

Visual Acuities

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Appendix chapter 13

13.1 Introduction

In this study, it was possible to carry out accurate assessment of vision in 87% of cases, which enabled categorisation into groups of visual acuities. In 125 cases (13%), several factors precluded precise notation. These factors included young age and lack of co-operation. The latter cases were placed in the WHO categories '6' and '7'. In 14 cases (2%) visual acuities were not available. (Table 13.1)

The results of visual acuities have been analysed initially on the basis of the acuity alone

as the findings of visual fields, were included and accordingly, patients were moved to other categories. (Table 13.3) These cases were mainly in category '1'.

Table 13.4 combines category '6' with category '2' (VI) and category '7' with category '3' SVI. after analysis of the data and taking into account the clinical condition and the visual acuities in other siblings with the same condition.

These are based on the former WHO categories of visual acuity.⁽¹⁾

Table 13.1 Categories of visual acuities in the total series

VA by WHO Notations	West Bank		Gaza Strip		Total Series	
	No.	%	No	%	No.	%
Category '1' (6/18 and better) (NVI)	16	5	26	9	44	7
Category '2' (6/18 to 6/60) - (Visual Impairment, VI)	90	26	82	28	175	26
Category '3' (<6/60 to 3/60) - (SVI)	31	9	26	9	57	9
Category '4' (<3/60 to LP) - (BL)	108	31	73	25	193	29
Category '5' (NLP)	56	16	43	15	106	16
Category '6' (able to see)	18	5	22	8	48	7
Category '7' (unable to see)	19	6	15	5	39	6
Unable to test	6	2	2	1	9	1

(Table 13.2); then other visual morbidities, such

13.2 WHO categories of visual acuities by numbers of patients and region

Category	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6 ^a	Category 7 ^b	UD	Region's Totals
VA Range	6/18 +	< 6/18 - 6/60	< 6/60 - 3/60	< 3/60 - LP	NLP	Mild VI	Marked VI		
Children <16									
West Bank	8 4	57 27	24 11.2	60 28.0	29 13.6	16 7.5	16 7.5	4 1.9	214 100
Gaza Strip	17 10	58 35	14 8.5	37 22.6	16 9.8	11 6.7	10 6.1	1 0.6	164 100
All OPT	25 6	118 29	38 9.4	103 25.4	49 12.1	35 8.6	31 7.7	6 1.5	405 100
WG/G Ratio	0.5:1	1.0:1	1.7:1	1.6:1	1.8:1	1.5:1	1.6:1	4.0:1	1.3:1
<16 Percentage	66	73	59	50	47	73	79	67	61
Adults 16+									
West Bank	5 4	22 17	11 8.3	61 47.0	27 20.3	2 1.5	3 2.3	2 1.5	133 100
Gaza Strip	6 5	21 17	15 12.0	39 31.2	27 21.6	11 8.8	5 4.0	1 0.8	125 100
All OPT	13 5	43 16	26 9.8	103 39.0	55 20.8	13 4.9	8 3.0	3 1.1	264 100
WG/G Ratio	0.8:1	1.0:1	0.7:1	1.6:1	1.0:1	0.2:1	0.6:1	2.0:1	1.1:1
Total West Bank	13 4	79 23	35 10.1	121 34.9	56 16.1	18 5.2	19 5.5	6 1.7	347 100
Total Gaza Strip	23 8	79 27	29 10.0	76 26.3	43 14.9	22 7.6	15 5.2	2 0.7	289 100
Total all OPT	38 6	161 24	64 9.6	206 30.8	104 15.5	48 7.2	39 5.8	9 1.3	669 100
WG/G Ratio	0.6:1	1.0:1	1.2:1	1.6:1	1.3:1	0.8:1	1.3:1	3.0:1	1.2:1

Percentages in bold *Italic* and represent the percentage of the category within each region.

^a Category 6: believed can see but visually impaired.

^b Category 7: believed to have significant visual disability.

UD: Undetermined

Table 13.3 Number of cases by WHO category of VA by region after adjustment by incorporating visual field loss

