Clinical Study of Vertical Strabismus Among Patients Attending Squint Clinic –Makkah Eye Hospital –Khartoum

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ABSTRACT

Background: The magnitude of vertical deviations among strabismus patients is not small, but it is under-diagnosed in most general ophthalmic clinics. It is diagnosis and intervention are important to prevent deep amblyopia and poor vision.

Objectives: The objectives of this research are to study the magnitude of vertical deviations among strabismus patients attending MAKKAH Eye Complex, Squint clinic, to determine various etiological factors and make a suitable plan of management.

Methods: It is across- sectional descriptive –hospital-based study at MAKKAH eye Complex, Khartoum, Sudan, in a period of 1 year, from November 2012- November 2013. This study included 102 patients, who presented to MAKKAH Eye Complex, Squint clinic, with vertical deviation or associated with horizontal deviations. The patients were directly interviewed through a case report sheet, refraction and orthoptic examination were done for each of them.

Result: Vertical deviation represents 0.15% of all strabismus patients, eighty-seven percent were below 16 years of age, 12.7% were above 17 years of age, the female number was a little more than male. 3/4 of patients were children with early onset of deviation in the majority of them. Positive family history in more than half of the patients. The majority of patients presented with inferior oblique overaction with esotropia, the commonest form was combined vertically with horizontal deviation. They represent 2/3 of patients with vertical deviations.

Conclusion: The commonest type of vertical deviation was combined vertically with horizontal deviations. Hypertropia is presented more than 75% of patients with vertical deviation. Surgery and spectacles represent the most suitable plan of management.

Keywords: Vertical Strabismus, Squint Clinic–Makkah, patients

Introduction

During my training at different hospitals, I came across many cases of vertical strabismus which was under-diagnosed. To know the magnitude of this problem among all age groups I thought of conducting this study at Makkah Eye hospital, which has a major squint clinic. The vertical

deviation is a misalignment of the visual axes. It may be comitant but usually incomitance. It can occur alone or with horizontal deviations. Most vertical deviations are incomitant. They are associated with so-called dysfunctional over action or under the action of superior and inferior

oblique muscles or restriction of vertical movement. Nearly every vertical paralytic deviation is incontinent at the onset but with time it approaches comitance unless they are associated with restrictions, such as might occur with an orbital blow out fracture or thyroid eye disease. (1)

The commonest cause of vertical strabismus in Europe is superior oblique palsy. It is usually congenital, the second common cause is trauma particularly head injury. The other causes may be intracranial neoplasm, central nervous system problems or diabetes. (2)

Here I did this research to know the magnitude of vertical deviation among strabismus patients, it is an effect of on binocularity of vision and to set a plan of management.

Objectives

General objectives:

- ❖ To report incidence and percentage of vertical deviations among strabismus patients at Makkah Eye Complex.
- ❖ Specific objectives:
- ❖ To determine the magnitude and extent of vertical deviations among strabismus.
- ❖ To determine associated horizontal strabismus and its effect upon management.
- ❖ To determine types of vertical deviations among patients with strabismus.
- ❖ To measure vision and refractive status among patients with vertical deviations.
- ❖ To monitor the plan of management drawn for those patients with vertical deviations.

Patient materials and methods

It is a cross-sectional descriptive hospital-based study at Makkah Eye Complex Setting:

This was a hospital-based study, carried out at the squint clinic at MAKKAH Eye Complex, Khartoum-Sudan. This hospital is a well-equipped centre and squint clinics have all the recent facilities for the diagnosis and management of strabismus.

Population and sampling methods

The period of study was one year from November 2012-November 2013. A total of 102 patients were selected by attending two squint clinics per week and examined clinically to identify those patients who had any degree of vertical deviation.

Sample size was 85 patients by equation:-
Increase to 102.

$$n = Z^2 (N) pq / (D^2 \times (N - 1) + Z^2 pq)$$

n= sample size, D= Desirable error 0.5

P= Prevalence

$$Q = 1 - P$$

Z= confidence interval at 95 = 1.96

N= Total population

Study Tools

This study was cross-sectional descriptive data, interviewing patients by case report form through taking a full history, examined them clinically-visual acuity of every patient was checked and recorded with and without glass and both for near and distance and also pinhole the anterior segment was examined by slit lamp. Orthoptic assessment includes both sensory and motor evaluation of strabismus by major amblyoscope, cover and uncover test was done. Cycloplegic refraction of all patients was done using cyclopentolate, 5%-1% eye drops or 1% atropine used three times daily for three consecutive days. Fundoscopy was done by direct ophthalmoscope, slit lamp, and 90 D lens.

