

Evaluation of Axial Length –Anterior Chamber Depth (AXL-ACD) Factor As A New Biometric Tool for Diagnosis And Prognosis of Primary Angle Closure Glaucoma.

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Abstract

Aim: Evaluation of axial length –central anterior chamber depth (AXL-ACD) factor as an objective assessment tool for diagnosis and prognosis of primary angle closure glaucoma (PACG)

Patients and methods: 116 eyes of 58 newly diagnosed cases with primary angle closure configurations (PACC) were evaluated. Refraction, gonioscopy, intraocular pressure recording, axial length and central anterior chamber depth was recorded. AXL-ACD factor was calculated. Comparison with controls and correlation with presence of peripheral anterior synechiae (PAS) was carried out.

Results : Mean AXL-ACD factor was 58.54 in PACC group and 67.65 in control group which was statistically highly significant. PAS were present in 85.7% of cases of PACC group with AXL-ACD factor less than 45 and 73.68% with AXL-ACD factor less than 50.

Conclusion: AXL-ACD factor is a simple, accurate, objective assessment tool for diagnosis of PACG and prediction of presence of PAS without gonioscopy and can be used for mass screening for PACG.

Keywords: Axial length (AXL), anterior chamber depth (ACD), factor, Peripheral anterior synechiae.

I. Introduction

Glaucoma is one of the leading causes of blindness world wide (1,2). Primary glaucoma affects 67 million people world wide (3). Asians account for almost half of this number (3,4,5). Primary angle closure glaucoma (PACG) is a major cause of visual morbidity in East Asia (6,7,8). Various studies in India have also found that the prevalence of PACG is higher than European people (3,9,10,11) with rates approaching those in Mongolia (9). PACG is at least as common as primary open-angle glaucoma (POAG) and is a major form of glaucoma world wide (3). Technological advances in objective assessment of glaucoma have been limited mainly to primary open angle glaucoma. Newer techniques are available which can accurately detect structural damage to the nerve fibre layer and the optic nerve and functional damage to the visual fields objectively in primary open angle glaucoma. In contrast the diagnosis of PACG is still largely based on clinical skills which are liable for subjective variations. Gonioscopy remains the mainstay of establishing the diagnosis of PACG. But gonioscopic findings are known to vary based on background illumination, time of day, indentation caused by gonio lens and the clinical skills of the examiner. In addition paucity of time in busy OPDs especially in community clinics leads to this test not being carried out routinely. The diagnosis of PACG in a number of cases may thus be missed.

Hence there is an immediate need of an objective assessment tool for diagnosis of PACG which is simple, accurate, devoid of subjective variations and which could easily be carried out by Optometrists and Ophthalmic assistants.

Axial length – central anterior chamber depth (AXL-ACD) factor has been conceptualized as an objective assessment tool and evaluated in this study for diagnosis and prognosis of PACG.

II. Patients And Methods

116 eyes of 58 newly diagnosed cases of Primary angle closure configuration (PACC) were included in the study. This included all cases with narrow angle configuration, with or without peripheral anterior synechiae (PAS), with or without raised intra ocular pressure, with or without optic nerve damage. Careful history of recurrent headache or past attack suggestive of acute angle closure was recorded. Complete ocular evaluation was done including refraction, presence of shallow anterior chamber, gonioscopy, intra ocular pressure recording. Axial length (AXL) and Central anterior chamber depth (ACD) were recorded using A scan biometry before YAG laser peripheral Iridotomy, (PI). Fundus evaluation was done after dilatation of pupils after YAG PI. All cases with Aphakia or Pseudophakia, with PI or any other ocular disease or trauma were excluded. 116 eyes of 58 controls were selected randomly from general population without screening for PACC. Axial length and central anterior chamber depth were recorded using A scan biometry. AXL-ACD factor was

calculated for PACC group and control group. Presence of peripheral anterior synechiae (PAS) was correlated with AXL-ACD factor. Statistical analysis was carried out.

III. Results

116 eyes of 58 patients of PACG were included in this study. The mean age was 50.31 yrs. The lowest age was 21 yrs and highest age was 76 yrs. The age distribution is tabulated in table 1.

Table – 1

Age Distribution

Ser No	Age Group	Number Of Eyes
01	< 20	Nil
02	21-30	06
03	31-40	30
04	41-50	22
05	51-60	32
06	61-70	24
07	71-80	02
08	> 80	Nil
Total		116

There were 28 males and 30 females[Table 2].

