EXTENDED REPORT

Charles Bonnet syndrome in Asian patients in a tertiary ophthalmic centre

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Aims: To describe the epidemiology of Charles Bonnet syndrome (CBS) among patients in an Asian tertiary ophthalmic centre and to describe the characteristics of the hallucinations experienced.
Methods: 1077 consecutive patients aged 50 years and above were asked a standardised question to determine if they had ever experienced formed visual hallucinations. All patients who experienced these symptoms were further interviewed using a detailed, standardised questionnaire to ascertain if they met the diagnostic criteria established for CBS.
Results: There were 491 men (45.6%) and 586 women (54.4%). The best corrected visual acuity ranged from 20/20 to light perception in the better seeing eye and from 20/20 to no light perception in the worse seeing eye. Four patients (0.4%) were diagnosed with CBS; two men and two women. There were two Chinese and two Indians. The average age of the CBS patients was 76.3 years (range 65–90 years). Two patients had cataracts, one had glaucoma, and one had both cataracts and glaucoma. A wide variety of visual hallucinations were reported. Three out of four patients experienced a negative reaction to their hallucinations. Only one patient had discussed his symptoms with a doctor.
Conclusions: This is the first report on the epidemiology of CBS in Asian patients. The prevalence rate of CBS (0.4%) is slightly lower than in comparable studies in non-Asian populations. The nature of the hallucinations experienced were similar to those previously reported.

Charles Bonnet syndrome (CBS) is a condition in which patients experience complex, formed visual hallucinations with retention of insight, in the absence of primary or secondary delusions or hallucinations in other sensory modalities.[1–6]

Although uncommon, it has been suggested that the prevalence of CBS may be higher than is generally believed either because patients do no not discuss their symptoms or the condition may be overlooked or misdiagnosed by doctors.[7 8]

Only a few cross sectional studies on CBS have been reported in Western populations[7 9–12] and, to the best of our knowledge, no cross sectional study has ever been reported in an Asian population.

Our study aimed to determine the prevalence rate of CBS among Asian patients in a tertiary ophthalmic centre, to describe the characteristics of the visual hallucinations experienced, and to determine the effects of the hallucinations on patients. In particular, we sought to determine the patients' emotional responses to CBS and whether they chose to confide in either family members or doctors.

PATIENTS AND METHODS

Approval was obtained from our institution's ethics committee before the commencement of the study in May 2002. In all, 1077 consecutive patients aged 50 years and above from the Comprehensive Ophthalmology Clinic in The Eye Institute at Tan Tock Seng Hospital, Singapore, were interviewed by three trained interviewers (VSYL, DYMH, EY). The nature of the study was explained and informed consent was obtained from each patient before commencing the interview. Patients were referred to the comprehensive clinic for a variety of ophthalmic conditions and included patients with neuro-ophthalmic disorders.

Demographic data, ophthalmic diagnoses, best corrected visual acuity (BCVA), as well as histories of other systemic medical problems were collected. The patients were asked a standard question to determine if they had ever experienced complex, formed visual hallucinations: ''Sometimes people who have eye problems affecting their eyesight see images or hallucinations that are actually not really there or see things that other people don't see. This is a known condition called Charles Bonnet syndrome. It happens to people who are of sound mind and have no mental or psychiatric problems. Have you ever experienced any visual hallucinations?''

All respondents who said ''yes'' were further interviewed by the main author (CSHT), using a detailed, standardised questionnaire to ascertain if they met the diagnostic criteria established for CBS. The diagnostic criteria used for CBS were presence of complex, formed visual hallucinations with normal insight and mental state examination, and absence of delusions or hallucinations in the other sensory modalities. Patients who experienced concomitant auditory hallucinations were excluded, even if these occurred together with the visual hallucinations. Patients who reported photopsias, floaters and simple patches of colour were excluded as these do not constitute complex hallucinations. The patients' conscious state and general health at the time of the hallucinations were ascertained to differentiate from hypnopompic and hypnogogical hallucinations, hallucinations associated with delirium, or those caused by medications. The Mini-Mental State Examination was used to determine cognition. Patients with dementia or conditions that may cause hallucinations such as a previous or current history of psychiatric illness, epilepsy, organic brain lesions, or drug and alcohol dependence were excluded from this study.

