ORIGINAL ARTICLE

COLOUR VISION DEFICIENCY (CVD) IN MEDICAL STUDENTS


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Background: The incidence of Colour vision deficiency varies from race to race and different in different geographical areas. Colour is very important sign used in medical profession, but there is no effective screening for Colour Vision Deficiency (CVD) at any level of medical profession. With the introduction of OSPE / OSCE in university examinations in Pakistan at undergraduate and postgraduate levels, the students with CVD may feel difficulty in identifying colour slides, lab instruments, specimens and examining patients leading to failure in the examination so this study is aimed to find out the incidence of CVD in medical students. Methods: A total of 2,000 medical students including 750 males and 1,250 females between ages 18–21 years were examined for CVD in different Medical colleges of Faisalabad. Each student of 1st year MBBS class without ocular abnormality was shown the complete range of Ishihara’s plates under day light conditions at normal reading distance. Results: Participant’s colour vision was tested using Ishihara’s Charts (Plates). Among 750 boys, 18 were colour deficient (2.4 %). Among 1250 girls, 56 were colour deficient (4.48 %). These results are discussed in relation to other studies and data on colour vision. Conclusion: With this incidence of colour vision deficiency, the students with CVD may feel difficulty in identifying colour slides, lab instruments, specimens and examining patients leading to failure in examination and difficulty in medical practice. Keywords: Ishihara’s Charts (Plates), Colour vision deficiency, Colour blindness.

INTRODUCTION

Colour vision plays an important role in health care system. Colours have three attributes: hue, intensity and saturation. Colour blind people are not actually blind, but are colour deficient, so more appropriate term to be used for colour blindness is colour vision deficiency (CVD). The first known scientific paper on CVD was written by John Dalton, who himself was colour blind, so CVD is also called ‘Daltonism’, after John Dalton. CVD is a condition characterized by disturbances of colour perception that occur if the amount of visual pigment per cone is reduced, or if one or more of the three cone systems are absent. Individuals with CVD are often unable to distinguish between different colours of the spectrum.

Wide spread interest in CVD followed John Dalton’s description of his own Duetsn (middle wave) deficiency, but, for the preceding centuries, the deficiency has been described as an immensely well kept secret. Many doctors may be unfamiliar with some modern concepts of colour vision; however, excellent reviews can be found. The Young Helmholtz theory of colour vision in humans postulates the existence of three kinds of cones, each containing a different photopigment and that are maximally sensitive to one of the three primary colours. Red, green and blue are the basic colours. Colour is mediated by ganglion cells that subtract or add input from one type of cone to input from another type. Normal vision is trichromatic, the three primary hues are detected by three types of cones containing photosensitive pigments that overlap but peak in the green (long wavelength), yellow-green (middle wave length), and violet (short wave length) parts of the spectrum. By comparing the rates of absorption of photons, the visual system is able to discriminate colours. It is the varieties of hue, saturation (the similarity of a colour to white) and brightness that lead to an estimate that the human eye is able to distinguish, at equal luminance 17,000 perceptible differences in colour. When a specific colour receptive cone is missing from the eye, the person is unable to distinguish same colour from others. Adjoining colours (colour contrast and colour constancy), expectation, and memory are among factors that influence the colours actually perceived.

The four types of CVD are Protan (red or long wave), Duetan (green or middle wave), Tritan (blue or short wave), and Achromatopsia (total absence of colour vision). Aetiologically, colour vision defect may be congenital (CCVD) or acquired (ACVD). Congenital CVD has 8% prevalence for men and 0.4% for women in general population. Red-green perceptive disorders are X-linked recessive, but blue colour perceptive disturbance is caused by a simple mutation in gene coding for blue receptor on chromosome 7, and is autosomal dominant. The acquired deficiencies are caused by ocular and intracranial pathologies, drugs, diabetic retinopathy, hypertension, glaucoma, macular degeneration and yellowing of the lens due to ageing. Tritan deficiencies are the most common of acquired form. The prevalence of acquired deficiencies is not known but probably greater than the congenital form, particularly in older people. Association between hearing and vision impairment has been investigated in detail. The findings
have significance for clinicians, in that finding a deficit in one domain (vision) indicates an increased likelihood of deficit in the other domain (hearing) especially in old age.20

In a study21, it was concluded that doctors suffering from CVD were poorer detecting physical signs and naming the colours and were less confident about their decisions. So the patients’ safety is potentially jeopardised if CVD is not tested both initially and routinely.22 Health professionals suffering from CVD have difficulty detecting body colour changes (pallor, cyanosis, jaundice), skin rashes and erythema, Stage I pressure ulcers, blood or bile in urine, faeces, sputum, vomit, malaena, mouth and throat conditions, test strips, colour coded medications, charts, slides, prints, and colour sensitive monitors etc.23,24

Colour is very important sign used in medical profession, but there have been few studies with references to implications of colour vision deficiency (CVD) on the medical skills of the persons involved in medical profession.14 Medical students are screened for congenital colour vision deficiency at only one university in United Kingdom25,26 and at a few in rest of the world14. Prevalence of (CVD) varies from race to race, and is different in different geographical areas.

