Original Article

Colour Vision Deficiency Amongst Medical Students - A Prospective cross-sectional study

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Abstract

Introduction: This study was conducted to analyze the prevalence of color vision deficiency among a group of medical students.

Materials and Method: In this prospective cross-sectional study, 300 undergraduate medical students in the age group of 19-22 years were screened for Color Vision Deficiency (CVD) using Ishihara's Pseudo-isochromatic chart. Students with defective color vision were identified.

Results: After careful screening it was noted that, out of the 300 students, color vision deficiency was seen in 9 students (3%) including 8 males and 1 female.

Conclusion: Our study shows a male preponderance for color vision deficiency which is similar to the previous studies done. CVD commonly remains undetected and hence medical students and doctors must be screened for color vision deficiency and made aware of their defect, so that they can take special care in future clinical practice.

Key Words: Color blindness, Ishihara plates, Medical students.

Introduction

Color plays an important role in being a sign in medical practice. Right from Biochemistry and Histology to Internal Medicine and Surgery, we unconsciously rely on our color vision to help us. However there has not been a lot of work done on studying the effects of Color Vision Deficiency (CVD) amongst doctors and medical students.

Awareness of the implications of CVD is usually restricted to those who suffer from it. Some doctors have given accounts in published articles about the difficulties it causes in medicine, and a couple of research articles have been published on this subject. Conclusions drawn from personal accounts inevitably are subjective, but recent studies have provided better evidence on the types of difficulty encountered and the effects on performance.

Screening for this deficiency pre-vocationally is only done for a few professions where color vision is considered important and not as a routine, even in the field of Medicine.

Normal vision is trichromatic, three types of cones detect the three primary hues which contain photosensitive pigments which overlap and peak in the green, violet and yellow-green parts of the spectrum. By comparing the rates of absorption of photons, the visual system can discriminate colours.[1]

Ganglion cells mediate color which add or subtract input from one type to cone to the input from another type.[2]

There are three different types of cones, which contain a photo pigment maximally sensitive to one of the three primary colors- Red, Green and Blue.

CVD is basically a disturbance in the perception of color which could be due to a decrease in the amount of visual pigment per cone or a reduction in the number of cones.[3]

Color vision deficiency can be congenital (CCVD) or Acquired (ACVD).[4]

CCVD accounts for 8% prevalence in males and 0.4% in females in the general population.[4]

The congenital form of CVD is usually X-Linked recessive except for Tritan deficiencies which are caused by a mutation in gene coding for blue receptor or chromosome 7 and is autosomal dominant.[5]

Acquired forms could be due to drugs,[6] diabetic maculopathy, hypertension, macular degeneration and yellowing of the lens[7] due to ageing.

The four types of CVD are Protan ('Red' or long wave), Duetan ('Green' or middle wave), Tritan ('Blue' or short wave) and very rarely Achromatopsia (Total absence of color vision).[8]

Widespread interest in CVD followed John Dalton's[9] description (1798) of his deutan (middle-wave) deficiency[10] but, for the preceding centuries, the deficiency has been described as 'an immensely well-kept secret'.[11]

Materials and Methods

A prospective cross-sectional study was conducted in Goa Medical College and Hospital from April 2017-May 2017. Informed consent was obtained from all participating medical students and approval was obtained from the Ethics Committee, Goa Medical College.

A total of 300 undergraduate Medical Students aged between 19-22 years were screened using 24 of Ishihara's Pseudo-Isochromatic plates.
The plates were held at 75 cm distance and tilted at right angles to the line of vision.

All the screening was conducted under daylight conditions in the Ophthalmology OPD with no use of artificial lighting. Binocular testing was done. It was ensured that the test was conducted with due correction for refractive errors both for distance and near vision.

Plate 1- Introduction Plate; Plate 2-15- transformation plates used for screening red-green deficiencies and Plate 16 and 17 are used for protan and deutran defects. If 13 or more plates were red normally, color vision was regarded as normal. If less than 9 plates were red normally, the color vision is considered defective.

Color deficit individuals were immediately re-tested for confirmation and subjected to refraction and correction, Slit lamp biomicroscopy, and fundus examination ensure that no other ocular abnormality was present.

Results

A total of 300 students were enrolled for the study with ages ranging from 19-22 years.

107 were Males and 193 were Females. So a significantly larger number of females were studied.

A total of 9 students were found to be Color Vision deficient accounting for 3% of the 9 students, 8 were males and 1 was female.

All the 9 students identified the first plate correctly but were unable to identify the transformation plates which other students had no difficulty with.

Four out of the nine color blind individuals were aware of their defect.

Discussion

We thus see that color vision deficiency is not rare amongst medical students. Studies have shown that it does cause significant difficulty in medical profession.

Personal accounts of Color vision deficiency have been published by four doctors.

Ahlensteil,[12] a physician; Logan,[13] a physician; Spalding,[14] a GP; and Currier, a neurologist. They reported a wide range of difficulties and many were common to all. Blushing, pallor, faint rashes, cyanosis, erythema, blood in body products, ophthalmoscopy, otoscopy, and microscopy could all cause difficulties in observation. Logan[13] and Spalding[14] recommended the screening of medical students. Logan commented that difficulties could be overcome by awareness, self-training, and effort.

A questionnaire study conducted by Spalding[14] to identify problems faced by 40 Color vision deficient doctors showed that the most common problems faced were:

- Widespread body color changes of pallor, cyanosis, jaundice, and cherry red (25 doctors);
- Rashes and erythema of skin (25 doctors);
- Charts, slides, prints, and codes (24 doctors);
- Test-strips for blood and urine (22 doctors);
- Ophthalmoscopy (18 doctors);
- Blood or bile in urine, faeces, sputum, or vomit (18 doctors);
- Otoscopy (14 doctors).

Dargahi et al (2010) reported 2.40% of medical laboratory sciences students and hospitals' clinical laboratories' employees of 'Tehran University of Medical Sciences' as color-deficient.[15]

Pramanik T, Khatiwada B and Pandit R[16] conducted a study to determine the color vision deficiency among the 215 students of Nepal medical college.

Sardighan reported 2.13% and 0.57% CVD in Iranian male and female medical students respectively.[17]

CVD becomes very important in cases where there is so called pivotal observation[18] 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 for example: An Ophthalmologist with CVD might miss a single dot hemorrhage on a pregnant patient's fundus which would cause him to not screen her aggressively and therein worsen her retinopathy.

Color vision deficiency is still untreatable though gene therapy is being tried on adult primates with red-green deficiency. Colour correction systems are being tried which claim to be able to change the wave lengths of each color going into one or both eyes using eyeglasses or soft contact lenses.

Conclusion

The importance of screening for color vision deficiency in medical students and doctors cannot be stressed enough to guide them in making correct choices in their specialization.

They should be counselled and because of the availability of a wide range of specialties, the need to be deemed unfit for the medical profession need not arise.

Branches like Ophthalmology, Pathology, Dermatology and Gastroenterology should be best avoided.

Screening helps doctors to identify their limitations and think of ways to overcome these challenges, thus increasing their confidence.

Ultimately, it protects the patient from harm and the doctor from litigation.

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