Original Article

Screening for Charles Bonnet syndrome: Should the definition be reconsidered?

PremNandhini Satgunam[1], Rebecca Sumalini[1,2], Gayathri Chittapu[3], Gunasree Pamarthi[3]

Purpose: Charles Bonnet syndrome (CBS) is a condition in which individuals with visual impairment (VI) and with no cognitive deficits experience visual hallucinations, typically with no other sensory hallucinations. Although few isolated case reports of CBS from India have been published, the prevalence for CBS in India is largely unknown. The primary aim of this study was to estimate CBS prevalence in patients with vision impairment visiting a tertiary eye care center. **Methods:** The study was conducted in two phases. In phase 1, patients with VI, age ≥40 years with presenting visual acuity worse than 20/63 were enrolled. In phase 2, patients with presenting visual acuity worse than 20/63 and/or with binocular visual field loss, age ≥18 years were recruited. A CBS survey was administered only to those who passed a screening test for cognition impairment. **Results:** A total of 218 patients were screened (phase 1 = 113 and phase 2 = 105). Two-hundred ten patients (mean age ± standard deviation = 49.2 ± 17.3 years, males = 139) were found eligible to complete the CBS survey. Fourteen patients were found to have visual hallucinations. In addition, three other patients had visual hallucinations with associated auditory input to the visual imagery. All patients had complete insight about their hallucinations. **Conclusion:** Depending on the inclusion criteria, we found the prevalence for CBS in patients with VI to vary between 6.7% to 8.1% (if including patients with auditory input). More investigation is needed to assess the associated role of other sensory inputs (e.g. auditory) with the visual imagery experienced in CBS.

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Charles Bonnet Syndrome (CBS) is a condition where an individual with visual impairment (VI) and with intact cognition experiences visual hallucinations with lack of other sensory inputs (e.g., no sound or smell is present).[1,2] The visual hallucinations experienced can be simple (e.g., seeing bubbles) or complex (e.g., seeing unicorns)[3,4] and can be static or kinetic images.[5] Although there is no definitive diagnostic criteria, descriptions have included absence of control over the hallucination, possible disappearance of the hallucination on closing the eyes and having full or partial awareness that the hallucinations experienced are not real.[6,7] The diagnostic criteria also have varied between the inclusion[8] and exclusion[9] of simple hallucinations.

The pathogenesis for the visual hallucinations in CBS is unclear. Some proposed theories include the deafferentation theory that suggests the visual hallucination arises from the visual association cortex after neuronal damage to the visual pathway.[1] Comparisons similar to patients experiencing a sensation of pain or discomfort at the site of an amputated body part (phantom limb theory) have also been made.[6] CBS is mainly diagnosed through verbal interrogation by the treating clinician, only when the patient complains about hallucinations. This poses a difficulty, as most clinicians do not interrogate proactively and patients also hesitate to present their symptoms for fear of being labelled mentally ill.[1] Thus, the condition remains largely unreported or underreported.[1,4] Also, as dementia, including Alzheimer's and Parkinson's disease are common in old age, many patients distressingly begin to assume they are developing such mental illness.[1,10]

While VI resulting from conditions affecting any of the visual pathway structures can cause CBS, it is very predominant in patients with age-related macular degeneration (AMD)[11-13] and other ocular diseases affecting the central vision like cataract.[14] The prevalence of CBS amidst the visually impaired population is higher in the Western population ranging from 11% to 63%.[15-17] On the other hand, the prevalence is lower in East Asian countries varying from 0.4% to 1.4%.[9,18,19] Social structure and close associations with family and friends have been quoted as reasons for the lower prevalence in the East Asian countries in contrast to an isolated lifestyle of the West.[9] However, it is not known if the lower prevalence is from underreporting in the East Asian countries owing to the social stigma associated with mental illness.[9] Other study design-related differences (e.g. inclusion and exclusion criteria)

[1]Brien Holden Institute of Optometry and Vision Sciences, L V Prasad Eye Institute, [2]Institute of Vision Rehabilitation, L V Prasad Eye Institute, [3]Work done when at Bausch and Lomb School of Optometry, L V Prasad Eye Institute, Hyderabad, Telangana, India

Correspondence to: Dr. PremNandhini Satgunam, Brien Holden Institute of Optometry and Vision Sciences, L V Prasad Eye Institute, Road No 2, Banjara Hills, Hyderabad - 500 034, Telangana, India. E-mail: premnandhini@lvpei.org

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for CBS could have also accounted for the differences in the prevalence.