Patients diagnosed with CBS were asked to describe their visual hallucinations experienced in detail (appendix). In addition, patients were asked for their reaction, if any, to these hallucinations. They were also asked if they had

Abbreviations: BCVA, best corrected visual acuity; CBS, Charles Bonnet syndrome

Table 1 Characteristics of study population (n = 1077)

	Number	%
Sex:		
Male	491	45.6
Female	586	54.4
Ethnic groups:		
Chinese	938	87.1
Indian	70	6.5
Malay	52	4.8
Others	17	1.6
Religion:		
Buddhists and Taoists	616	57.2
Christians and Catholics	168	15.6
Muslims	62	6.0
Hindus	45	4.2
No religious affiliation	137	12.7
Others	9	0.9
Ophthalmic diagnosis:		
Cataract	643	59.9
Diabetic retinopathy	148	13.8
Glaucoma	93	8.7
Age related macular degeneration	50	4.7
Others	143	13.3
Best corrected visual acuity (better seeing eye):		
20/20–20/40	844	78.4
20/50–20/200	206	19.1
Worse than 20/200	27	2.5
Best corrected visual acuity (worse seeing eye):		
20/20–20/40	530	49.2
20/50–20/200	365	33.9
Worse than 20/200	182	16.9
Housing type:		
Public housing (apartments)	810	86.2
Private condominiums	53	5.6
Private, landed property	77	8.2

previously discussed the hallucinations with anyone and, if so, the reaction of the people spoken to. Those who had not previously discussed their symptoms with anyone were asked the reasons for this.

RESULTS

A total of 1077 consecutive patients with a mean age of 67.9 years (range 50–104 (SD 8.89)) were screened; 740 of these patients (68.7%) were aged 64 years or above. The average number of family members living with the patients was 2.6 (range 0–9 (SD 1.74)). The demographics of the patients screened are summarised in table 1.

Of the 1077 patients screened, four (0.4%) were diagnosed with CBS. The average age of the CBS patients was 76.3 years (range 65–90 years). The characteristics of the visual hallucinations experienced and the patients' reactions are listed in table 2.

The four patients reported a wide variety of visual hallucinations including people, animals, flowers, and various inanimate objects such as spectacles, a cup, and handkerchiefs. The images seen were unfamiliar to the patients, meaning that they did not recognise and/or recall that they had ever seen these images before.

Three of the CBS patients experienced a negative reaction to their hallucinations: two were annoyed and the third was initially frightened but had since grown used to it. The fourth patient did not experience any reaction and simply accepted the hallucinations as a consequence of his cataract. None reported any personal meaning in the content of the hallucination.

DISCUSSION

Since visual hallucinations can be caused by a wide variety of conditions affecting any part of the visual pathway as well as other brain structures, systemic diseases, organic brain pathology, or psychiatric illnesses must be excluded before a diagnosis of CBS can be made.

Several theories have been suggested to explain CBS although heterogeneous and multifactorial causes appear to be the best explanation at present.[1 2] Reduced or aberrant visual stimulation appears to be the initiating factor,[6] which then causes visual hallucinations either by a release phenomenon[13] or by cortical irritation. Schultz *et al* proposed that they are the visual analogue of the phantom limb phenomenon. The hallucinations are caused by brain activity in the absence of sensory (visual) input.[6]

Our cross sectional study represents the largest single consecutive group of ophthalmic patients screened for CBS and, to the best of our knowledge, is the first performed in an Asian (non-white) population. Only patients aged 50 and above were screened since many studies have demonstrated that the prevalence rate increases with age,[1 10] although it may also affect younger patients,[6 14 15] including those in the paediatric age group.[16 17] Interestingly, the average age of patients with CBS (76.3 years) in our study was higher than that of the population being screened (67.9 years).

