

# A prospective study of blotchy pigments distribution in anterior chamber among angle closure glaucoma patients

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## Abstract

**Background:** To estimate the prevalence of Blotchy pigments in abnormal anterior chamber angle conditions. Blotchy pigments are patchy pigment clumps on the trabecular meshwork or on the back part of the cornea, which are considered “impression of iris pigments, a sign of irido-trabecular contact. **Methodology:** Randomized cross-sectional prospective study. Subjects aged above 40 years attending the outpatient department of Ophthalmology at Navodaya Medical College, Raichur from June 2016 to June 2017 who underwent a standardized eye examination. 97 Subjects thus identified as primary angle closure suspects were grouped as occludable angle (GROUP I) and 103 controls (people not meeting the criterion) were grouped as non-occludable angle (GROUP II). Presence or absence Blotchy pigments were noted and compared quadrant wise amongst the two groups. The sensitivity and specificity of the presence of pigments, quadrant involved and angle status was analyzed using SPSS software. **Results:** Presence of Blotchy pigments were noted in 25(25%) and 2(0.01%) subjects in Group I and Group II respectively. Quadrant wise analysis revealed that superior quadrant (60%) was the most commonly involved in Group I where as in group II it was inferior quadrant (100%). Presence of Blotchy pigments in occludable angle was significantly associated with high IOP and was established using paired t-test ( $p=0.001$ ). **Conclusion:** Blotchy pigments in occludable angles indicate that these pigments apart from being a sign of irido trabecular contact could also be warning sign of intermittent angle closure.

**Key Words:** Blotchy pigments, Anterior chamber angle, Angle closure glaucoma.

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## INTRODUCTION

Glaucoma is the leading cause of blindness in the advancing age group. Primary angle closure glaucoma is seen in eyes with shallow anterior chamber. The spectrum of primary angle closure disease includes primary angle closure suspect (PACS), primary angle closure (PAC),

primary angle closure glaucoma (PACG). This recent classification reflects the stages in the natural history of the disease taking into account that majority of patients are asymptomatic. In a survey conducted by Quigley *et al*, by 2020, India will become second overall in number with glaucoma, surpassing Europe. The percentage known to have glaucoma before survey was 26.0% (21.5%) for open angle glaucoma(OAG) and 28.6% (38.4%) for angle closure glaucoma(ACG).<sup>1</sup> Therefore it is of utmost importance to find reliable and early indicators of ACG which is one of the leading causes of blindness and ocular morbidity in south India.<sup>2</sup> Blotchy pigments are thought to indicate irido-trabecular contact. They defined as trabecular meshwork pigments or pigments on the back part of the cornea, which are considered as iris pigment impressions.<sup>3</sup> A recent study by Harsha *et al* documented the presence of Blotchy pigments in normal and occludable angles and concluded

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it as a sign of angle closure. The prevalence of Blotchy pigments was also estimated in POAG to understand its clinical significance.<sup>4</sup> This is the only study found in literature regarding the presence of Blotchy pigments and further studies are in need to consolidate the findings. Primary angle closure suspects (PACS) are prone for intermittent angle closure with a low threshold for diagnosis as they are asymptomatic and progress to irreversible angle closure glaucoma unaware to both the physician and patient. Blotchy pigments in primary angle closure suspects could be indicative of intermittent angle closure and hence their documentation will definitely help in demarcating the ones who are more likely to progress towards visual blindness. The present study was aimed at determining the occurrence of Blotchy pigments and their quadrant wise distribution in abnormal angle conditions and its clinical importance as a marker of angle closure.

