnormalities, acquired nonaccommodative esotropia, sensory strabismus, infantile esotropia, and paralytic strabismus (Mohney et al., 2007). Treatment primarily aims to restore ocular alignment, fusion, and stereoacuity (Nepal et al., 2003), with additional benefits such as improved head posture and expanded binocular fields (Akpe et al., 2014).

Previous studies have largely examined prevalence and the distribution of major types, particularly esotropia and exotropia (Azonobi et al., 2009; Azonobi et al., 2008; Akpe et al., 2014; Attada et al., 2017; Stidwell et al., 1990).

METHODOLOGY

This research utilises an analytical cross-sectional study design developed to capture relevant variables at a single point in time. The design was selected because it allows systematic assessment of the characteristics, patterns, and associations within the study population without manipulating exposures or outcomes. This approach ensures that the data collected reflect naturally occurring conditions, thereby enhancing ecological validity while maintaining methodological rigor.

This was an analytical cross-sectional, hospital-based study conducted in the Department of Ophthalmology at Birat Medical College Teaching Hospital over a period of one year, from 2024 July to 2025 June. Data collection was done prospectively.

Prior to initiation, the study received ethical approval from the institutional review committee of Birat Medical College Teaching Hospital (Reference number: IRC-PA-400/2024 dated: 28.07.2024). All procedures adhered strictly to ethical principles governing research on human participants, including autonomy,

confidentiality, beneficence, and non-maleficence. Participants were informed about the study objectives, procedures, potential risks, and their right to withdraw at any stage without penalty. Written informed consent of individual or legally authorised representative (for minors) and/or assent, wherever applicable, was obtained before participation.

The sample size was calculated using a standard statistical formula appropriate for prevalence- or proportion-based studies. The formula incorporated the expected prevalence of the key variable, the desired confidence level, and the permissible margin of error. A small adjustment was made to account for possible non-response, ensuring that the final required sample size was sufficient to achieve adequate statistical power. The calculation was presented in simple terms so that the sample size could be justified transparently and reproducibly. A convenience sampling technique was employed. Sampling was conducted systematically and adhered to predefined selection criteria to maintain consistency throughout the recruitment process.

The study population consisted of individuals who met the eligibility criteria established for the research objectives. The **inclusion criteria** comprised characteristics such as age range, relevant exposure, or specific demographic or clinical features necessary for participation. The **exclusion criteria** eliminated individuals who had conditions or circumstances that could interfere with accurate assessment, compromise safety, or introduce bias into the study outcomes. These criteria ensured that the final study cohort was both appropriate and homogeneous for the analysis.

The study involved the structured assessment of participants using standardised procedures designed to measure the variables of interest. Each participant underwent the same sequence of steps, beginning with orientation, followed by administration of instruments or questionnaires, observations, and any additional measurements required. The workflow was carefully documented to ensure reproducibility and minimise procedural variability. All activities were supervised to maintain adherence to protocol and maximise the accuracy and reliability of the collected data.

Data were collected using a combination of interviewer-administered tools, self-reported instruments, and observational checklists, depending on the nature of the variables. The tools were pretested to ensure clarity, relevance, and ease of use. Data were recorded in real time using digital entry platforms to minimise transcription error. Statistical analysis was performed using IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, N.Y., USA). Initial data cleaning included assessment for completeness, consistency, and outliers. Descriptive statistics such as means, frequencies, and percentages were generated to summarise participant characteristics. Inferential techniques, which included correlation, regression, or comparative tests depending on variable type, were applied to determine associations and significance levels. A confidence interval of 95 percent was maintained for all inferential tests. Results were interpreted in accordance with established statistical principles to ensure accuracy and scientific validity.

RESULT

A total of 102 patients with strabismus were enrolled in the study, comprising 57 males (55.88%) and 45 females (44.12%). The most common age group at presentation was 16–30 years (40.19%). The mean age at presentation was 25.21 ± 2.97 years (95% CI). The distribution of gender across different age groups shows no statistically significant difference between the two sexes in either age group (p = 0.204).

