CILIARY BODY AREA IN PUPIL BLOCK

Poster No. P- TU-052

P A Good,[1] R Siddiqi,[1] W Nolan [2]

1 Vision Sciences Dept, 2 Glaucoma Dept,
Birmingham & Midland Eye Centre, SWBH NHS Trust, Birmingham, UK

Introduction

- Primary angle closure glaucoma (PAC(G)) is the major form of glaucoma in Asia,[1-3] compared to primary open angle glaucoma (POAG), which is the predominant disease among Caucasians and Africans.[1]
- In China, it is estimated that PAC(G) affects 3.5 million people and 28 million have blindness due to PAC(G) in Mongolia, Singapore, China and India.[3] By 2020, PAC (G) will affect 20 million people and 5.3 million will be blind.[3]
- PAC(G) has not been recognized as a common condition in Europeans, sparse data suggests that PAC(G) is uncommon among European-derived people. It is reported has a prevalence rate of around 0.1% in the population aged 40 years and older.[4] A population-based study in northern Italy found a higher prevalence of 0.6%.[5] However, these studies are not entirely representative of European patients with PAC(G).
- Previous research has confirmed that many anatomical factors of the anterior segment predispose individuals toward PAC/G including: small cornea, increased lens thickness and shorter axial lengths.[1,6]
- Known risk factors are a small eye, large lens, and crowding of the anterior chamber. The role of the ciliary body in the mechanism of PAC is unknown except in plateau iris where it is anteriorly rotated.
- It has been suggested by Quigley [7] that the choroid has a significant role in the mechanism of angle closure,(choroidal expansion theory). Increases in the volume of the anterior choroid (uveal effusion) may influence the ciliary body. This may have a mechanical effect causing forward and upward rotation of the iris causing narrowing of the angles.
- This study assesses the role of the ciliary body in pupil block by measuring the ciliary body cross sectional area using ultrasound biomicroscopy (UBM).

Methods

- Consecutive patients with a diagnosis of primary angle closure (glaucoma) PAC(G), as diagnosed by gonioscopy, were recruited from glaucoma clinics at Birmingham & Midland Eye Centre, Birmingham, UK.
- Exclusion criteria: Any other ophthalmic pathology, previous surgery.
- Fifty eyes (25 patients) with angle closure underwent UBM using a Lin 50 UBM probe (Aviso system by Quantel medical, Clermont Ferrand) and SL-OCT examination (Heidelberg Engineering, Germany).
- A scan biometry was also performed: measuring axial length (AXL), lens thickness (LT), and ACD (anterior chamber depth).
- Pupil block was identified by the iris contour as per UBM. As shown in figure 1 below.

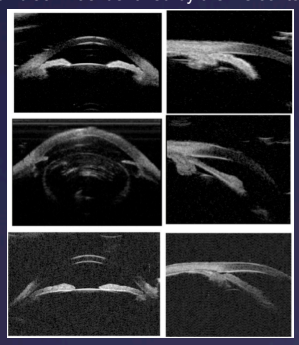


Fig 1 showing structural mechanism of PAC(G). Pupillary block is the commonest mechanism encountered, characterized by convexity and bowing of the peripheral iris. (Top) pupil block and non-pupil block can co-exist, iris convexity is prominent but the AC is deep whereby there is a flat central iris plane, and a sharp angulation of the peripheral iris where it inserts into the iris root. (Middle) Lenticular angle-closure has a typical 'vesuvian' iris profile. Plateau Iris (Bottom) is characterized by a flat iris plane, deep central AC depth, shallow peripheral AC, steeply rising iris root and angular irido-treabecular contact (ITC).

- Cross-sectional Ciliary body area was measured in 4 quadrants from the edge of the pars plana to the ciliary sulcus,The anterior margin being the supraciliary space, and sclero-choroidal margin.
- The mean CBA for these 4 quadrants was calculated and compared to a control group of 30 normal eyes with with open angles of a similar axial length (AXL), and ethnicity (caucasian). Lens thickness (LT) was also measured. The two groups were age and sex matched.
- *Statistical analysis was by analysis of variance*

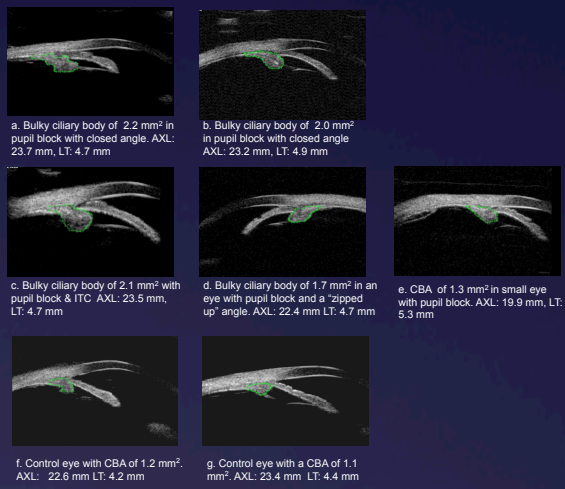
Results

- The mean AXL in the eyes with pupil block was 22.3 mm (range 20.8-23.4 mm), compared to 22.4 mm in the controls (range 21.0-23.5 mm).
- Mean LT was 4.83 mm in the group with pupil block and 4.36 mm in the controls.
- The mean cross sectional area of the ciliary body was 1.92 mm squared in the group with pupil block and 1.35 mm squared in the controls
- Significance of p<0.025 was noted between the two groups in lens thickness and ciliary body area

