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Original Article

Association between axial length of the eye and primary angle closure glaucoma

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Abstract

Background: Angle closure glaucoma is emerging as a leading cause of blindness in Asia.

Objective: To compare the ocular axial length of normal individuals and the subjects with primary angle closure glaucoma. This study has been conducted to determine axial length of eye as a risk factor of primary angle closure glaucoma.

Materials and Methods: A cross-sectional comparative study was carried out in Mechi Eye Care Centre, Jhapa, Nepal including forty eyes of 20 diagnosed cases of primary angle closure glaucoma (40 eyes) and 40 eyes of 20 normal subjects selected by simple random sampling. A complete ocular examination of all the subjects was carried out. Axial length measurement was done using ultrasound A scan.

Results: Out of 80 eyes, there were 40 eyes of 20 diagnosed primary angle closure subjects and 40 eyes of 20 normal subjects. The mean axial length and standard deviation of primary angle closure glaucoma were 21.93 $\pm$ 1.16 mm (95% CI = 21.41 - 22.45) and those of control group were 23.01 $\pm$ 0.49 (95% CI = 22.79 - 23.23). The axial length of less than 23 mm was found as a risk factor for angle closure glaucoma (Relative risk =3.40; p = 0.0032).

Conclusion: This study showed that patients with the axial length of less than 23 mm are at risk to develop primary angle closure glaucoma. This result can be confirmed by doing population based study in a larger sample size.

Keywords: Axial length, Primary angle closure glaucoma, Nepal

Angle closure glaucoma is an important cause of blindness in Asia. India has higher prevalence of PACG compared with Western populations[1]. Quigley has estimated that 66.8 million people are affected by primary glaucoma worldwide, with 6.7 million people being bilaterally blind due to the disease[1]. The prevalence of primary open angle glaucoma (POAG) versus primary angle closure glaucoma (PACG) varies with race and region.

An estimated eight million Asian Indians were projected to have glaucoma by the year 2000 with equal numbers of open angle and angle closure glaucoma[1]. Population based studies from India have suggested that angle closure glaucoma is at least as common as open angle glaucoma[2,3]. A significant percentage of the population (10.35%) has been reported to have occludable angles[3]. The reasons for the relatively high prevalence of occludable angles and angle closure glaucoma are, however, not known. It has been estimated that 3.9 million people worldwide will be blind owing to primary angle-closure glaucoma (PACG) by 2010, and that this figure will rise to 5.3 million by 2020. The majority of those affected will be living in Asia[4].

Clinic based studies have suggested that eyes with occludable angles and angle closure glaucoma have a shorter axial length, shallower anterior chamber, and a thicker lens[5–8] .

The shallower anterior chambers are in part because of the thicker and more anterior position of the crystalline lens[7].

Progressive increase in lens thickness with age results in greater shallowing of the anterior chamber[9].

Identification of risk factors of angle closure glaucoma is important for prevention of this devastating irreversible

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blinding disorder. Shorter axial length is one of the risk factors of primary angle closure glaucoma. This study was conducted to determine association of axial length with primary angle closure glaucoma.

Materials and methods

A hospital based prospective cross-sectional study was conducted in Mechi Eye Care Centre (MECC), Birtamode Jhapa from June 2005-August 2005. Informed consent was taken from all the subjects included in this study.

Diagnosed patients of all clinical sub-types of primary angle closure glaucoma attending glaucoma clinic of the MECC during the study period and normal subjects above 40 years of age selected by random sampling were included in this study. Forty eyes of twenty primary angle closure glaucoma subjects and 40 eyes of normal subjects were included in this study.

Patients with primary open angle glaucoma, normal tension glaucoma, secondary glaucoma, non-glaucomatous optic atrophy, patients with corneal disorder such as (corneal abrasion, superficail punctate keratitis) and those not willing to participate in this study were excluded in this study. Detailed history was taken from all subjects included in this study and recorded in pro forma. Best-corrected visual acuity was recorded in all the subjects with the help of standard Snellen's E chart. Detailed slit lamp evaluation was done for every case under Haag Streit 900 slit lamp and the findings recorded. Intraocular pressure was measured in all cases with applanation tonometer. Gonioscopy was performed with Goldmann one mirror gonio lens in every subject. Grading of the irido-corneal angle was done using the modified Shaffer - Spaeth system.

Evaluation of the fundus, particularly of the optic disc was done with direct ophthalmoscope (Neitz hand held model ophthalmoscope). Visual field analysis was done with Humphrey automated perimeter and the findings were recorded. A total of 40 eyes of 20 normal subjects above the age of 40 years were selected by simple random sampling. All these subjects underwent detailed ocular examination. Axial length measurement with A scan machine was done in all 80 eyes of 40 subjects included in this. All clinical types of primary angle closure glaucoma were included in this study.

Data analysis was done by Microsoft excel software and Epi-info program. The p value of <0.05 was considered as statistically significant.