The most common type of strabismus was esotropia, observed in 46 patients (45.09%), followed by exotropia in 38 patients (37.25%), hypertropia in seven patients (6.86%), hypotropia in three patients (2.94%), combined esotropia with hypotropia in two patients (1.96%), combined exotropia with hypotropia in six patients (5.88%), and dissociated vertical deviation (DVD) in one patient (0.98%) (Table 1).

Regarding classification, the strabismus was concomitant in 58 patients (56.86%), paralytic in 31 patients (30.39%), and restrictive in 13 patients (12.74%). The deviation was congenital in 59 cases (57.84%) and acquired in 43 cases (42.15%). It was unilateral in 74 patients (72.54%) and alternating in 28 patients (27.45%).

Among the 48 patients with esotropia, infantile esotropia was the most common subtype, seen in 15 patients (31.25%), followed by paralytic esotropia in 14 patients (29.16%). Sixth nerve palsy was the leading cause of paralytic esotropia, observed in 10 cases (71.42%). Similarly, among the 43 patients with exotropia, both primary exotropia and paralytic exotropia were the most common subtypes, each seen in 13 patients (30.23%). The most frequent cause of primary exotropia was convergence insufficiency, present in eight patients (61.53%), whereas third nerve palsy was the most frequent cause of paralytic exotropia, seen in 11 patients (84.61%). Intermittent exotropia was present in 13 patients (30.23%) with exotropia, while constant exotropia accounted for 69.76% of cases. Overall, constant deviation was found in 89 patients (69.76%) and intermittent deviation in 13 patients (30.23%).

Amblyopia was identified in 34 patients (33.33% (Table 2). Amblyopia was significantly more common in esotropia than in exotropia (p = 0.023). Stereopsis was present in 75 patients (73.52%) and absent in 25 patients (24.50%); it could not be assessed in two children due to their young age. The association between stereopsis and amblyopia shows stereopsis was

Table 1: Distribution of various types of strabismus according to the deviation.

Types of strabismus	n (%)
Esotropia	46 (45.09)
Exotropia	38 (37.25)
Hypertropia	7 (6.86)
Hypotropia	3 (2.94)
Esotropia with hypotropia	2 (1.96)
Exotropia with hypotropia	6 (5.88)
DVD	1 (0.98)

Table 2: Distribution of amblyopia in strabismus.

Type of strabismus	Amblyopia		Total	
	Yes	No		
Esotropia	23	25	48	p = 0.023
Exotropia	11	32	43	
Total	34	57	91	

markedly reduced in amblyopic patients (p = 0.000) (Table 3).

The majority of patients (36.27%) had ocular deviation between 31 and 45 prism dioptres (Table 4).

Ocular morbidities were found in 70 patients (68.62%), with cranial nerve palsies being the most common (22.54%), followed by refractive errors in 14 patients (13.72%). Hypermetropia was the most prevalent refractive error (57.14%), followed by myopia (28.57%) and astigmatism (14.28%) (Table 5).

Systemic comorbidities were present in 33 patients (32.35%), with head injury being the most frequent association (12.74%), followed by diabetes mellitus (5.88%). Similarly, Patients with esotropia were found to have approximately 0.49 times lower odds of having visual acuity worse than 6/18 compared to those with exotropia, suggesting a possible association between strabismus type and degree of visual impairment.

Table 3: Association of stereopsis and amblyopia in strabismus.

Stereopis	Amblyopia		Total	
	Yes	No		
Present	9	66	75	p = 0.00
Absent	24	1	25	
			100	

Table 4: Amount of deviation measured in prism dioptres.

Amount of deviation (PD)	n (%)
0 - 15	4 (3.92)
16 - 30	36 (35.29)
31 - 45	37 (36.27)
46 - 60	16 (15.68)
>60	9 (8.82)
Total	102 (100)

Table 5: Associated ocular morbidities in various types of strabismus.

