

CASE REPORT

A case of schizophrenia with congenital color vision deficiency: From the perspective of color universal design to promote medication adherence

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Abstract

Color-blindness, or more accurately, color vision deficiency (CVD), which is the inability or decreased ability to distinguish different colors, is one of the commonest visual disorders. Patients with schizophrenia usually have multiple types of visual processing impairments, including color vision impairments. Here, we present a case of schizophrenia with congenital CVD. The patient was aware of his color deficiency since elementary school. We assessed his ability to distinguish medicines based on their color, including those that he had been previously prescribed. Although he could distinguish all of the tablets, he could not distinguish the color of the blister packs, specifically that of the bromazepam 2 mg pack (green) from the 1 mg pack (red). This case suggests that CVD patients might misunderstand the color of medications, which might lead to medication errors, or poor drug adherence. The color universal design principle should be considered when designing tablets and their blister packs, in order to improve medication adherence.

KEYWORDS

color blindness, color universal design, color vision deficiency, medication adherence, schizophrenia

1 | INTRODUCTION

Color-blindness, or more accurately, color vision deficiency (CVD), is the inability or decreased ability to distinguish between different colors, and is one of the commonest visual disorders.¹ Here, we present a case of schizophrenia with congenital CVD. The patient has provided permission to publish these features of his case, and the identity of the patient has been protected.

2 | CASE REPORT

The patient was a 25-year-old man who had been under treatment for schizophrenia for 5 years. He was treated with the long-acting

antipsychotic aripiprazole (400 mg/28 days) and risperidone oral solution 1 mg/mL, along with benzodiazepines (bromazepam 2 mg tablet or lorazepam 0.5 mg tablet), as needed. The patient was currently enrolled in a vocational training school. Since he applied for employment transfer support, which required a health certificate that included the results of a color vision test. Color vision testing using the "Ishihara test"² revealed that he had difficulty distinguishing between red and green colors. Questioning revealed that he had been frequently unable to distinguish between red and green colors even before he was diagnosed with schizophrenia and had been diagnosed with this during medical checkups at elementary school. There were no other factors, including medications, to explain his visual condition. His antipsychotic medications and symptoms of schizophrenia had not changed the severity of his CVD. Since

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additional testing was needed to determine the degree of color deficiency, he was referred to an ophthalmologist, but he declined the consultation because the CVD did not interfere with his life.

However, the question arose about whether he was able to distinguish the color of medications, since he often confused red and green items. This would likely apply to tablets and blister packs as well. Although he said he had never experienced medication errors, we were not completely sure about this. Hence, we assessed all possible medications that he received, including those he had been prescribed in the past, such as:

2.1 | Oral solutions

Risperidone oral solutions: 0.5 mL (orange), 1 mL (blue), 2 mL (green), and aripiprazole oral solution: 1 mL (pink), 6 mL (cream color).

2.2 | Tablets

All of the tablets were white, except for flunitrazepam (light blue). The patient could distinguish all of the tablets.

2.3 | Blister packs

Diazepam tablets: 5 mg (sky blue), 2 mg (yellow), lorazepam tablet 0.5 mg (silver), alprazolam tablet 0.4 mg (silver), flunitrazepam tablet (green), brotizolam tablet (purple), bromazepam tablets: 2 mg (green), 1 mg (red).

We found that although he was able to distinguish all of the other blister packs, he could not distinguish between the bromazepam 2 mg (green) and 1 mg (red) packs.

3 | DISCUSSION

Color vision deficiency might be congenital or acquired, and congenital forms of CVD occur as a result of cone cell dysfunction.¹ Color blindness is classified into various types according to the affected cone cells, with the red–green deficiency being the most frequent in humans.^{1,3} The prevalence of red–green color deficiency in European Caucasians is about 8% in men and about 0.4% in women, with a prevalence of between 4% and 6.5% in men of Chinese and Japanese ethnicity; the prevalence is also increasing in men of African ethnicity.³ There are several different causes for acquired color vision defects, such as ocular or neurological diseases, metabolic disorders, drugs, and toxins.⁴

Patients with schizophrenia usually have multiple types of visual processing impairments, including color vision impairments.⁵ Previously, 62% of individuals with schizophrenia reported visual distortion.⁶ Another study reported that, among patients with

schizophrenia, 50% patients had moderate CVD, 36% had slight CVD, and 12% had severe CVD.⁷ Psychotic symptoms⁷ and antipsychotic medications⁸ might also be related to color vision impairments. The precise mechanism of CVD in patients with schizophrenia is still unclear, and its treatment is also unclear. Our patient had red–green CVD that had been identified even before he was diagnosed with schizophrenia, suggesting that his CVD was congenital. Additionally, the antipsychotic medications and symptoms of schizophrenia had not affected the severity of his CVD.

People with CVD usually experience disorders in daily activities, learning, and skill acquisition for particular professions, and therefore cannot perform certain jobs.⁹ The management of congenital CVD consists of appropriate counseling, including career counseling. While certain visual aids might also be supportive in CVD patients, they do not normalize CVD¹. Our case highlighted the possibility that CVD patients might misunderstand the color of some medications, which might lead to medication errors or poor drug adherence. It is important to avoid confusing colors in medications. To avoid medication errors, tablets and blister packs should be created using colors and shapes that can be easily differentiated by everyone. The concept of such a color design method is called color universal design.¹⁰ It is important to incorporate color universal design in medication, so that the information can be correctly recognized. Poor color identification might lead to misuse of medication not only by CVD patients, but also by all patients, including those with age-related eye problems. Consideration of color universal design when designing tablets and blister packs will likely improve medication adherence. As mentioned above, given the high prevalence of CVD, care and support for CVD is required in psychiatric patients, especially those with schizophrenia. Additionally, the concept of color universal design is valuable not only for CVD patients, but also for all patients. However, little is known about the care and support of CVD in psychiatric patients, suggesting the need for further research.

AUTHOR CONTRIBUTIONS

KM treated the patient, acquired data, and wrote the manuscript. CT and MU and KF conducted the clinical evaluation. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

APPROVAL OF THE RESEARCH PROTOCOL BY AN INSTITUTIONAL REVIEWER BOARD

The ethics committee is not required to review case reports.

INFORMED CONSENT

The patient gave written consent for publication of this case report.

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