## MATERIALS AND METHODS

This is a prospective cross-sectional study of Indian PACS subjects recruited from Navodaya Medical College, Raichur, Karnataka India. Written informed consent was obtained from each subject. The study had the approval of the Institutional ethical Review Board and adhered to the Declaration of Helsinki. This cross-sectional study included subjects aged above 40 years who were recruited between June 2016 to June 2017 from our ophthalmology outpatient department. Primary angle closure suspects (PACS) is an eye in which appositional contact between the peripheral iris and posterior trabecular meshwork is considered possible with normal IOP, optic disc and visual field. It is defined as an angle in which  $>270^\circ$  of the posterior trabecular meshwork cannot be seen.<sup>5</sup> All subjects underwent a standardized eye examination that included visual acuity measurement, slit-lamp examination, optic disc examination with a 90-diopter lens, intraocular pressure (IOP) measurement by Goldmann applanation tonometry. Subjects with shallow anterior chamber based on Van Herrick's grading using Slit lamp Biomicroscopy (Anterior chamber depth  $<1/4$ th corneal thickness), normal IOT ( $\leq 21$ mmHg), normal fundus picture and visual fields were included in the study. Subjects excluded from the study were known cases of glaucoma, patients with active ocular inflammation, obstruction to a good view of posterior and anterior chamber due to any pathology, congenital or acquired iris anomalies, previous history of intraocular surgery /LASER treatment, pseudoexfoliation, history of trauma and neovascularisation of iris or the AC angle. Enrolled subjects were invited to undergo gonioscopy under standard conditions. Gonioscopy was performed in all participants by a senior ophthalmologist with extensive experience in gonioscopy, using a Goldman

four-mirror lens at a 25 magnification with low ambient illumination. 1 mm vertical beam of light was offset vertically for superior and inferior quadrants and horizontally for nasal and temporal quadrants. Care was taken to avoid light falling on the pupil. The Shaffer's grading system was used for categorizing the subjects into non-occludable angle (group I) and occludable angle (group II). 97 Subjects thus identified as suspected primary angle closure were grouped as occludable angle (GROUP I) and 103 controls (people not meeting the criterion) were grouped as non-occludable angle (GROUP II). Presence or absence Blotchy pigments were noted and compared quadrant wise and clock wise amongst the two groups. Indentation gonioscopy was done whenever the angle was not visible completely to note the Blotchy pigments. At the end of procedure 1 drop of 0.5% Moxifloxacin was instilled in the conjunctival sac. The sensitivity and specificity of the presence of pigments, quadrant involved and angle status was analyzed using SPSS software.

## RESULTS

**Table 1: MEAN AGE OF SUBJECTS**

	GROUP I	GROUP II
MEAN AGE (in years)	67.3 +/- 3.2	64.1 +/- 3.6

Mean age of subjects in GROUP I ( OCCLUDABLE ANGLE) was 67.3 +/- 3.2 years, where as the mean age of GROUP II (NON OCCLUDABLE ANGLE) was 64.1 +/- 3.6 years. Number of males in occludable and non-occludable angle were 47 and 50 respectively where as the number of females in the two groups were found to be 50 and 63 respectively.

**Table 2: INTRA OCULAR PRESSURE GRADED INTO THREE CLASSES**

	RANGE OF IOT(mmHg)
CLASS I	10-13
CLASS II	14-17
CLASS III	18-21

The intra ocular pressure of the patients was graded into three classes. The number of subjects in each class in both the groups was documented. 34 subjects in GROUP I and 44 subjects in GROUP II had IOP in the range of 10-13mmHg, thus classified into CLASS I. CLASS II had 43 subjects from group I and 38 subjects from group II with IOP range of 14mmHg-17mmHg. 20 subjects in group I and 15 subjects in group II had IOP range 18-21mmHg in Class III.

**Table 3: AVERAGE IOT OF SUBJECTS WITH BLOTCHY PIGMENTS IN DIFFERENT QUADRANTS**

	INFERIOR	SUPERIOR	NASAL	TEMPORAL
GROUP I	19.2 +/- 1.0	17.7 +/- 1.0	-	18.8 +/- 1.0
GROUP II	18.2 +/- 1.0	-	-	-

On gonioscopy, Blotchy pigments were found in 25 subjects in group I and 2 subjects in group II. Gonioscopy was done Quadrant wise to analysis the Blotchy pigments in both the groups. In group I, 5 subjects were found to have Blotchy pigments in inferior quadrant, 15 in superior quadrant and 5 in temporal quadrant. Where as in group II, 2 subjects had Blotchy pigments in inferior quadrant. The average IOP of subjects with Blotchy pigments in specific quadrants was calculated.