Prevalence of CBS in India is unknown. Few isolated case reports of CBS in patients with VI have been mostly documented by psychiatrists in India.[20-23] Most of these reported patients were treated with psychiatric medications. Although there is no standard treatment for CBS, especially in cases of irreversible vision loss, management for this condition largely includes patient education, counselling, and reassuring the patient.[17,24] Improving social interaction[1,4] and low vision rehabilitation may also alleviate CBS.[16] Benefits of psychiatric medications such as pregabalin,[25] olanzapine,[22] etc., have also been documented. The reports of benefit with medication are also subjective like the diagnosis for this condition. The present study was undertaken to screen and characterize the presentations of CBS in patients with VI visiting a tertiary eye care center in India.

Methods

A cross-sectional study was undertaken. The study protocol was approved by the Institutional Review Board. The study protocol adhered to the tenets of Declaration of Helsinki. All patients in this study were enrolled with written informed consent. The study period was from December 2013 to March 2014, and patients were recruited during two days of a 6-day working week from the outpatient department. Patients above 40 years of age with visual acuity worse than 20/63 in the better eye were enrolled. Visual acuity values were recorded from their clinical records. Patients with any neurological conditions were excluded. Enrolment of the patients, administering the Rowland Universal Dementia Assessment Scale screening and the CBS survey (see below) were done by two authors. Both the authors read out the instructions and the questions in the same way to avoid any examiner bias. The screening and survey happened during the clinic visit of the patient.

Rowland universal dementia assessment scale screening

All the enrolled patients underwent the Rowland Universal Dementia Assessment Scale screening to rule out cognitive impairment. Questions in Rowland Universal Dementia Assessment Scale were verbally translated to Hindi (official language) or Telugu (regional language) to those patients who did not communicate in English. Rowland Universal Dementia Assessment Scale screening assesses multiple cognitive domains such as body orientation, praxis, drawing, judgement, memory, and language. Rowland Universal Dementia Assessment Scale is not affected by gender and preferred language.[26] Rowland Universal Dementia Assessment Scale has also been found to be appropriate for the sociocultural settings in India over the mini-mental state examination.[27] Only those patients who passed the Rowland Universal Dementia Assessment Scale (score 23 or more out of 30) were administered the CBS survey.

CBS survey

There is no accepted standard survey available to diagnose CBS. We designed a simple survey with nine questions (see Appendix) based on an earlier study conducted in Asia.[9] We pilot tested our survey with few naïve respondents (not actual patients) to check for clarity of the questions. No other validation procedure was undertaken. We designed the survey in English, and translated it to Hindi and Telugu, and back translated with two native speakers of the languages who were also fluent in English.

The first question on the survey asked if the participant has experienced seeing imaginary figures. If they say yes, they were asked to continue answering the rest of the questions. If they answered no, they were asked if they knew of someone who has reported seeing such images. If they answered yes, they were asked to continue answering the rest of the questions (to whatever extent they know). If they answered no, they were asked to stop. We believed that in some instances patients may not be willing to reveal their own hallucination experience for the fear of negative stigma, but may be willing to answer in proxy.

Study Phase II

During the recruitment of patients in the first phase, two patients were referred to us by their treating ophthalmologists who knew about our study. These patients proactively complained of seeing imaginary figures to their ophthalmologists. One patient had glaucoma with advanced field loss and good binocular visual acuity (20/20) because of which he was not enrolled in the study. This patient complained of seeing images of Caucasians walking, with no noise/voice associated with it. The second patient had diabetic retinopathy and binocular visual acuity of 20/25 and therefore was not included. This patient complained of seeing animals and had no other sensory inputs. A third patient with right homonymous hemianopia was seen by the first author for Peli-Prism fitting trial. The patient during the prism trial complained of seeing many people come from the right side and silently cross into his left visual field. He was fully aware that they were imaginary and reported seeing such images in the past ever since his hemianopia. This patient had 20/25 binocular visual acuity. We did not include patients with good visual acuity as per our study protocol. Although association of CBS in the presence of good visual acuity is not common, we found a report[25] of such occurrence as well.

Given that patients with better visual acuity and constricted fields may also have hallucinations, a phase 2 of the study (November 2016 to July 2017) was conducted. This study phase also included patients having visual field loss with otherwise normal visual acuity. Given that CBS was reported in younger individuals,[28] patients aged 18 years and above were also recruited as a part of the second phase of the study. The remaining inclusion criteria and testing protocol were all the same as that followed in the earlier phase of the study. The amended protocol was also approved by the institutional review board. The same set of instructions read out in the earlier study phase was also used in this study phase.