Procedure

The diagnosis was made by a senior ophthalmologist at the squint clinic. Then I took full history and examination. Before that, I sent the patient to the Refractionist to do refraction. I measured the angle of deviation by the prism bar. An Orthoptic examination for every patient was done by orthoptist.

Data analysis

The data analysis was carried out using SPSS (Statistical Package of Social Sciences) software computer program version 18.

Inclusion Criteria

All patients who had a degree of vertical strabismus were included except those who refuse to be included in this study.

Ethical considerations

I took permission from the Medical Director of Makkah Eye Complex, Khartoum; all patients were examined after obtaining informed verbal consent.

Result

102 Patients were interviewed using a case report form at Squint Clinics at Makkah Eye Hospital. The case report form was analyzed using SPSS version 18 gives:

Figure1: Shows Distribution of patient with vertical deviation among strabismus by sex, 63(62%) Were female, 39(38%) were male.

Figure: 1 Distribution of Patients with vertical deviation according to sex

Figure 2: Shows distribution of patients with vertical deviation among strabismus by age, 89 patients (87,3%) from 1-16 years old, 13 patients (12,7% above 17 years old.

Figure: 2 Distribution of Patients with vertical deviation according to the Age

Figure 3: Shows distribution of patients with vertical deviation among strabismus by presenting complain, 79 patients (77, 5%) have family noticed deviation, 18 patient (17, 6%) were other noticed deviation, 5 patient (4, 9%) presenting with diplopia.

Figure: 3 Distribution of Patients with vertical deviation according to the Presenting Complain

Figure 4: Shows distribution of patient by age of onset and presentation, 77 patient presenting early (75, 5%), 25 patient (24, 5%) present late.

Figure: 4 Distribution of Patients with vertical deviation according to the age of presentation

Figure5: Shows distribution of patient by general health, 98 patient (96,1%) were good, 4 patient (3,9%) were others.

Figure: 5 Distribution of Patients with vertical deviation according to the state of general health

Figure 6: Shows distribution of patient by family history, 56 patients (55%) had a positive family history, 46 patients (45, 1%) had a negative family history.

Figure: 6 Distribution of Patients with vertical deviation according to the family history

Figure 7: Shows distribution of patient by previous ocular history, 50 patient were wearing glass(49%), 16 patient had occlusion(15,7%), 20 patient had surgery(19,6%), others include (trauma etc...) 9 patient(8,8%), no previous ocular history 7 patient(6,9%).

Figure: 07 Distribution of Patients with vertical deviation according to the previous ocular history

Figure 8: Shows distribution of patient by RT eye visual acuity , 69patient (67,6%)had 6\6 visual acuity,22 patient(21,6%)between (6\9-6\18),5 patient(4,9%)less than 6\18,6 patient(5,9%)were uncooperative.

Figure: 8 Distribution of Patients with vertical deviation according to the visual acuity RT Eye

Figure 9: Shows distribution of patient by LT eye visual acuity,68 patient (66,7%)had 6\6 visual acuity,24 patient(23,5%)between(6\9-6\18) , 4patient(3,9%) less than 6\18, 6 patient un cooperative for visual acuity(5,9%).

Figure: 9 Distribution of Patients with vertical deviation according to the visual acuity LT Eye

Figure10: Shows distribution of patient by refraction, 62 patient were emme-tropic (60, 8%), 31 patient were hypermetropic (30,4%),9 patient had Myopia (8,8%).

Figure: 10 Distribution of Patients with vertical deviation according to the refractive state

Figure 11: Shows distribution of patient by cycloplegic refraction,47 patient were Emme-tropic(46,1%),47 patient were hyper metropic (46,1%),8 patient were myopic(7,8%).

Figure: 11 Distribution of Patients with vertical deviation according to the cycloplegic refraction

Figure 12: Shows distribution of patients by anterior segment findings, 94 patients had negative anterior segment findings (92%), 8 patients had positive Findings (8%).