Table – 2 Sex Distribution

Ser No	Sex	Number of Patients	Number of Eyes
01	Male	28	56
02	Female	30	60
Total		58	116

Mean AXL ACD factor in PACC group was 58.54 and control group was 67.65[Table 3].

Table – 3 Axl-Acd Factor Normals Vs Pacc

Ser No	Normals	PACC
01	67.65 (Mean)	58.54 (Mean)

The difference was statistically highly significant at P< 0.001. Correlation of PAS with AXL ACD factor revealed that PAS were present in 85.7% of cases of PACC group with AXL ACD factor less than 45 and 73.68 % of cases of PACC group with AXL ACD factor less than 50[Table 4].

Table – 4 Axl-Acd Factor Vs Pas (In Pacg)

Ser No	Axl-Acd Factor	Number	PAS Present	Percentage
01	<45.00	07	06	85.71
02	45.01-50.00	12	08	66.66
03	50.01-55.00	19	10	52.63
04	55.01-60.00	23	12	52.17
05	60.01-65.00	28	12	42.85
06	65.01-70.00	10	06	60.00
07	70.01-75.00	10	04	40.00
08	75.01-80.00	03	01	33.33
	>80	34	02	5.88
Total		166	61	52.58

Fig 1



Incidence of PAS increased with decreasing AXL ACD factor with marked increase in cases with AXL ACD factor less than 50.

IV. Discussion

Glaucoma is one of the leading causes of blindness worldwide . Primary glaucoma affects 67 million people across the world (3) . Primary Angle closure glaucoma has been recognised to be the major form of primary glaucoma in East Asians (3) . Various studies in India (1,2,9,10,11) have also found that the prevalence of PACG is higher than POAG. The high prevalence of angle closure in China and India means that PACG may be at least as common as primary open-angle glaucoma and therefore a major form of glaucoma worldwide (3). Due to high prevalence of PACG in this thickly populated region of the world there is an immediate need of an objective assessment tool which could be used for screening and diagnosis of PACG. Newer advances in analysis of Nerve fibre layer, Optic nerve head and visual fields are helpful in POAG but are of little help in early diagnosis of PACG. The diagnosis of PACG is largely based on gonioscopy which is liable to subjective variations in clinical skills and interpretations by the examiner. It is also impractical in busy OPDs and population based studies.

Eyes with primary angle closure have certain common biometric characteristics. .These include shallow anterior chamber depth. (ACD), short axial length (AXL), thick lens, anterior lens position, small corneal diameter and radius of curvature (3,12,13,14) . Anterior chamber depth has been used as a screening test for primary Angle closure glaucoma (15). Since it is of a very low magnitude even a minute error ranging in decimals could lead to misinterpretation as the cut off between PACG and non PACG would be in fractions of a millimeter. Hence a new biometric tool for assessment of PACG was conceptualized and evaluated in this study. This is AXL-ACD factor. Since eyes with PACG are known to have shallow anterior chamber depth (ACD) and short axial length (AXL) ^{3,12,13,14} a multiplication of Axial length with the central anterior chamber depth would magnify the small difference in Anterior chamber depth and Axial length between PACG and normal eyes. The cutoff for PACG could be adjusted to increase the sensitivity or the specificity of the test. A low cutoff would increase the specificity which is important in clinic based approach and a higher cutoff would increase the sensitivity which will be beneficial for screening in population based studies.

Correlation of PAS with AXL-ACD factor revealed that PAS were present in 85.7% of cases of PACC group with AXL –ACD factor less than 45 and 73.68% of cases of PACC group with AXL-ACD factor less than 50. This revealed that if cutoff for AXL-ACD factor is reduced progressively not only does it have a diagnostic value but it also has a prognostic value. Thus at lower levels of AXL-ACD factor one can be sure of diagnosing PACG and can also anticipate presence of PAS with more surety even before gonioscopy.

This is a simple method. A scan biometry is routinely performed at almost all eye centres across the world for Intra ocular lens power calculation. A simple modification of the software of A scan could give the AXL-ACD factor and the probability of presence of Primary Angle Closure Glaucoma in the patient.

This is an initial attempt utilizing the original concept of AXL-ACD factor for diagnosis and prognosis of PACG. Being the first study no comparisons can be made with past literature. However a number of studies have been performed in the various parts of the world (3,15,16) utilizing the parameter of anterior chamber depth and axial length separately which support the concept of AXL-ACD Factor. Multi centric studies can be performed in future to further refine the data and make it clinically applicable universally.

V. Conclusion

Axl-Acd factor is a simple, accurate, objective assessment tool for diagnosis of PACG and prediction of presence of PAS without gonioscopy and can be used for mass screening for PACG.

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