Results

A total of 218 patients (phase I = 113, phase II = 105) who were approached agreed to participate in the study. No patient refused participation in the study. The results from both the study phases are pooled together. The overall mean age ± standard deviation was 49.2 ± 17.3 years. Most of the patients (210 of the 218) passed the Rowland Universal Dementia Assessment Scale and their results are reported. The ocular conditions of these patients are shown in Table 1.

The mean age of the males (n = 139) and females (n = 71) were 48.9 ± 17.4 years and 49.7 ± 17.4 years, respectively. The overall mean ± standard deviation of the Rowland Universal Dementia Assessment Scale score was 26.12 ± 2.16. The mean Rowland Universal Dementia Assessment Scale score for males and females were 26.2 ± 2.24 and 25.98 ± 1.99, respectively, and no statistically significant difference (two sample t-test, P = 0·49) was found between them.

All the 210 patients were administered the CBS survey. No patient reported knowing a friend who has experienced visual hallucinations. Seventeen patients (8.1%) reported experiencing visual hallucination and completed the full survey, four of these patients were from study phase I and 13 patients were from study phase II. Fourteen patients (6.7%) reported seeing visual hallucinations without voice and the other three (1.42%) reported the hallucinations to be associated with voice (2 from phase I). Table 2 shows the demographics of these 17 patients along with the description of the hallucination they experienced. Only 4 of the patients (24%) had hallucinations that did not involve people, the remaining patients mostly saw human figures in their visual hallucination. Other than human figures, animals were also reported by 5 of the patients (29%). All the 17 patients had full insight about their hallucination. The prevalence for CBS [with 95% confidence interval, CI] thus varied between 6.7% (95% CI: 3.7% to 10.9%) to 8.1% (95% CI: 4.8% to 12.6%), excluding and including the auditory input with the visual hallucination, respectively.

Discussion

This study is the first to systematically screen for CBS in a tertiary eye care center in India. We found about 6.7% of patients with VI to have CBS at our tertiary eye care center, when we adhere to the existing definition of CBS (presence of visual hallucination alone). If we include the three other patients who reported experiencing visual hallucination along with an auditory input relevant to the visual imagery, the prevalence rises to about 8.1%.

Table 1: The different ocular diseases diagnosed in the 210 patients are shown

Ocular conditions	Number of patients (%)
Cornea related	
Corneal scar	7 (3.33)
Steven Johnson Syndrome sequelae	2 (0.95)
Phthisis bulbi	3 (1.43)
Lens related	
Cataract	46 (21.9)
Aphakia	2 (0.95)
Uvea related	
Uveitis	2 (0.95)
Uveal coloboma	8 (3.81)
Retina related	
Macular dystrophies	8 (3.81)
Macular degenerations	13 (6.19)
Macular scar	16 (7.62)
Macular edema	3 (1.43)
Macular hole	3 (1.43)
Diabetic retinopathy	19 (9.05)
Retinitis Pigmentosa	31 (14.76)
Retinal vasculitis	3 (1.43)
Optic nerve related	
Glaucomatous optic atrophy	19 (9.05)
Non-glaucomatous optic atrophy	9 (4.29)
Whole globe	
Albinism	3 (1.43)
Others	13 (6.19)

Two independent case reports[21,22] interestingly also from India have noticed auditory inputs in CBS patients experiencing visual hallucination. In both these reports, the patient's visual hallucination completely disappeared along with audio input after visual restoration with cataract removal, clinching the diagnosis for CBS. Another report[29] outside of India have also observed such improvements. A diagnostic dilemma for CBS in the presence of auditory hallucination was also reported in two patients in Japan.[30] In all these case reports, it is unclear if the auditory input had any association with the visual imagery. We use the terminology "auditory input" rather than "auditory hallucination" to make a distinction. Auditory hallucination could be reserved for hearing noises/voices in the absence of an external auditory stimulus and in the absence of any other sensorial input. Auditory input to a visual imagery on the other hand is hearing noises/voices that are relevant to the perceived visual hallucination. The three patients in our study who experienced visual hallucination had an auditory input associated with the visual imagery. Therefore, we do not report it as auditory hallucination. Auditory and visual hallucination independent of each other has also been reported in a patient with CBS in the past.[31] The auditory hallucination (similar to CBS) was because of the sensory deprivation of hearing in this patient. It may be of interest to have patients with auditory input to their visual imagery check for hearing loss. We did not do hearing tests in our study patients.