Figure: 12 Distribution of Patients with vertical deviation according to the anterior segment findings

Figure 13: Shows distribution of patients by posterior segment findings, 97 patients had negative findings (95,1%), 5 patients had positive findings (4,9%).

Figure: 13 Distribution of Patients with vertical deviation according to the posterior segment findings

Figure 14: Shows distribution of patient according to deviating eye, 18 patient the right eye was the deviating eye, 26 patient the left eye was the deviating eye (25, 5%), 58 patient both eyes were deviating (56, 9%).

Figure: 14 Distribution of Patients with vertical deviation according to the deviated eye

Figure 15: Shows distribution of patient according to examination by cover test of near angle of deviation, 14 patient had hyper deviation (13,7%), 12 patient had hypo-deviation (11,8%), 47 patient had hyper with eso deviation (46,1%), 4 patient had hypo with eso deviation (3,9%), 4 patient had hypo with exo deviation (3,9%), 21 patient had hyper with exo deviation (20,6%).

Figure: 15 Distribution of Patients with vertical deviation according to the near angle of deviation

Figure 16: Shows distribution of patient by examination by cover test of distance angle of deviation, 14 patient had hyper deviation(13,7%), 12 patient had hypo deviation(11,8%), 25 patient had hyper with exo deviation(24,5%), 44 patient had hyper with eso deviation(43,1%), 4 patient had hypo with eso deviation(3,9%), 3 patient had hypo with exo deviation(2,9%).

Figure: 16 Distribution of Patients with vertical deviation according to the distance angle of deviation

Figure 17: Shows distribution of patient according to plan of management, 46 patient on observation(45%), 81 patient on glass(79%), 29 patient on occlusion(28%), 74 patient get surgery(73%), 5 patient on prism(5%).

Figure: 17 Distribution of Patients with vertical deviation according to the plan of management

Table 01: Shows distribution of patients by examination of ocular motility 47 patients with full ocular motility (46,1%) 55 patients with no full ocular motility (53, 9%).

	Frequency	Percent	Valid Percent	Cumulative Percent
Full	47	46.1	46.1	46.1
Not Full	55	53.9	53.9	100.0
Total	102	100.0	100.0	

Table 01: Distribution of Patients with vertical deviation according to the ocular motility

Table 02: Shows distribution of patient by examination of abnormal head posture,33 patient had face turn(32,4%), 39 patient had head tilt(38,2%),13 patient had chin elevation(12,7%), 1patient had chin depression(1%), 16 patient with no abnormal head posture(15,7%).

	Frequency	Percent	Valid Percent	Cumulative Percent
Face turn	33	32.4	32.4	32.4
Head tilt	39	38.2	38.2	70.6
Chin elevation	13	12.7	12.7	83.3
Chin depression	1	1.0	1.0	84.3
No	16	15.7	15.7	100.0
Total	102	100.0	100.0	

Table 02: Distribution of Patients with vertical deviation according to the abnormal head posture

Table 03: Shows distribution of patient by examination of the binocular single vision,42 patient had a positive or good binocular single vision (41,2%),23 patient had Negative or no binocular single vision(22,5%),37 patients uncooperative with an examination of binocular single vision(36,3%).

	Frequency	Percent	Valid Percent	Cumulative Percent
Positive	42	41.2	41.2	41.2
Negative	23	22.5	22.5	63.7
Uncooperative	37	36.3	36.3	100.0
Total	102	100.0	100.0	

Table 03: Distribution of Patients with vertical deviation according to the Binocular Single Vision

Table 04: Shows distribution of patient according to diagnosis, 50 patient had Esotropia with inferior oblique over action (49%), 22 patient Exo with inferior oblique over action (21.6%), 11 patient had inferior oblique over action (10.8%), 6 patient had superior oblique over action (5.9%), 1 patient.

A case of brown syndrome, 2 patient had inferior rectus under action and secondary superior rectus over action, 1 patient had superior rectus under action (1%), 3 patient had superior oblique under action (2.9%), 1 patient had restrictive thyroid myopathy (1%), 1 patient had myasthenia gravis (1%), 1 patient had duane retraction syndrome (1%), 4 patient had monocular elevation deficit (3.9%).