The prevalence of CBS in the few cross sectional studies performed to date ranges from 1% to 13%.[7 10–12 18 19] The variation in reported prevalence rate of formed visual hallucinations may partly be explained by the different patient populations screened, which varied from those in general medical[9] and ophthalmology clinics,[10] to patients seen in a low vision clinic[7 18] and patients with specific ocular pathology.[11 12 19] The prevalence rate of CBS in our study (0.4%) is slightly lower than the 1–2% reported in studies involving patients with generally good visual acuity.[9 10] If we used the same age criteria specified by Tuenisse *et al*[10] and included only patients aged 64 and above, the prevalence rate in our study increases to 0.5%.

The lower prevalence of CBS in our study may be the result of a real difference in the prevalence rates of CBS between Asian and white populations, possibly as a result of genetic differences or structural variation in the eye or visual pathway. It is also possible that some patients who had experienced visual hallucinations chose not to reveal their symptoms to the investigators. Other authors have suggested that the actual prevalence of CBS may be higher than reported because patients may be afraid to reveal their experiences for fear of being labelled a psychiatric case or "mad."[8 18 20] The diagnosis of a psychiatric illness carries a stigma in many cultures.[21] In a recent survey of psychiatric patients in Singapore, a significant proportion disclosed that the stigma had repercussions on their employment prospects, social interaction, and self esteem.[22] It is hoped that with increased awareness of CBS among medical professionals and the public, patients will be less hesitant to reveal their symptoms.

In our study, the proportion of males with CBS was 0.41% compared to 0.34% in females. Some other studies that have demonstrated no difference between the sexes,[1 10 11] although a few have found a higher ratio of females to males.[6 9 12]

The prevalence rate of CBS in Chinese patients was 0.21% compared to 1.44% in non-Chinese. Because of the rarity of this condition, we are unable to ascertain if a true difference in the prevalence rate exists among the various ethnic groups. Most previous studies have not provided information on the ethnic groups of the cases reported so the variation of prevalence rates among different ethnic groups, if any, is not known.[6]

The average number of family members staying with patients with CBS was lower: 1.5 (range 0–4) compared to 2.6 for the population screened. Some studies have shown that patients living alone[9 11] or who reported feeling lonely[23] were more likely to experience CBS.

Table 2 Characteristics of patients who experience visual hallucinations

	Patient 1	Patient 2	Patient 3	Patient 4
Age (years)	90	78	72	65
Sex	Female	Female	Male	Male
Race	Chinese	Chinese	Indian	Indian
Number of family members staying with patient	0	4	1	1
Ophthalmic diagnoses	Both eyes: glaucoma, cataract	Right eye: pseudophakic, left eye: cataract	Both eyes: glaucoma with superior arcuate visual field defect	Right eye: clinically significant macular oedema, posterior capsule opacity, left eye: cataract
Visual acuity	Right eye 20/60, left eye hand motion	Right eye 20/100, left eye 20/60	Right eye 20/30, left eye 20/40	Right eye 20/60, left eye 20/100
Duration of symptoms	1 year	2 months	1.5 years	1 year
Frequency of symptoms	Daily	Daily	Every 2–3 days	1–2 times per week
Duration of each episode	5 minutes–1 hour	Seconds	Seconds	5 minutes
Change in frequency of hallucination	Same	Stopped	Increased	Increased
Hallucinations	Children, Indian worker, corpse	Half body of a handsome male, flowers	People, animals, sheets and handkerchiefs	Man, dog, spectacles, and cup
Size compared to normal objects	Normal	Normal	Smaller	Normal
Coloured image	Yes	Yes	Yes	Yes
Solid/transparent	Solid	Solid	Variable	Solid
Movement of images	Yes	No	Yes	Yes
Clarity of image compared to normal images	Clearer	Clearer	Less clear	Same
Recurrent image	Yes	No	Yes	No
Always occurs in same region of visual field	No	No	No	No
Occurs only in worse seeing eye	No	No	No	No
Triggering factors	Watching television, eating	None	Watching television	None
Actions that stop hallucinations	None	Turn on lights	None	Approach object
Emotional reaction	Angry	Angry	Previously worried, now no reaction	No reaction
Discussed with family members	Yes	Yes	Yes	No
Reaction of family members	Supportive	Supportive	''It's your imagination''	–
Discussed with doctor	No	No	Yes	No
Reaction of doctor	–	–	''Laughed and recommended no further action''	–