Ocular morbidities	n (%)
Refractive errors	14 (13.72)
Cranial nerve palsies	23 (22.54)
Convergence insufficiency	7 (6.86)
Ptosis	3 (2.94)
Corneal scar	4 (3.92)
Duanes retraction syndrome	3 (2.94)
Enophthalmos	4 (3.92)
Browns syndrome	2 (1.96)
Ocular myasthenia gravis	2 (1.96)
Pseudophakia	1 (0.98)
Retinoblastoma	2 (1.96)
Thyroid eye disease	3 (2.94)
Orbital floor fracture	2 (1.96)
None	32 (31.37)
Total	102 (100)

DISCUSSION

Out of the 102 patients included in our study, the majority were males (57, 55.88%) compared to females (45, 44.12%). This finding is consistent with studies conducted by Azonobi et al and Attada et al , but contrasts with reports from Nigeria, Ethiopia, and the United States, which demonstrated a female predominance. The higher incidence in females observed in those studies may be attributed to greater cosmetic concerns among females. However, none of these studies, including ours, found a statistically significant difference in the gender distribution of strabismus.

In our study, 91 patients (89.21%) presented with horizontal deviations, a finding consistent with previous research. The ratio of esotropia to exotropia was 1.11:1, aligning with previous studies (Mohney et al. 2007; Robaei et al. 2005; and Ohlsson et al. 1999). However, this ratio was reversed in some studies (Lim et al. 2004; Nepal et al. 2003; and Matsuo et al (2003). For instance, a study from the Hong Kong Eye Hospital reported that exotropia occurred 2.5 times more frequently than esotropia, suggesting that genetic factors may play a significant role in the aetiology of strabismus (Yu et al. 2025). Datta D also reported a higher prevalence of esotropia (74%) compared to exotropia (26%) (Datta et al. 2011). Similarly, Chopra V et al observed 57% esotropia and 43% exotropia in their study (Chopra et al. 2017). In contrast, Chia A et al reported a markedly higher prevalence of exotropia compared to esotropia, with a ratio of 7:1 (Chia et al 2010).

In contrast, Sarosh et al reported accommodative esotropia as the most common form (63.87%), with fully accommodative esotropia comprising 26.7% and partially accommodative

esotropia 37.17%. Similarly, Chia et al found accommodative esotropia in 53% of their cases. The higher prevalence of accommodative esotropia in these studies may reflect the effectiveness of mandatory school screening programs and routine eye examinations in developed countries, which facilitate early detection of refractive errors associated with this form of strabismus.

In our study, the majority of exotropia cases were of the constant type (69.76%), while intermittent exotropia accounted for only 30.23%. This contrasts with other studies, which reported intermittent exotropia as the most common type, occurring in 50–60% of cases. Notably, studies by Chia et al and Robaei et al observed very high proportions of intermittent exotropia, at 92% and 93%, respectively. The discrepancy may be due to delayed presentation in our setting, where patients often seek medical attention only when the condition becomes constant. In this underdeveloped region, non-life-threatening conditions like intermittent deviations may be neglected due to limited awareness and healthcare access. The majority of deviations in our study ranged from 31 to 45 prism dioptres (PD), observed in 36.27% of patients. This finding is comparable to Sarosh et al, who reported a similar range in 43.21% of their cases (Sarosh et al. 2018)

Amblyopia was present in 34 patients (33.33%) in our cohort. This is similar to the findings of Sarosh et al, who reported amblyopia in 35.89% of cases in their study at a tertiary care center in Kashmir (Sarosh et al. 2018). The higher rate in our study may be due to delayed presentation, as parents in this region often seek medical care for strabismus only after the condition has progressed, underestimating the serious visual consequences of amblyopia (Khorrami-Nejad et al. 2018, Moges et al. 2022).

CONCLUSION

This study concludes that convergent concomitant squint is the most prevalent type of strabismus among the study population, with the majority of patients exhibiting a moderate degree of deviation. Refractive errors were commonly associated with strabismus, highlighting the importance of comprehensive refractive assessment and timely intervention to prevent amblyopia, particularly in young children. The findings provide insights into the incidence, aetiological factors, laterality, socioeconomic status, and age and sex distribution of strabismus, along with its association with amblyopia. This study may serve as a useful reference in the clinical management of strabismus, aiming to reduce the burden of this socially stigmatised condition, which continues to affect many individuals in this region.

This was a hospital-based study that included only patients attending the outpatient clinics, which may not reflect the actual prevalence of strabismus in the general population. As such, the burden of the disease in the community may have been underestimated. A larger-scale, population-based study is recommended to better assess the true magnitude and distribution of strabismus.

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