	Frequency	Percent	Valid Percent	Cumulative Percent
Esotropia with Inferior oblique over Action	50	49.0	49.0	49.0
Exo with Inferior oblique Action	22	21.6	21.6	70.6
Inferior oblique over Action	11	10.8	10.8	81.4
Superior Oblique Over Action	2	2.0	2.0	83.3
Superior rectus over action	2	2.0	2.0	85.3
Superior Rectus Under Action	1	1.0	1.0	86.3
Superior Oblique Under Action	6	5.9	5.9	92.2
Restrictive Thyroid Myopathy	1	1.0	1.0	93.1
Myasthenia Gravis	1	1.0	1.0	94.1
Brown Syndrome	1	1.0	1.0	95.1
Duane Retraction Syndrome	1	1.0	1.0	96.1
Monoocular Elevation Deficit	4	3.9	3.9	100.0
Total	102	100.0	100.0	

Table 04: Distribution of Patients with vertical deviation according to the diagnosis

Table 05: Shows distribution of patient according to the examination of near angle of deviation 17% angle>15, 55% of patients 15-30 also 24% 31-50 also 3% <50.

Angle in Δ	Frequency	Percent	Valid Percent	Cumulative Percent
small>15Δ	20	19.6	19.6	19.6
15-30Δ	55	53.9	53.9	73.5
31-50Δ	23	22.5	22.5	96.1
<50Δ	4	3.9	3.9	100.0
Total	102	100.0	100.0	

Table 06: Distribution of Patients with vertical deviation according to the distances angle of deviation

Table 06: Shows distribution of patient according to the examination of distance angle of deviation 19% angle>15, 54% of patients 15-30 also 22% 31-50 also 4% <50.

Angle in Δ	Frequency	Percent	Valid Percent	Cumulative Percent
small>15Δ	20	19.6	19.6	19.6
15-30Δ	55	53.9	53.9	73.5
31-50Δ	23	22.5	22.5	96.1
<50Δ	4	3.9	3.9	100.0
Total	102	100.0	100.0	

Table 06: Distribution of Patients with vertical deviation according to the distances angle of deviation

Table 07: Shows distribution of patient with dissociated vertical deviation among vertical deviation, 20 patient had V pattern with inferior oblique overaction (19,6%), 8 patient had A pattern with inferior oblique overaction and superior oblique under action (7,9%), 1 patient had X pattern with superior oblique under action, 73 patient had no pattern.

	Frequency	Percent	Valid Percent	Cumulative Percent
V Pattern	20	19.6	19.6	19.6
A Pattern	8	4.9	4.9	24.5
X Pattern	1	3.9	3.9	28.4
No	73	71.6	71.6	100.0
Total	102	100.0	100.0	

Table07: Distribution of Patients with vertical deviation according to the DVD

Discussion

Squint may be horizontal, vertical or mixed type. In a vertical deviation, the visual axis of the non-fixating eye is either above or below the fixating target. A vertical deviation may be manifest or latent, congenital or acquired and comitant or incomitant. A major feature of vertical deviations which add to their complexity is that vertical deviations are concerned with muscles which have multiple functions that vary with different field of gaze. Mostly, the vertical deviation present in the visual prematurity period, therefore if left untreated they can cause irreversible deep amblyopia and permanent postural alteration⁽³⁵⁾.

This study is a cross-sectional descriptive-hospital-based study, the total number of strabismus patients presented to the Makkah Eye hospital squint clinic in a year November-2012 to November-2013 was 15.261 patients. Patients with vertical deviation were 102. The percentage of vertical deviation is 0.15%. This is near to study in Pakistan in 2005, in Alshifa Eye Trust Hospital, Rawalpindi by Muhammed Abbas. It consisted of 924 patients but it was retrospective in 224 patients and 700 were a prospective clinical evaluation for vertical deviation. The age of these patients ranges from 2- 45 years with a mean age of 12 years and a median of 8 years. In this study the age of patients 87.3% was below 16 years of age, 12.7% was above 17 years of age. This shows that most of the patients included in this study were children below 16 years of age. In this study 63 were females (62%), 39 were males. In contrast in Rawalpindi males were more than female, (52.8%) were males and (47.1%) were females. Another retrospective cohort study in the Islamic Republic of Iran in Yazad city the Female had a higher rate of congenital vertical strabismus than males like our study. Also, more than half had a positive family history (55%) in this study, in contrast to only 13% had a positive family history in the Rawalpindi study.