Category of VA	1' (NVI)		'2' & '6' (VI)		'3' SVI		4'+5' BL		3'+4'+5'+7' SVI/BL		UD	Total		
VA Range	6/18 +		<6/18 - 6/60		<6/60 - 3/60		<3/60 - NLP		<6/60 - NLP					
Children < 16														
West Bank	8	<i>3.7</i>	73	<i>34.1</i>	24	<i>11.2</i>	89	<i>41.6</i>	129	<i>60.3</i>	4	<i>1.9</i>	214	<i>100</i>
Gaza Strip	17	<i>10.4</i>	69	<i>42.1</i>	14	<i>8.5</i>	53	<i>32.3</i>	77	<i>47.0</i>	1	<i>0.6</i>	164	<i>100</i>
All OPT	25	<i>6.2</i>	153	<i>37.8</i>	38	<i>9.4</i>	152	<i>37.5</i>	221	<i>54.6</i>	6	<i>1.5</i>	405	<i>100</i>
WB/GS Ratio	0.5:1		1.1:1		1.7:1		1.7:1		1.7:1		4.0:1		1.3:1	
Percentage of < 16	<i>66%</i>		<i>73</i>		<i>59</i>		<i>49</i>		<i>54</i>		<i>67</i>		<i>61</i>	
Adults 16+														
West Bank	5	<i>3.8</i>	24	<i>18.0</i>	11	<i>8.3</i>	88	<i>66.2</i>	102	<i>76.7</i>	2	<i>1.5</i>	133	<i>100</i>
Gaza Strip	6	<i>4.8</i>	32	<i>25.6</i>	15	<i>12.0</i>	66	<i>52.8</i>	86	<i>68.8</i>	1	<i>0.8</i>	125	<i>100</i>
All OPT	13	<i>4.9</i>	56	<i>21.2</i>	26	<i>9.8</i>	158	<i>59.8</i>	192	<i>72.7</i>	3	<i>1.1</i>	264	<i>100</i>
WB:GS Ratio	0.8:1		0.8:1		0.7:1		1.3:1		1.2:1		2.0:1		1.1:1	
West Bank Total	13	<i>3.7</i>	97	<i>28.0</i>	35	<i>10.1</i>	177	<i>51.0</i>	231	<i>66.6</i>	6	<i>1.7</i>	347	<i>100</i>
Gaza Strip Total	23	<i>8.0</i>	101	<i>34.9</i>	29	<i>10.0</i>	119	<i>41.2</i>	163	<i>56.4</i>	2	<i>0.7</i>	289	<i>100</i>
All OPT	38	<i>5.7</i>	209	<i>31.2</i>	64	<i>9.6</i>	310	<i>46.3</i>	413	<i>61.7</i>	9	<i>1.3</i>	669	<i>100</i>
WB/GS Ratio	0.6:1		1.0:1		1.2:1		1.5:1		1.4:1		3.0:1		1.2:1	

Percentages in ***bold italic*** and represent the percentage of the category by region.

Category '6': Visually impaired but can see

Category '7': believed to be BL or SVI. UD Undetermined.

Table 13.4 WHO categories of visual acuities by numbers of patients and region combined as previous table

Category of VA → VA Range →	NVI 1'		VI '2' & '6'		SVI '3'		Blind 4'+5'		SVI/BL 3'+4'+5'+7'		UD		Region's Total	
	6/18 +		<6/18 - 6/60		<6/60 - 3/60		<3/60 - NLP		<6/60 - NLP					
<16														
West Bank	8	<i>3.7</i>	73	<i>34.1</i>	24	<i>11.2</i>	89	<i>41.6</i>	129	<i>60.3</i>	4	<i>1.9</i>	214	<i>100</i>
Gaza Strip	17	<i>10.4</i>	69	<i>42.1</i>	14	<i>8.5</i>	53	<i>32.3</i>	77	<i>47.0</i>	1	<i>0.6</i>	164	<i>100</i>
All OPT	25	<i>6.2</i>	153	<i>37.8</i>	38	<i>9.4</i>	152	<i>37.5</i>	221	<i>54.6</i>	6	<i>1.5</i>	405	<i>100</i>
WB/GS 16+	0.5:1		1.1:1		1.7:1		1.7:1		1.7:1		4.0:1		1.3:1	
West Bank	5	<i>3.8</i>	24	<i>18.0</i>	11	<i>8.3</i>	88	<i>66.2</i>	102	<i>76.7</i>	2	<i>1.5</i>	133	<i>100</i>
Gaza Strip	6	<i>4.8</i>	32	<i>25.6</i>	15	<i>12.0</i>	66	<i>52.8</i>	86	<i>68.8</i>	1	<i>0.8</i>	125	<i>100</i>
All OPT	13	<i>4.9</i>	56	<i>21.2</i>	26	<i>9.8</i>	158	<i>59.8</i>	192	<i>72.7</i>	3	<i>1.1</i>	264	<i>100</i>
WB:GS Ratio	0.8:1		0.8:1		0.7:1		1.3:1		1.2:1		2.0:1		1.1:1	
Percentage of <16	<i>66</i>		<i>73</i>		<i>59</i>		<i>49</i>		<i>54</i>		<i>67</i>		<i>61</i>	
West Bank Total	13	<i>3.7</i>	97	<i>28.0</i>	35	<i>10.1</i>	177	<i>51.0</i>	231	<i>66.6</i>	6	<i>1.7</i>	347	<i>100</i>
Gaza Strip Total	23	<i>8.0</i>	101	<i>34.9</i>	29	<i>10.0</i>	119	<i>41.2</i>	163	<i>56.4</i>	2	<i>0.7</i>	289	<i>100</i>
All OPT	38	<i>5.7</i>	209	<i>31.2</i>	64	<i>9.6</i>	310	<i>46.3</i>	413	<i>61.7</i>	9	<i>1.3</i>	669	<i>100</i>
WB/GS Ratio	0.6:1		1.0:1		1.2:1		1.5:1		1.4:1		3.0:1		1.2:1	