	Pupil Block Mean (sd) N=50	Controls Mean (sd) N=30	Significance (p)
AXL (mm)	22.9 (2.4)	23.0 (2.1)	P = 0.86
LT (mm)	4.83 (0.63)	4.36 (0.52)	P= 0.016 **
CBA (mm^2)	1.92 (0.18)	1.35 (0.11)	P= 0.012 **

*Table 1: Showing mean, standard error & p value of AXL, LT and CBA * denotes $p<0.0001$, ** $p<0.03$*

Fig 2 Showing UBM images and ciliary body area (green contour line denotes CBA)



a. Bulky ciliary body of 2.2 mm^2 in pupil block with closed angle. AXL: 23.7 mm, LT: 4.7 mm

b. Bulky ciliary body of 2.0 mm^2 in pupil block with closed angle AXL: 23.2 mm, LT: 4.9 mm

c. Bulky ciliary body of 2.1 mm^2 with pupil block & ITC AXL: 23.5 mm, LT: 4.7 mm

d. Bulky ciliary body of 1.7 mm^2 in an eye with pupil block and a "zipped up" angle. AXL: 22.4 mm LT: 4.7 mm

e. CBA of 1.3 mm^2 in small eye with pupil block. AXL: 19.9 mm, LT: 5.3 mm

f. Control eye with CBA of 1.2 mm^2. AXL: 22.6 mm LT: 4.2 mm

g. Control eye with a CBA of 1.1 mm^2. AXL: 23.4 mm LT: 4.4 mm

Conclusions

- Eyes with pupil block revealed significant increases in lens thickness and ciliary body area. The effect of lens thickness in pupil block is well described [6], this is the first time that increased ciliary area has been described as a possible mechanism in pupil block and subsequent angle closure. As the ciliary body is a uveal extension of the choroid, this study supports Quigley's theory that uveal expansion is a possible mechanism in angle closure glaucoma.
- Gohdo et al [8] found thin ciliary bodies in patients with narrow angles. He suggested that ciliary body atrophy causes anterior rotation of the ciliary processes due to reduced attachment of the ciliary body to the scleral spur. However their study was limited as it included only the meridional cross-section of the ciliary body.
- In common with other caucasians with angle closure the axial lengths of patients in this study were shorter than the population mean, and therefore may have influenced the thickness of the anterior choroid and hence ciliary body area.
- The study highlights the need to evaluate the size as well as the anterior rotation of the cilary body in patients with pupil block. Furthermore, this can only be achieved using ultra biomicroscopy, as anterior segment OCT does not give a sufficiently detailed view of the ciliary body.

References

1 *Yip JL, Foster PJ (2006). Ethnic differences in primary angle-closure glaucoma. Curr Opin Ophthalmol 17(2):175-180.*

2 *American Academy of Ophthalmology. Primary angle-closure. In: Caprioli J, Gaasterland DE, Gross RL, et al. editors. Preferred practice patterns. San Francisco: American Academy of Ophthalmology; 2000.*

3 *Quigley HA, Broman AT (2006). The number of people with glaucoma worldwide in 2010 and 2020. Br J Ophthalmol 90(3): 262-267*

4 *Wensor MD, McCarty CA, Stanislarsky YL (1993). The prevalence of glaucoma in the Melbourne visual impairment project. Ophthalmol 105: 733-739.*

5 *Bonomi L, Marchini G, Morrata M (2000). Epidemiology of angle closure glaucoma. Prevalence, clinical types, association with peripheral anterior chamber depth in the Egna-Neumarkt glaucoma study. Ophthalmol 107: 998-1003.*

6 *Lowe RF (1970). Aetiology of the anatomical basis for primary angle closure glaucoma. Br J Ophthalmol 54: 141.*

7 *Quigley HA (2009). Angle-closure glaucoma-simpler answers to complex mechanisms: LXVI Edward Jackson Memorial Lecture. Am J Ophthalmol 148(5): 657-669.*

8 *Gohdo T, Tsumura T, Iijima H, Kashiwagi K, Tsukahara S (2000). Ultrasound biomicroscopic study of ciliary body thickness in eyes with narrow angles. Am J Ophthalmol 129(3): 342-346.*

Email: peter.good@swbh.nhs.uk