CBS has been reported in patients with various ocular pathology including age related macular degeneration,[9 11 12] diabetic retinopathy,[7 9 10] glaucoma,[19] and cataract.[10 20] Complex visual hallucinations may also occur following certain ophthalmic procedures, including laser photocoagulation for choroidal neovascularisation[24] and macular translocation.[25] In fact, one patient in this series reported the onset of CBS following laser iridotomies for bilateral primary angle closure glaucoma and has been separately reported.[26]

Interestingly, the BCVA in the better seeing eye was quite good in three of our patients. Although CBS occurs more commonly in patients with poor visual acuity,[10–12] Gold *et al* argued that the diagnosis of CBS does not exclude or require eye pathology.[3] This view has been supported by findings in other studies, where the BCVA in the better seeing eye of some CBS patients was as good as 20/30.[9 12] One reported CBS patient had a BCVA of 20/20 in both eyes.[20] Holroyd *et al* suggested a possible explanation might be that while visual disorder is a predisposing factor for visual hallucinations, the degree of visual loss may not be related to the likelihood of developing CBS.[9] In a review of 64 cases, Schultz *et al* found that the degree of reduction in visual acuity ranged from slight to total blindness. In some cases, the reduction in vision was the result of a hemianopia with normal acuity in the intact visual field.[6] This may explain the occurrence of visual hallucinations experienced by our third patient. Although the central visual acuity was good, he had bilateral superior arcuate visual field defects.

The characteristics of CBS hallucinations are quite variable between patients and the hallucinations experienced by our patients exhibited the same wide variety as in previous studies.[7 9 11]

The same three patients who found their hallucinations annoying or frightening voluntarily discussed their symptoms with their family members. Two reported that their relatives were supportive and attributed the hallucinations to their poor eyesight. Since they did not perceive the hallucinations to be a problem, they did not see the need to discuss their symptoms with a doctor. The third patient's relatives concluded that the hallucinations were the result of his imagination. This prompted him to seek the advice of his family physician who ''laughed and recommended no further action.'' The fourth patient was not bothered at all by his hallucinations and did not mention it to anyone.

Not all patients discuss their hallucinations with their doctors.[7 11 19 20] In one study, 73% made no mention of their symptoms to their doctors.[7] Common reasons included fear of being labelled insane,[7 11 12 18 20] of not being taken seriously,[7] or because they thought that they should not consult a doctor for this.[7] In one study, of the 16 patients who did discuss their symptoms with a doctor, only one doctor (6.3%) made the correct diagnosis.[7]

Other than the initial fear or irritation, which subsided with time, our patients did not experience any extreme emotions as a result of their hallucinations. CBS patients are known to experience various reactions to their hallucinations, from negative emotions[9 12] such as anxiety and irritation to positive ones such as joy or amusement.[7]

None of our patients felt the need to hide their symptoms for fear of being labelled a psychiatric case, although, similar

to other CBS patients,[10 19] three were relieved to hear that CBS is a known condition and affects others. It is important for doctors to be aware that formed visual hallucinations may occur in visually impaired patients. The proportion of visually handicapped individuals in the Asia ranges from 0.4% to 1.2%[27 28] and some of these may experience formed visual hallucinations. Even if they are not bothered emotionally or have come to accept them, it still brings some relief that such symptoms do not indicate psychiatric illness.

The mainstay of treatment of CBS involves recognition, empathy, reassurance, and patient education.[1 2] Pharmacotherapy has not universally proved to be useful,[1 2] although drugs such as carbamazepine and haloperidol[8] have been used. Since our patients were not bothered by their symptoms, they were reassured and educated about the condition.