Percentages in Italic bold and represent the percentage of the category within each region. Category '6': believed can see but visually impaired. Category '7': believed to have significant visual disability. UD Undetermined

13.2 WHO Categories of Visual Acuities

Category ‘1’ (6/18 and better, NVI)

The smallest of the visual acuity categories in this study is category ‘1’ (6/18 and better) with a total of 44 patients (29 of whom were <16 years of age and 15 of whom were >16). (Table 13.5) In the under 16 group, there was a preponderance of these cases in GS (n=19) versus the WB (n=10). The patients in this category formed 6% of the total series and 7% of the total number of children. Analysis of the visual acuities in this category is as follows:

Table 13.5 Range of Snellen’s visual acuities in WHO category ‘1’ (NVI) ^a

VA	<16	16+	Total	%
6/18	17	7	24	54.5
6/12	6	2	8	18.1
6/9	3	2	5	11.4
6/6	3	2	5	11.4
6/5	0	1	1	2.3
Category ‘6’	0	1	1	2.3
Total	29	15	44	100
Remainder ^b			38	6

^a before adding other parameters such as field defect. ^b Moved to other categories – 4 children, 2 adults)

Cases with 6/18 Vision: 23 patients (<16 years)

Over 50% of patients in this category border the visual impairment category ‘2’. Two patients can more appropriately be considered partially sighted belonging to Category ‘3’ as a result of the visual disability and field impairment caused by the ectopia lentis. An additional 3 patients, have contracted visual fields due to retinal dystrophy, and the last from optic atrophy (Table 13.6) and can also be considered blind (category ‘4’). This leaves 18 patients who truly fit the criteria of NVI.

Table 13.6 Clinical findings in category ‘1’ with visual acuities pre ^a and post ^b adjustment

Clinical Findings	VA ^a	VA ^b
Optic atrophy, extra digit	1	4
Bilateral sectorial RP, vitreous bands tubular vision	1	4
Retinal dystrophy, nyctalopia tunnel vision, sub-mentation	1	4
Ectopia lentis, high myopia	1	3

Visual acuities category recorded at the examination without inclosing visual field contraction

Patients with 6/12 vision and better

Only one patient fell into this category with 6/9 vision and had generalised contraction of the visual field as a result of retinal dystrophy which placed him within the SVI category

Patients with other visual acuities

The remainder of category ‘1’, consisted of 8 patients with 6/12 vision, 3 of them with conditions indicating some visual field contraction, including 1 with early childhood onset RP, 1 with right dense cataract and left aphakia, and 1 with bilateral aphakia. There was only one patient with 6/9 vision who had contracted visual fields to 20-25° and 1 patient with 6/6 vision had right phthisis and left buphthalmos with contracted visual fields.

In summary, NVA category ‘1’ forms, after adjustment, 6% of the total (4% in the WB and 8% in the GS). Sixty-six patients in this category are under 16 years of age.

Category ‘2’ (<6/18 to 6/60, VI)

This is a large category which, before transferring patients from category ‘6’ (i.e. those believed to see) to this category (Table 13.7), had a total number of 154, thus forming 25% of the total (23% WB, 28% GS). Twenty nine percent

of <16 fell into this category (WB 27%, GS 35%). The proportion of children in this category was 73%. The breakdown of visual acuities in this category is shown in Table 13-6.

After inclusion of patients from category ‘6’, (Table 13.3, 13.4) an additional 43 patients were added. This has made it 209 patients representing 31.2% of the patients in the series (WB 28%, GS 44%). It formed 37.8% of childhood visual acuities (WB 34.1%, GS 42.1%).