In our study 75% of patients, the onset was early and in 25% the onset of strabismus was late. It is near to the Rawalpindi study, the Onset of strabismus in infancy i.e before age of 1 year was

seen in 47% of patients, and (53.7%) the onset below 7 years, and only (1.88%) 2 patients' onset in their adulthood. In contrast to the Yazad study in which there was no association between age of onset, surgical outcome, and sex. ⁽³⁷⁾

In Rawalpindi study the best-corrected visual acuity in right eye was 6/6-6/12 in (59.60%), 6/18-6/60 in (27.40%), less than 6/60-3/60 in (8.50%), less than 3/60 +ve light perception in (7.50%). In left eye it was 6/6, 21.70%, 4.70%, 6.60% respectively. It was near to this study in which the best-corrected visual acuity in the right eye (67.6%) was 6/6, 21.6% of a patient between (6/9-6/18), 5 patients worse than 6/18, 6 patient uncooperative.

Cycloplegic refraction in the Rawalpindi study was 13.21% emmetropia, 79.86% were other refractive errors. In contrast, this study was 46.1% emmetropic, 54% were other refractive errors. In the Rawalpindi study 13.21% had ptosis, 2.83% had nystagmus, while 1% had proptosis. Near to this study In which anterior segment finding was -ve in 92% of patients, where +ve findings in 8% of patients, including corneal opacity, proptosis due to thyroid ophthalmopathy, ptosis, posterior capsular opacity after cataract extraction also eso-exo deviation and nystagmus. Posterior segment findings in this study were 95% -ve findings, while 4.9% +ve (5 patients) include 2 optic atrophy, 2 maculopathy, and 1 had glaucoma. Most of the patients had no problem rather than a vertical deviation. In the Rawalpindi study 20 patients (62.50%) had V pattern, 12 (37.50%) had A pattern, this ratio is more than in our study. ⁽³⁵⁾ Where in our study dissociated vertical deviation 19.6% had V pattern with inferior oblique overaction, 8 patients had A pattern with inferior oblique overaction, 1 had X pattern with superior oblique palsy.

In another study in Okayama University in Japan in 2002 to evaluate the contribution of vergence adaptation to the difference in a vertical deviation between distance and near viewing inpatient with unilateral superior oblique palsy, using prism

adaptation test it is near to our study. 84 patients were classified into 3 groups A-B-C based on differences between distance and near viewing and response were classified into 3 groups. The first vertical adaptive after effect is increasing in deviation by 5 prisms or more with prism adaptation test. It showed 16% at distance 27% at near viewing among 3 groups adaptive vergence contribute more to group (B), in which distant deviation exceed near deviation, patient with group (B) change to group (A) category, of these 7 increase near deviation, so that deviation differences between distance and near decrease. The vertical prism adaptation test is useful to determine the extent of surgery by breaking fusional vergence in patients with hypertropia in whom deviation differs concerning viewing distance⁽³⁶⁾.

In this study, we use the magnitude of the angle of deviation for examination to evaluate differences between near and distance, which showed different results than Okyama study. We found in examination of near angle of deviation as follow (13.7%) was hyper deviation, (11.8%) hypo deviation, (46.1%) eso deviation with hyper deviation, (3.9%) eso with hypo deviation, (3.9%) exo deviation with hypo deviation, (20.6%) hyper with exo deviation. In the distant angle of deviation the differences occur in patient hyper deviation with eso they decrease 44 patients (43.1%), and patients hyper deviation with exo they increase to become 25 patients (24.5%). This shows importance of evaluation of deviation in near and distance especially inpatient within comitant hypertropia whom undergo surgery for exact correction.