Results

Forty eyes of normal subjects and forty eyes of primary angle closure glaucoma subjects underwent axial length measurement with ultrasound A scan in glaucoma clinic of Mechi Eye Care Centre Birtamode, Jhapa. Table 1 shows the age distribution of normal and primary angle closure glaucoma subjects. The mean age and standard deviation of male of the normal subjects were 51.29 $\pm$11.76 years (95% CI = 50.66 - 51.75). The mean age and standard deviation of female of normal subjects were 52.40 $\pm$ 8.47 years (95% CI = 51.66-53.14). The mean age and standard deviation of primary angle closure glaucoma subjects were 47.6 $\pm$ 18.41 years (95% CI = 47.36-47.84).The mean age and standard deviation of female of the primary angle closure glaucoma subjects were 53.67 $\pm$ 19.37 years (95% CI=52.95-54.39). Since the difference in mean age between the groups was not statistically significant ($p > 0.05$), they were comparable.

Table 2 shows that mean axial length of 40 eyes and standard deviation of normal subjects were 23.01 $\pm$ 0.49 mm (95%CI = 22.79-23.23). The mean axial length of 40 eyes and standard deviation of primary angle closure glaucoma subjects were 21.93 $\pm$ 1.16 mm (95% CI = 21.41-22.45). The axial length of less than 23mm was found as a risk factor (RR=3.40; p=0.0032).

Table 1: Mean age distribution of normal and primary angle closure glaucoma subjects in years.

Sex	**Normal subjects (n-20)**	**Primary angle closure glaucoma subjects (n-20)**
Male	51. 29 $\pm$1.76 (95%CI=50.66-51.75)	47.6 $\pm$ 18.41(95%CI=47.36-47.84)
Female	52.40 $\pm$ 8.47 (95%CI=51.66-53.14)	53.67 $\pm$ 9.37(95%CI=52.95-54.39)

Table 2: Axial length of normal and primary angle closure glaucoma subjects

Variable	**Normal (n=40 eyes)**	**PACG (n=40 eyes)**	**p-value**
Axial length (mm)	23.01 $\pm$ 0.49 (95% CI=22.79-23.23)	21.936 $\pm$ 1.16 (95%CI=21.41-22.45)	<0.005

Discussion

This comparative cross-sectional study was carried out in Mechi Eye Care Centre from June 2005-August 2005. This study was conducted to determine association between axial length and primary angle closure glaucoma. Primary angle closure glaucoma is estimated to affect a significant proportion of the population worldwide. Of those affected, the majorities reside in developing countries. In the developing world, more than 80% of the people afflicted with glaucoma are unaware that they have the disease, and visual impairment from primary angle closure glaucoma is more severe than from primary open angle glaucoma. Identification of risk factors for primary angle closure glaucoma is essential for early detection and timely intervention to prevent visual impairment.

Eighty eyes underwent axial length measurement. The position of lens and the corneal diameter are related to the axial length of the globe. A short eye which is frequently hypermetropic has a small corneal diameter and a relatively anteriorly located lens[10]. In this study the mean age and standard deviation of male primary angle closure glaucoma subjects were 47.6 ± 18.41(95%CI = 47.36-47.84).The mean age and standard deviation of female primary angle closure glaucoma subjects were 53.67±19.37 years (95%CI=52.95-54.39). It is interesting to note that in the present study the age of onset of angle closure glaucoma is earlier than the reported age[10].

However, the early onset of angle closure glaucoma in the studied population cannot be explained. Similar study in a larger sample size may be required to verify the findings. This study showed that the mean and standard deviation of axial length of eyes of normal subjects were 23.01 ± 0.49 (95%CI=22.79 - 23.23) and the mean and standard deviation of axial length of eyes of primary angle closure glaucoma subjects were 21.93 ± 1.16 (95%CI=21.41-22.45). The shorter axial length among the primary angle closure glaucoma in our study compared to normal subjects suggests an anatomical predisposition to primary angle closure glaucoma. This is comparable with a study where mean and standard deviation of normal individuals were 22.76(± 0.78) mm and that of the individuals with angle closure glaucoma was 21.92(± 0.7)[11]. South Indian eyes with angle closure glaucoma and occludable angles seem to have significantly shorter axial lengths[11].There is evidence in the literature that eyes with angle closure glaucoma or occludable angles have shorter axial lengths[5,6,7,8].

Glaucoma is the leading cause of irreversible blindness. Identification of its risk factors is crucial for prevention of this disease entity. In this study the axial length of less than 23 mm was found as a risk factor (Relative Risk = 3.40; p = 0.0032) for primary angle closure glaucoma.

Conclusion

This study showed that patients with the axial length of less than 23 mm have 3.4 times more risk of developing primary angle closure glaucoma than the normal subjects. This result can be confirmed by doing population based study in a larger sample size.

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