Table 13.7 Snellen’s visual acuities in WHO category ‘2’

VA	No. of Patients	%
6/60	62	47
6/36	44	33
6/24	27	20
Total	133	100

Category ‘3’ (<6/60 to 3/60, SVI)

This category, based on visual acuities alone, had 50 patients. However after adjusting category ‘1’ on the basis of visual morbidity, 14 patients fell within the criteria of svi (partially sighted). The revised category ‘3’ encompasses a total of 64 patients. It forms 9.6% of the total series (WB 10%, GS 10%) and 9.4% of childhood cases (WB 11.2%, GS 8.5%). The percentage of < 16 was 59% of the total (Tables 13.3 and 13.4). Nearly a third of visual acuities in this category borders with blindness. Three quarters of patients had the recognised acuities of this category, and about a quarter had better acuities but with additional visual morbidity such as contracted field.

Category ‘4’ (<3/60 to PL, BL)

This category comprises 206 patients (31% of the series), with 35% in the WB and 26% in the GS). It includes 25% of those under the age of 16 in whom this category formed 39% of the total

categories (WB 47% and GS 31.2% (Tables 13.3, 13.4).

Figure 13.1 Breakdown of visual acuities Category ‘3’ (SVI)

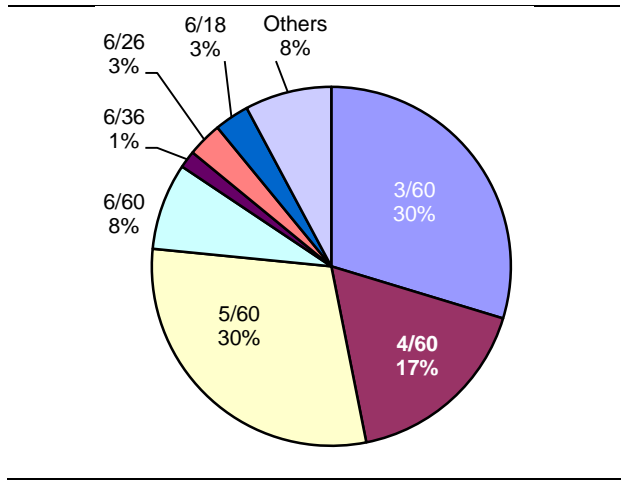
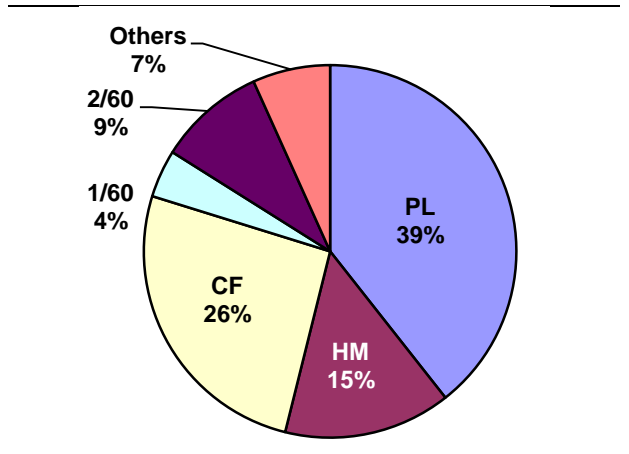


Figure 13.2 Visual acuities Category ‘4’ (SVI)



Patients with Light Perception

This is not a WHO visual acuity category but it has its own characteristics. The number of patients with PL only was 76 patients forming 11% of the total series, a significant proportion of the total. There is a preponderance of females in this group (M/F ratio 1:0.75, males n=33, females n=43) created by the abundance of

females over the age 16 in this category (females 21, males 9, ratio 1:0.45). In the under 16, the numbers of males and females are about equal with a M/F ratio of 1:1.1. Patients <16 formed 60% of the total.

Category '5' (NLP)

This is a sizeable category with 104 patients forming 15.5% of the total series and 12.1% of the total children (WB 13.6% and GS 9.8%). Children formed a high proportion at 47% of the patients in this category (Tables 13.3, 13.4).

Category '6' (cannot be tested, believed sighted)

In category '6', there were 5 adults and 46 children. Analysis of this subgroup shows that among the 5 adults, 1 could possibly fall into the VI (category '2', if not the SVI category '3' (svi), by virtue of having congenital cataract, left aphakia and right buphthalmos. Among the 46 children, it was possible to speculate the possible visual acuity in 19 of them. It can be conjectured that 15 at least of the 19 may belong to the vi category '2', and 4 to the svi category '3'. Forty-three of the children in this category were below the age 9 years, and 30 were below the age of 4 years.

Category '7' (cannot be tested, believed blind)

There were 36 patients in this category. Thirty-two were below the age of 16 (88%) and 4 were adults. Of these 28 were below the age of 8 years.