Owing to the small number of CBS cases, we were unable to determine the risk factors for CBS. As more Asian CBS patients are studied, it may be possible to determine if there is any predilection among certain sex or ethnic groups. In summary, our study shows that patients attending a tertiary ophthalmic centre in Singapore have a prevalence rate of CBS which is slightly lower than in comparable studies in non-Asian countries.

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APPENDIX

Questions on hallucinations

- 1 How long have you seen these images?
- 2 How frequently do you see these images?
- 3 How long does each episode last?
- 4 Has the frequency of hallucinations changed or remained the same since it started?
- 5 Can you describe the images that you see? (If there are more than one, list the common types of hallucinations)
  - People
  - Animals
  - Plants/trees/flowers
  - Buildings
  - Scenery
  - Others (list)
- 6 What is the size of the image compared to normal objects of the same type?
- 7 Does the image have colour or is it black and white?
- 8 Does the image appear solid or can you see though it?
- 9 Does the image ever move?
- 10 How clear is the image compared to normal objects?
- 11 Is this image familiar to you (something that you have seen before)?
- 12 Do you see the same image over and over again?
- 13 Does the image appear in only some parts of your vision or can it appear anywhere?
- 14 Does the image occur only in the eye with poorer vision?
- 15 Is there any situation that makes the image more likely to appear?
- 16 Is there anything that you can do to make the image go away?
- 17 What is your usual reaction to the hallucinations?
- 18 Have you ever told a family member of your hallucinations? If so, what was their reaction? If you did not tell anyone, why not?
- 19 Did you discuss your symptoms with your doctor? If so, what was his reaction? If not, why not?
- 20 Does the image have any personal meaning to you? If yes, elaborate
- 21 Do you feel better now that you know that people who are ''normal'' (that is, not mad) can sometimes see these images?

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ECHO

Gene effects in environmentally determined subgroups

Please visit the *Journal of Medical Genetics* website [www.jmedgenet.com] for a link to the full text of this article.

There has been controversy about the usefulness of stratification by environmentally determined subgroups in genetic research. In cancer epidemiology only a few genetic polymorphisms cause a substantial change in risk and many genes involved in the metabolism of mutagens have little or no effect. But the inclusion of environmental measures in genetic studies might reveal environment-gene interactions. Such combined studies have been questioned, however, on the grounds that they are unlikely to increase the power of the genetic study very much. It has been said that the effects of genes in different environmental subgroups are likely to be in the same direction even if varying in size, and this would limit the gain in power. Australian authors have listed several examples to counter this argument.

The first example they give is of the influence of maternal smoking on the effect of the *CYP1A1* gene on birthweight. The gene controls the metabolism of chemicals in tobacco smoke. When all 741 mothers in a study were considered the incidence of low birthweight was identical (21.5%) in mothers with genotype AA and mothers with genotype Aa or aa. Among the 124 maternal smokers however, the incidence of low birthweight was 24% (AA) *v* 45% (Aa or aa).

The second example concerns the *GSTP1* glutathione transferase gene, Parkinson's disease, and exposure to pesticides. Among all subjects in one study there was no significant association between the genotype and Parkinson's disease but among subjects exposed to pesticides one polymorphism increased the risk of Parkinson's disease more than fivefold. In the third example they quote a study of the effect of a monoamine oxidase A polymorphism on antisocial behaviour. It has been found that the polymorphism increases the rate of antisocial behaviour only among people who suffered from maltreatment as children. Among people who had not been maltreated in childhood the polymorphism tended to be associated with less antisocial behaviour. Another example of a change in direction of gene effect according to environmental subgroup is the effect of an alcohol dehydrogenase polymorphism on HDL cholesterol concentrations according to level of alcohol consumption. Different polymorphisms may also have different effects on the outcome of a single environmental factor. An example of this is the effect of different β_2 adrenoceptor gene polymorphisms on the risk of obesity at varying levels of carbohydrate consumption.

The authors of this paper conclude that inclusion of environmental data may enhance the search for disease causing genes.

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