**Table 4: STATISTICAL SIGNIFICANCE OF PRESENCE OF BLOTCHY PIGMENTS IN OCCLUDABLE ANGLE WITH HIGH IOP ESTABLISHED USING PAIRED t-test (p=0.001).**

OCCLUDABLE ANGLE	BLOTCHY PIGMENTS	NO BLOTCHY PIGMENTS	P value
Mean IOT(mmHg)	18.0+/1.2	13.2+/1.3	(0.0001)

The likelihood of the presence of Blotchy pigments with increase in mean IOP of subjects with occludable angle was established using paired t-test and was found to be statistically significant(p=0.001).

## DISCUSSION

Primary angle closure glaucoma (PACG) is an important cause of ocular morbidity and blindness in the South-east Asian countries <sup>1,2</sup> having a greater impact on blindness compared to POAG.<sup>2,6,7</sup> Blotchy pigments were found in only 2% of the subjects belonging to the non-occludable angle group. In the study by Harsh *et al*, Blotchy pigments in the non occludable angle had been attributed to increased pigmentation in the Indian eye, with predisposition to AC angle of the eye to pigmentation especially in inferior angle as the current of aqueous flows from superior to inferior angle.<sup>4</sup> The results of our study favoured this hypothesis but one of the drawbacks of our study was that gonioscopy was performed by only one expert consultant with immense prior experience in glaucoma clinic thus leaving no room for cross verification to rule out hyperpigmentation. It is also noteworthy that though pseudoexfoliation (PEX) was ruled out to the best of our knowledge clinically, trabecular hyperpigmentation is common in PEX and is usually most marked inferiorly. It may antedate the appearance of PEX by several years and the pigment may have a patchy distribution which could appear as Blotchy pigments. Subject characteristics in occludable angle group were older in age, female gender and hyperopic which are proven risk factors for angle closure disease in south Indian populations.<sup>6,7,10,11</sup> Majority of the subjects had visited the out-patient department(OPD) seeking cataract surgery indicating cataractous increase in volume of lens could be the cause of intermittent closure in these occludable angles.<sup>8</sup> Blotchy pigments were seen in 25%

of occludable angle with superior quadrant being the most commonly involved followed by inferior, temporal and nasal. In study conducted by Xiang bin Kong, Paul J evaluating ITC using ultrasound biomicroscopy (UBM) concluded ITC was identified in 78.6% of the superior, 59.8% of the inferior, 40.2% of the nasal, and 25.6% of the temporal quadrants in the PACS.<sup>12</sup> The quadrant wise prevalence of Blotchy pigments evaluated in our study is in accordance with the irido-trabecular contact assessed using advanced technology thus validating that Blotchy pigments have a strong co-relation with irido-trabecular contact. The likelihood of detecting Blotchy pigments in anterior chamber angle increased with rise in intra ocular pressure. Blotchy pigments were detectable with minimal rise in IOP in superior quadrant thus making it the most commonly involved quadrant in occludable angle where as a significant rise in IOP was required to produce Blotchy pigments in the other quadrants. Blotchy pigments have been considered precursor for peripheral anterior synechiae (PAS) defined as focal or broad based permanent adhesion between iris and trabecular meshwork which prevents complete opening of the angle and thereby obstructing the outflow of aqueous humor. Though the location of pigments is in agreement with the most commonly involved quadrant in PAS (i.e superior)<sup>9,13</sup> nevertheless prospective studies are in need requiring years of meticulous follow up to establish a confirmatory association. Though all the subjects in the study had IOP in normal range of less than 21mmHg, Blotchy pigments were found more commonly in subjects with higher level of normal range of IOP in our study. However diurnal variation in IOP was not recorded and this conclusion was based on IOP of subject at presentation only.

## CONCLUSION

Occludable angles are more prone for intermittent angle closure. Blotchy pigments in occludable angles indicate that these pigments apart from being a sign of irido trabecular contact could also be warning sign of intermittent angle closure and thus a tell- tale sign of angle closure. Diagnosing and treating angle closure eyes in PACS stage with laser iridotomy is reported to be effective in preventing progression to blinding primary angle closure glaucoma (PACG). Thus, Blotchy pigments can be used as an affordable screening tool in early detection of primary angle closure suspects at risk. However, prospective studies are required to assess the number of patients with Blotchy pigments who progress through the spectrum of angle closure disease.

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