It therefore appears from further analysis of this category, which took into account factors such as age, onset of the condition, clinical pattern and comparison with similar cases in the series, that it was possible to assume the probable acuity in these eyes. Therefore, among the 36 cases in this category, it can be assumed that 7 will fall into the SVI category '3', 28 into the Blind category '4' and 1 into NLP category '5'. The estimated visual acuities in categories 6 and 7 are listed in Table 13.2.

'Blindness' (categories '4' and '5')

The total number of blind patients were 310 forming 46.3% of the total series. Numbers of adults and children are nearly equal (49% children). Regional distribution of patients showed 177 patients from the WB (51%) and 119 from GS (41.2%). In the <16, 3 7.5% were blind (WB 41.6%. GS 32.3%). In the 16+, blindness formed 59.8% of patients in the cohort (WB 66.2, GS 52.6%).

Combined SVI/BL

This heading incorporates visual categories '3', '4', '5, and those 'believed to be unable to see' in category '7'. This group in other words encompasses all the patients who are blind and partially sighted. Their number was 413; that is 61.7% of the series. The proportion of children in this group was 54% making 221 cases in the total series. In the WB, this group formed 60.3% and in GS 47% of the <16 age cohort. In the 16+ cohort, the percentage of partially sighted/blind was, as expected, higher at 72.7% (WB 76.7% and GS 68.8%).

Revised WHO Blind Category

The WHO revised the categories of visual impairment which divides Blindness into three categories.⁽¹⁾ According to this new classification, the number of patients in the additional categories is shown in Table 13.8.

Table 13.8 Distribution of cases according Revised WHO categories.

Category	No.	%
'3' < 3/60 – 1/60	26	8.7%
'4' <1/60 - PL	167	56.2%
'5' NPL	104	35%

13.3 Visual Acuities in <16 Cohort

The afore mentioned visual impairment in children is summarised in (Tables 13.3, 13.4) which shows children’s visual categories and highlights the percentage of BL and SVI/BL in children. The total figures for combined SVI/BL are 56% in the WB, 46.7% in the GS and 52.4% in the whole OPT combined.

In the under 10 age group, blindness occurred in 94 children in this age cohort (n=251) making 37.5% of the total (WB 39.7% of 126 cases, GS 36.8% of 106 cases).

13.4 Pathologies in Visual Acuities Categories in <16

Pathologies NVI Category ‘1’, NVI (<16)

The three major sites of pathology that formed the bulk of this category were the retina 43% (n=19), the lens, 23% (n=10) and the whole globe, 20% (n=9). Nineteen patients had retinal pathology as the primary disorder followed by the lens with 10 cases and the whole globe with 9 cases. The remaining 6 patients were distributed amongst the other anatomical sites. (Figure 13.3)

Amongst the retinal conditions, 7 were retinal dystrophies (rod-cone 3, rod monochromatism 2, others 2), 6 myopia, 4 albinism, and 1 acquired.

Pathologies in VI Category ‘2’ (<6/18 to 6/60) in (<16)

Conditions dominating this category were; retina (93 patients, 78% of whom were retinal dystrophies), lens (n=50, 80% with CC) and the whole globe (n=8) (Figure 13.7), the same as category ‘1’.

Among the retinal pathologies in this category, there were 27 cases with cone-rod dystrophy, 24 with rod-monochromatism, 16 with albinism, and 16 with macular degeneration. Myopia and rod cone dystrophies accounted for 4 cases each. The lens had the largest number of cases (n=50) which included 40 with congenital cataract and 10 with other lenticular problems. (Figure 13.3)

Figure 13.3 Retinal pathologies in category ‘2’ visual acuities (VI)