With the introduction of OSPE/OSCE in university examinations, the students with CVD may feel difficulty in identifying colour slides, lab instruments, specimens, and examining patients, leading to failure in the examination. This study is aimed to find out the incidence of CVD in medical students.

MATERIAL AND METHODS

A total of 2,000 medical students of 1st year MBBS class including 750 boys and 1,250 girls aged 18–21 years have been tested for CVD in Punjab Medical College Faisalabad, Independent Medical College, Faisalabad, and University Medical and Dental College, Faisalabad. The inclusion criteria were 1st year MBBS class without ocular abnormality.

Each student was shown the complete range of Ishihara’s plates under day light conditions at normal reading distance. Time consumed for reading each plate was not more than 5 seconds. The plates were shown to each student once only.

RESULTS

Total 2,000 students of age group 18–21 years were examined having mean age 20.85 years. The frequency of CVD in the subjects is shown in Table-1.

Table-1: Frequency of CVD in first year medical students (n=74)

<table>
<thead>
<tr>
<th>Subject (n=2000)</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (n=750)</td>
<td>18</td>
<td>2.4</td>
</tr>
<tr>
<td>Females (n=1250)</td>
<td>56</td>
<td>4.48</td>
</tr>
</tbody>
</table>

DISCUSSION

The prevalence of CVD varies from race to race and differs in different geographical area.25,26 Vijayalakshmi et al, reported CVD in Hindu casts and religious groups of different parts of the India. The prevalence reported was 2.1% in 7,542 males and 0.2% in 3,519 females.27 Prevalence of the CVD in Caucasians is 8% for men and 0.4% for women.28 In Western Nepal, in a study on 964 school children (10–19 years age group), CVD was found in 18 boys with prevalence of 3.8%, but none of the girls was found affected.29 Sardighan30 reported 2.13% and 0.57% CVD in male and female Iranian medical students respectively. In USA, prevalence of CVD in junior medical students was 12.8%30, and in dental students it was 7.8%31. In UK, prevalence among histology students was 8.7%.32 Seven percent of males and 0.4% of female population is suffering from CVD in 10 million American people.33 In the present study, the observation among medical students of Faisalabad revealed prevalence of 2.4% in males and 4.48% in females. Significantly higher prevalence in females requires further work to explore the problem.

Individuals with CVD perform less well than those with normal colour vision.34 Failure of observation for those with congenital CVD has been demonstrated for students in practical chemistry35, histopathology36, microscopy37, and persons using colourimetric test for blood and urine samples38,39. Koningsberger et al40 found 15 (11.11%) endoscopists with CVD attending a meeting, all of them were unaware of it. The direct observation of physical signs in patients that are reported to cause difficulties, for example, pallor, erythema, cyanosis, and body products, comprise the range of colours that are known to cause failures of discrimination for those with CVD.40,41,42 CVD becomes very important in cases where there is so called pivotal observation43, a single sign that is essential to observe for the correct course of action. If a doctor misses certain symptoms or clues because of CVD, the patient’s medical issue may be undetected and become worse when it could easily have been prevented. With the increased use of colour oriented computer screens, people with CVD may likely miss important signs that indicate cancer or other anomalies that are present. Spalding44 found support that doctors and nurses with CVD, specifically moderate or severe performed worse than ones with normal colour vision for certain medical procedures.

As for outlook/prognosis is concerned, it is still a lifelong condition and there is no known treatment45, but experimental study on adult red green colour blind primates (gene therapy cures colour blind monkeys46) might provide a breakthrough in this regards. Recolouring tools are available that modify the colours in an image so they are more easily distinguishable for those with CVD.43

CONCLUSION AND SUGGESTIONS

With higher incidence of colour vision deficiency, the students with CVD may feel difficulty in identifying colour slides, specimens, and examining patients leading to failure in examination, and difficulty in medical practice. There is need for screening for CVD in medical students, medical laboratory technologist and doctors, not only at the time of selection, but also periodically during training/practice. This would facilitate the detection and management of CCVD as well ACVD more effectively.

REFERENCES

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