Not all patients with VI develop visual hallucination and not all patients experiencing visual hallucination have an auditory input associated with the visual hallucination. Also, some patients with CBS go on to develop dementia or other psychiatric problems[32] and in some cases, patients with psychiatric/neurological disorders can develop CBS after acquiring a vision disorder.[33] It has also been noted that about 12.8% of patients with VI have visual and auditory hallucination.[34] Given all these different presentations and variations, there may be a need for finer classification of CBS possibly with subtypes. A previous study had described "CBS plus" condition only when additional cognitive impairment is found.[21,22] A distinction for auditory input without cognitive impairment, however, has not been discussed thus far in the literature.

A meaningful auditory input associated to the source of the visual imagery perhaps has a bearing on the cultural setting. In India, the cultural setting is very different from rest of the countries in the West. Loud traffic noises, crowded people, chatty neighbors, and busy streets are common scenes. Noisy environment is an integral part of the lifestyle and culture, and people are used to these background environmental noises. Environmental and ethnicity influence on hallucinatory experiences are documented to be different.[35,36] It could be possible that the visual hallucination associated in a cultural setting like India easily predisposes an associated auditory input to the visual imagery. The ethnicity and environmental setting of patients who had both visual and auditory hallucination in

Table 2: Profile of patients with visual hallucinations

Age/Gender Binocular visual acuity	Diagnosis/other details	Hallucination Description	Duration/frequency
84/Male 20/502	Pseudophakia, tessellated fundus (BEa). Spectacles broken, since1 year.	Sees cows and goats, not with great details. The images bothered him. These images disappeared upon moving or blinking the eyes. Noticing the images after discontinuation of his spectacles.	12 months/Not sure on how often he saw these images.
47/Male 20/100	Cataract (BE), diagnosed during the study visit. Patient has vision difficulties for about 3 years.	Seeing animal like images, coming close to him at night times when he is alone. He was bothered by the images and the image disappears upon closing his eyes.	>12 months/Not sure on how often he saw these images.
70/Male 20/126	Optic atrophy (BE), diagnosed 1 year back.	Seeing images of people, family members (recognized by their voice). Reports images to persist upon closing or blinking his eyes. He was not always bothered by these images.	12 months/saw these images (once in 2-3 weeks).
42/Female 20/159	RP[b] diagnosed 6 years back. Visual fields less than 5 degrees (BE).	Sees trees and people. Also sees her daughter (hears voice). Image appears more in dim light, doesn't necessarily disappear with blink. Images do not bother her.	Not sure.
65/Male 20/400	Retinal vasculitis (BE), diagnosed 3 years ago.	Sees shadows of people walking.	<6 months/ sometimes (once in 2-3 weeks).
57/Male 20/100	Resolved central serous retinopathy (BE), Healed retinal vasculitis (LE), vision loss since 42 years.	Sees both familiar and unfamiliar people when he is alone.	<6 months/rarely (once in 2-3 months).
50/Female 20/100	Glaucoma (BE), diagnosed 1 year ago.	Not specific of what she sees, says it could be animals/ people. Specifically sees when she is with her family/ friends.	6-12 months/almost daily.
45/Male 20/159	Retinal vasculitis (BE), diagnosed 10 years ago.	Sees people and animals when he is alone.	6-12 months/rarely (once in 2-3 months).
52/Female 20/126	Myopic macular degeneration (BE), diagnosed 10 months ago.	Not specific of what she sees, says it could be animals/ people. Sees both when she is alone and with others.	Not sure since when and how frequent it is.
58/Male 20/600	Myopic chorioretinal degeneration (BE), diagnosed 15 years ago.	Sees people and animals along with audio sometimes. Mostly when she is alone.	>12 months/more than once in a week.
50/Female 20/63	Glaucoma (BE), diagnosed 6 months ago.	Sees both familiar and unfamiliar people when she is alone.	>12 months/not sure of how frequent it is.
28/Female 20/80	Optic atrophy, (S/P Brain tumor) (BE), diagnosed 9 years ago.	Saw creepers and demonic faces 1 month after the loss of vision.	Had seen such images 1 month after the loss of vision for about 6 months.
21/Male 20/63	RP (BE), advanced VF loss: <10-20 degrees in both eyes. diagnosed 7 years ago.	Sees people standing and walking, when he is with others.	<6 months/always (more than once in a week).
22/Female 20/126	LCA[c] (BE), diagnosed 4 years ago.	Sees people walking when she is with family/friends.	<6 months/rarely (once in 2-3 months).
40/Male 20/400	RP (BE), diagnosed 30 years ago.	Sees snake like images.	<6 months/rarely (once in 2-3 months).
27/Female 20/32	RP (BE) (advanced VF loss: <10 degrees in both eyes), diagnosed 7 years ago.	Sees people when she is alone.	>12 months/always (more than once in a week).
54/Male 20/320	Glaucoma (BE), diagnosed 5 years ago.	Sees family members often.	<6 months/always (more than once in a week).

the study from USA[34] is not known. A previous study from Singapore[9] reported excluding patients experiencing auditory hallucination even though it was associated with the visual hallucination. The study, however, does not report the number of such exclusions. Further carefully controlled studies will be required to answer the speculation on association between environmental noise levels and auditory input to visual hallucinations in CBS patients.