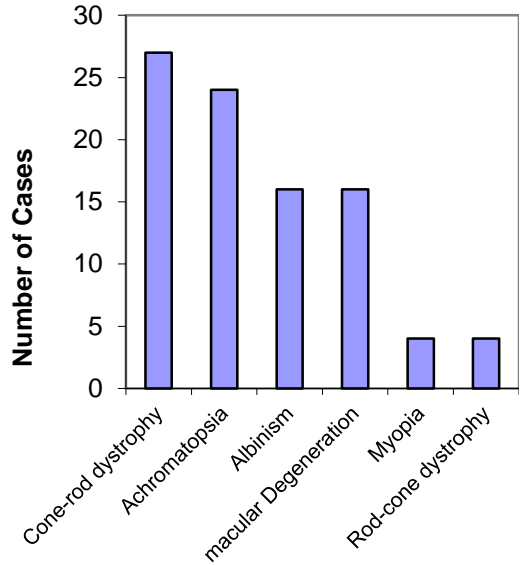
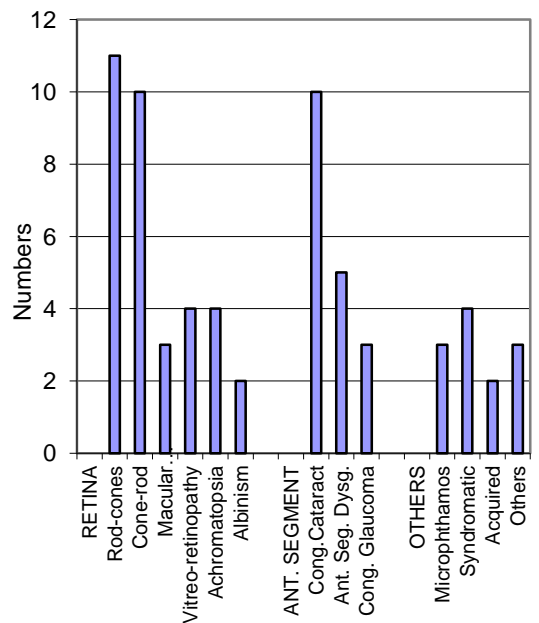


Figure 13.4 Pathologies in the SVI category ‘3’ of visual acuities



(Partially Sighted) (<16)

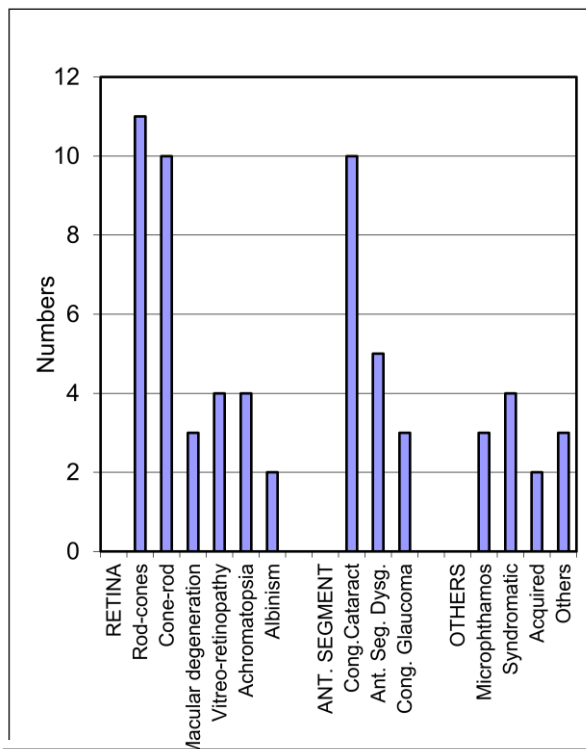
Retinal conditions followed by lens and whole globe conditions were the predominant sites of pathologies in this category with 56% (n=36), 19% (n=12) and 17% (n=11) respectively. Figure 13.8 demonstrates the various retinal pathologies in this category. (Figure 13.4)

Pathologies in Category '3' (<6/60 to 3/60) -

Category '3' (<6/60 to 3/60) - (Partially Sighted)

Retinal conditions followed by lens and whole globe conditions were the predominant sites of pathologies in this category with 56% (n=36), 19% (n=12) and 17% (n=11) respectively. Figure 13.8 demonstrates the various retinal pathologies in this category. (Figure 13.5)

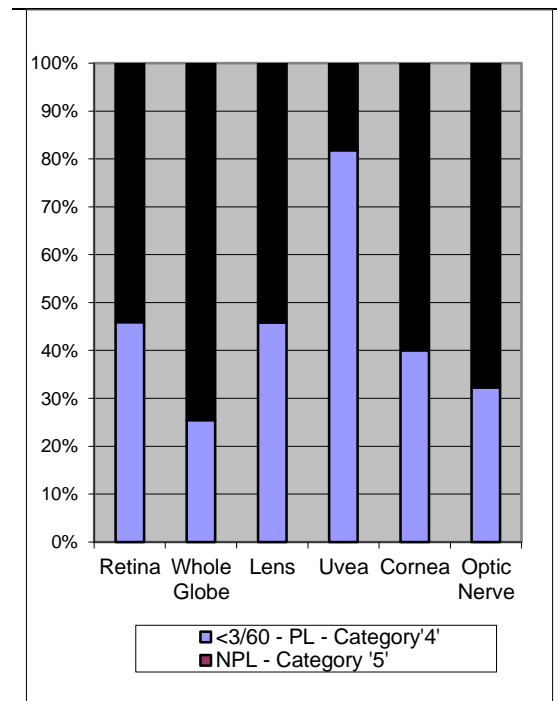
Figure 13.5 Pathologies in the SVI category '3' of visual acuities



Pathologies in BL Category '4' (<3/60 to LP) (<16)

Of the anatomical sites affected in this group, the retina scored the highest at 62%, followed by the whole globe with congenital glaucoma forming two thirds of that group (Figure 13.6). The lens is in third position at 11% followed by the uvea at 9%. The majority with corneal and optic nerve pathologies had visual acuities in this category with 5% each. Retinal dystrophies formed the vast majority of the retinal cases (n=114, 89%) and over half of the total category.