In another retrospective cross-sectional study of 300 consecutive patients with vertical diplopia by MATAM hanker to evaluate clinical features of various aetiologies of adult hypertropia and discuss the diagnostic approach of evaluation of vertical diplopia. It showed ocular motility deficits in 33% of patients whose thyroid eye diseases comprise the largest group, which were less than this study. The majority of patients diagnosed as

fourth nerve palsy, thyroid orbitopathy, ocular surgery, orbital fracture, childhood strabismus, third nerve palsy, and myasthenia gravis respectively⁽³²⁾. In this study 47 patients (46.1%) had full ocular motility, while 55 patients (53.9%) not full. In Yazad city study was similar to our study, 265 strabismus patients (19.2%) had pure vertical strabismus, (80.8%) had combined horizontal and vertical strabismus. Hypertropia account for (91.7%) more common than hypotropia (8.3%).

In this study the majority of patients were hypertrophic due to inferior oblique overaction isolated or associated with horizontal deviations as follows; 50 patients (49%) were esodeviation with inferior oblique overaction, 22 patients (21.6%) exodeviation with inferior oblique overaction, 11 patient pure inferior oblique overaction, 6 patients with superior oblique overaction one of them Brown syndrome, 2 patient inferior rectus under action one of the congenital fibrosis of extraocular muscles, 1 patient had superior rectus under action, 1 patient with restrictive thyroid orbitopathy, 3 with superior oblique palsy, 1 with myasthenia gravis and 4 patients with mono ocular elevation deficit, this is in contrast to the previous study. ⁽³²⁾

In this study 20 patient had history of strabismus surgery most of them bi medial recession for correction of congenital- accommodative esotropia similar to Wilson and Parks study, they performed statistical analysis of onset and natural history of primary inferior oblique overaction in 456 strabismus patients with 5 years or more of follow up, 72% with congenital esotropia, 34% patients with accommodative esotropia, 32% of patients with inter-mitten exotropia developed inferior oblique overaction at average age of 3.6 and 5.2 years, respectively. There was a positive correlation to a number of horizontal surgeries in congenital esotropia but not in other groups. The incidence of overactive inferior oblique muscles was not related to the age at onset of strabismus, time from onset of strabismus to surgery, age at

first surgery or decompensation of ocular alignment⁽⁷⁾.

In contrast to this study another study in Olmsted country in Minnesota, it was a retrospective population-based cohort, diagnosed with vertical strabismus from January 1985 through December 1994; to assess incidence and type of childhood, hypertropia. 42 cases were identified. Nearly three fourth (71.4%) had fourth cranial nerve palsy, primary inferior oblique overaction, Brown syndrome, or vertical tropia in setting of the abnormal central nervous system⁽³¹⁾.

In this study plan of management most of the patients wearing glass (79%) for correction of refractive errors or improve deviation (accommodative esotropia with inferior oblique overaction, 47% on observation, 28% on occlusion, 73% for surgery to correct deviation, 5 patients on the prism to correct deviation and diplopia. patients can be on more than one plan of management i, e on glass+occlusion+surgery.

Early diagnosis and management in effected families and screening of patients with strabismus family history is needed.

Conclusion

From this study, we conclude that:

- Vertical deviation represents 0.15% of all strabismus patients in squint clinic at MAKKAH Eye Complex.
- Eighty-seven percent of vertical strabismus patients are children below the age of 16 years and the onset of strabismus in most of the patients was early.
- Seventy percent of patients are combined horizontal with vertical deviation; pure vertical deviation was 30% only.
- Positive family history was 55%.
- The commonest cause of vertical deviation in this study is inferior oblique overaction with esotropia (congenital-accommodative).
- Head tilt and face turn represent the most common forms of abnormal head posture.

- Dissociated vertical deviation present in 29 patients of all vertical strabismus patients, V pattern with inferior oblique overaction on 2/3 of patients the remaining were A & X pattern respectively.
- Glasses and surgery represent the suitable plan of management in the majority of 102 patients of vertical deviation.

Recommendation

- A regular check-up at schools is important to detect and treat early cases to prevent deep amblyopia and poor vision.
- we recommend more special squint clinics in other ophthalmic hospitals and centres and provided it with good equipment and tools needed at squint clinics.
- Further retrospective studies should be done, which enable researchers to get a large sample of many years to determine various etiological factors of vertical deviation and encouraging more specific studies like the incidence of hyper tropia-hypo tropia in other ophthalmic centers, the incidence of restrictive thyroid myopathy and other causes of incomitant vertical deviations.

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