Higher prevalence of CBS in Western countries[11-13] typically have a large number of patients with AMD or where conducted only on AMD patients. AMD is the leading cause of blindness

in the Caucasian population. In countries like India, cataract is a leading cause of VI, evidenced also by the ocular diagnosis of our study population, 46/210 patients had cataract whereas only 3/210 had AMD. Retinitis pigmentosa was the second leading cause of VI (n = 31) in our study cohort. Although different kinds of visual hallucinations have been described in ocular conditions leading to VI because of pathologies occurring at different anatomical levels,[37] it is not known if there is a greater predisposition for CBS to occur in diseases that affects retina rather than in a condition that causes VI because of optical degradation. Comparison of prevalence of CBS between cataract, retinitis pigmentosa, and other retinal and neural conditions (e.g. traumatic brain injury resulting in hemianopia) from homogenous population may give some insights to this question.

We found the Rowland Universal Dementia Assessment Scale screening easy for our patients to understand and perform. Two questions in Rowland Universal Dementia Assessment Scale involve the use of vision. One question instructs the participant to copy a geometric figure and the second question instructs them to copy the examiner performing a hand exercise (praxis). If the visual acuity of the participant is very poor, they may not be able to perform these visual tasks. The worst binocular visual acuity was 20/800 in our study. Most of our study patients struggled to copy the geometric figure exactly; nevertheless, they passed Rowland Universal Dementia Assessment Scale through other domains. The difficulty to copy the geometric figure was not necessarily from vision limitation. We noticed those who had poor literacy level reported they can see the figure, but do not know how to draw it. We did not record the educational levels of our patients in this study. Education bias in Rowland Universal Dementia Assessment Scale has been reported.[27] Future work planning to use Rowland Universal Dementia Assessment Scale to rule out cognitive deficits in patients with VI must consider this limitation. Electronic magnification device may be used to enable the participant to do the drawing task (in cases of vision difficulty), such adaptive technology was not used in this study. Another option could be that Rowland Universal Dementia Assessment Scale can be rescaled, dropping the questions on the visual task; however, such a modification may require revalidation of the Rowland Universal Dementia Assessment Scale screening test. Mini-mental state examination test, while used in several CBS studies also has limitations from visual task,[4] but this test has also been criticized for not being sensitive enough to pick up early dementia.[32]

Visual hallucinations can also be caused by neurological disorders (e.g. Parkinson's disease, Lewy body dementia, Lhermitte's hallucinosis), psychiatric disorders (e.g. delirium, schizophrenia), toxic and metabolic disorders (e.g. drug withdrawal syndrome, endocrine disturbances), and by other miscellaneous conditions (e.g. sleep deprivations, intense emotional experiences).[4] A recent review article reports that most CBS patients could be exhibiting early dementia that is missed,[32] whereas on the other hand misdiagnosing CBS patients resulting in unsuitable therapy is also worrisome.[6] Clearly, there is a great need for understanding, diagnosing, and comanaging CBS patients with a team of multidisciplinary healthcare professionals. Systematic multidisciplinary research will also be valuable to understand this condition in the aging population.

All of the 17 patients in our study had not reported about their visual hallucination to their testing eye care professional. Upon detection, we educated the participant about CBS and also advised them to seek low vision services and increase their social activities.

Conclusion

In conclusion, we observed that the number of patients with CBS reporting to our tertiary eye care center may be higher than those reported for other Asian countries.[9,18,19] A larger perhaps multicenter study covering different geographical regions in India can give an accurate estimate for the prevalence of CBS in India. Given that the syndrome can be easily mistaken for dementia or other cognitive impairment, it is important eye care professionals be aware of this condition, identify these patients, and as required comanage them with other healthcare professionals. Information pamphlets on CBS given to patients with VI impairment and or their family members can create greater awareness. At present, we have such information pamphlets in English, Hindi, and Telugu in our clinic. Patients experiencing visual hallucination with associated auditory input should also be investigated carefully under the purview of CBS.

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Conflicts of interest

There are no conflicts of interest.

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