Figure 13.6 Pathologies in categories '4' and '5' of visual acuities (Blind) by anatomical sites



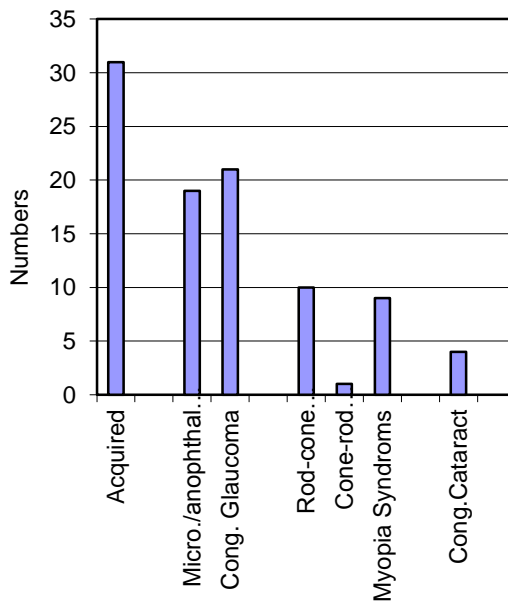
Pathology in the ‘Blind’ Category (categories ‘4’ and ‘5’)

The pathologies in this group have been addressed separately under groups ‘4’ and ‘5’. demonstrates the proportion of each of these categories in each of the anatomical sites of pathology in the blind series. (Figure 13.6)

Pathologies in the BL Category ‘5’ (NLP) in (<16)

The largest clinical entity in this category is acquired conditions (n=31). Two thirds of the acquired conditions were in the 16 plus age group. Among the whole globe cases, microphthalmia / anophthalmia was the largest category followed by congenital glaucoma, phthisis bulbae and disorganised eyes. Among the retinal dystrophies rod-cone was the predominant condition. (Figure 13.7)

Figure 13.7 Common clinical conditions in patients with NLP



Pathology in the SVI/Blind Combined Category (Categories ‘4’ and ‘5’)

Figure 13.8 depicts the proportion of the two Blind visual categories in the common clinical conditions. Of those with acquired conditions in this combined group, 15 had corneal conditions. These form 68% out of the total cornea in the series (n=22).

Pathology in Category ‘6’ (cannot be tested, believed sighted)

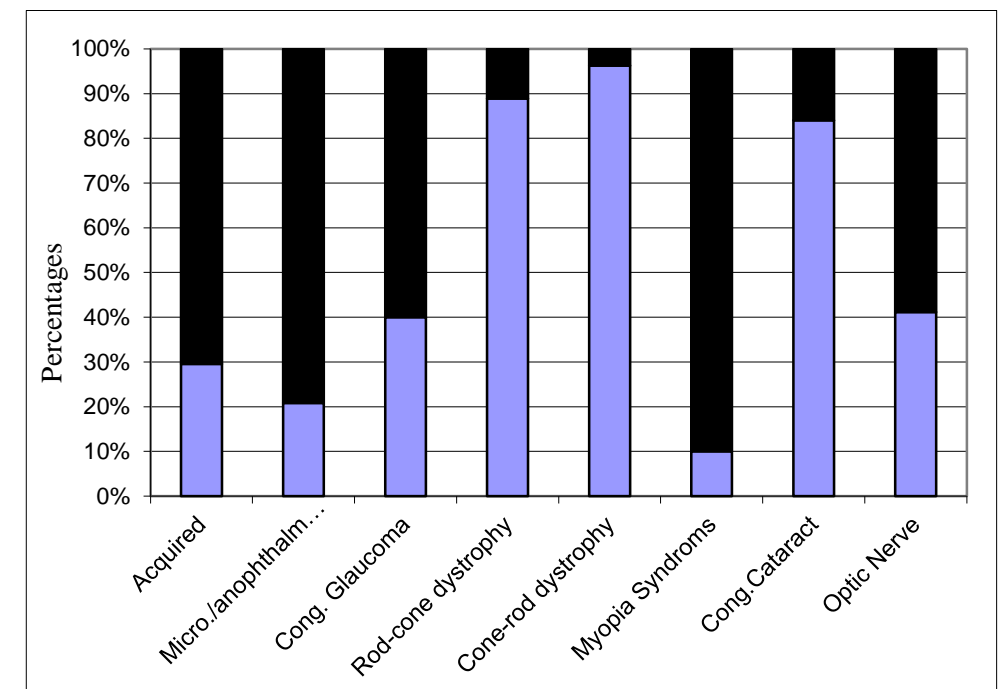
These 19 cases exhibited a spectrum of clinical conditions as follows: 2 patients with buphthalmos (1 of whom had bilateral corneal scarring), 2 with albinism with hypoplastic maculae, 2 with rod-cone dystrophy, 3 with cataract (1 of whom also has unilateral microcornea), 10 with CC who are aphakic (2 of whom had thickened posterior capsules and 1 with optical iridectomy). Forty-three of the children in this category were below the age of 9 years, and 30 were below the age of 4 years.

Pathology in Category ‘7’ (cannot be tested, believed blind)

The predominant conditions causing the visual disability in this category were congenital glaucoma (n=16), retinal dystrophies (n= 8) particularly rod-cones, lens conditions (n= 4), optic nerve disorder (n= 2) and other retinal conditions (n= 5), in addition to 1 with uveal coloboma.

Among the 36 patients, it can be postulated that 19 had svi (2 LCA, and 2 with PCG with buphthalmic eyes. Another 15 could fall into the VI category ‘2’ (2 with albinism with hypoplastic maculae, 3 with congenital cataract (2 of whom had microphthalmos (MC) and 1 with microcornea). The remaining 2 patients were aphakic following congenital cataract surgery, one of whom had a thickened posterior capsule and the other optical iridectomy.

Figure 13.8 Clinical conditions in the SVI (blue) BL (black) categories of visual acuities.



References

1. Johnson GJ, Foster A. Prevalence, incidence and distribution of visual impairment. In: Johnson GJ, Minassian DC, Weale RA and West SK (eds.), *The Epidemiology of Eye Disease*, second edition, Arnold 2003, pp 3-28.

Chapter 13 Appendix

Figure A13.1 Distribution of visual acuity by region and age (Comparison between the West Bank Gaza Strip). Erratum: (The first VI in white should read NVI (no visual impairment))

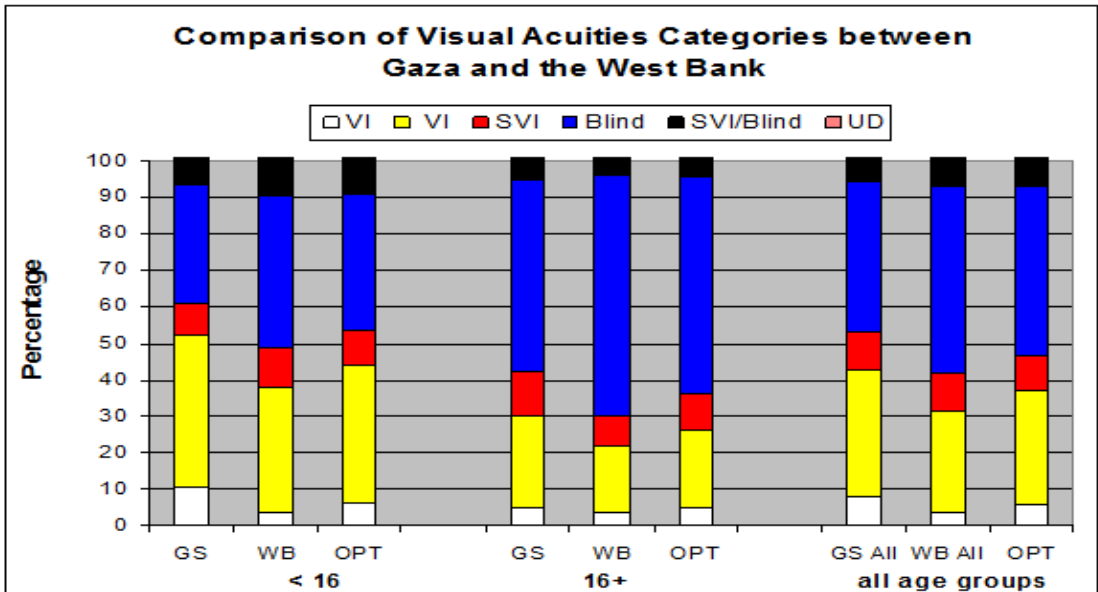


Figure A13.2 Distribution categories of visual acuities by anatomical sites

