ORIGINAL REPORT

Color Blindness Defect and Medical Laboratory Technologists: Unnoticed Problems and the Care for Screening

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Abstract- Color –blindness is the inability to perceive differences between some color that other people can distinguish. Using a literature search , the results indicate the prevalence of color vision deficiency in the medical profession and its on medical skills. Medical laboratory technicians and technologists employees should also screen for color blindness. This research aimed to study color blindness prevalence among Hospitals' Clinical Laboratories' Employees and Students in Tehran University of Medical Sciences (TUMS). A cross- sectional descriptive and analytical study was conducted among 633 TUMS Clinical Laboratory Sciences' Students and Hospitals' Clinical Laboratories' Employees to detect color – blindness problems by Ishihara Test. The tests were first screened with certain pictures, then compared to the Ishihara criteria to be possible color defective were tested further with other plates to determine color – blindness defects. The data was saved using with SPSS software and analyzed by statistical methods. This is the first study to determine the prevalence of color – blindness in Clinical Laboratory Sciences' Students and Employees. 2.4% of TUMS Medical Laboratory Sciences Students and Hospitals' Clinical Laboratories' Employees are color- blind. There is significant correlation between color – blindness and sex and age. But the results showed that there is not significant correlation between color –blindness defect and exposure to chemical agents, type of job , trauma and surgery history, history of familial defect and race. It would be a wide range of difficulties by color blinded students and employees in their practice of laboratory diagnosis and techniques with a potentially of errors. We suggest color blindness as a medical conditions should restrict employment choices for medical laboratory technicians and technologists job in Iran.

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Key words: Color vision defect; clinical laboratory techniques; manpower; students

Introduction

Color – blindness is the inability to perceive differences between some colors that other people can distinguish. It is most often of genetic nature , but might also occur because of eye, nerve or brain damage or due to use of chemicals(1-2).

Inherited color blindness is most common , affects both eyes and does not worsen over time. This type is found in about 8% males and 0.4 of females. These color problems are linked to X chromosome and are almost always passed from a mother to her son (3). Also, Red – green color deficiencies are inherited in an x-linked fashion. Approximately 6% of males of European ancestry have this type of color vision deficiency. The great majority of individuals with x-linked color deficiency indicates primarily a green – color deficiency. A smaller percentage of individuals with X-linked color deficiency indicates relative red color deficiency (4). Acquired color-blindness is generally unlike the more typical genetic disorders. For example, it is possible to acquire color blindness only in a portion of the visual field' but maintain normal color vision elsewhere. Some forms of acquired color-blindness are reversible(5). There is no treatment for color-blindness, nor it is usually the course of any significant disability. Being color-blind does keep one from performing certain jobs and makes others difficult. A color-blind person is generally unable to interpret some chemical reactions and the chemical testing kits (6). Screening showed that 96% of the color-blind students attending middle school and 65% of the color-

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blind university students are not aware of their anomalous vision status. Thus , screening during the school years would greatly help affected students to choose their future professional orientation (7).

Color blindness deficiency has a high prevalence and is often a handicap in every life. Those who have color-blindness deficiency will be better able to adapt and make more inherited career choices, if they know about their deficiency (8). "Koningsberger et al" (1994) reported that color vision deficiencies were detected in 8% of Dutch gastrointestinal endoscopist affects an endoscopist's diagnostic skill. Using a literature search, the results indicated the prevalence of color vision deficiency (CVD) in the medical profession and its on medical skills(9).

A study , based on retrospective analysis of all the consecutive 471 candidates was conducted for pre employment medical examination (PMES) in non-gazetted railway services in divisional hospital. Majority of the candidates were males and 2.5% of them had deficiency in perception of colors (10).

A number of employees of a public transport authority complained that they had been discriminated against in being restricted in their employment on the basis medical standards for color vision for officers with safety sensitive duties. The complaints were resolved with an agreement to develop and apply a practical test to determine whether officers had appapriate ability to identify signals (11).

Carroll Hospital Center in United States of America establish policies and procedures concerning physical evaluation of candidates for hospital employment. All candidates will have a basic vision screen for eye light and color-blindness. Medical laboratory technicians and emergency department clinical staff will also be screened for color-blindness using the Ishihara screen (12). However, "Heriot- Watt" University also is committed to the health and safety of its staff. As part of this commitment, this pre-employment health questionnaire is required to be completed by all staff have ever suffered from some illness such as color blindness (13).

Materials and Methods

This research reported here aimed to study color-blindness prevalence among Tehran University of Medical Sciences Hospitals' Clinical Laboratories Employees and Students for screening.

A cross-sectional, descriptive and analytical study was conducted among 633 TUMS Medical Laboratory Sciences' Students and Hospitals' Clinical Laboratories' Employees as total employees and students to detect color-blindness problems by Ishihara Test.

Color vision deficiency is most detected with special colored charts called the Ishihara test plates. On each plate is a number composed of colored dots. While holding the chart under good lighting , the patient is asked to identify the number (3,6).

The tests were first screened with certain pictures, then compared to the Ishihara criteria to be possible color defective were tested further with other plates to determine color – blindness defects. The data was saved using with SPSS software and analyzed by statistical methods.

Results

Among 633 studied people, 66% were hospitals' clinical laboratories' employees and 30.3% were medical laboratory sciences students and also 1.1% were both students and employees. 0.5% of students and 1.9% of employees were color-blind. There is no significant correlation between type of job and color-blindness.

94.3% of studied people didn't present trauma and eye surgery history' while 5.7% of them presented these history. Only 2.4% of studied people who didn't present trauma and eye surgery history were color-blind . There is not significant correlation between color-blindness defect and trauma and eye surgery history.

Table 1. The distribution frequency of color-blindness defect of TUMS Medical Laboratory Students and Hospitals' Clinical Laboratories' Employees by sex, $X^2 = 28.825$ $P<0.001$

Color blindness defect / sex		No		Yes		Total	
		N	%	N	%	N	%
Male	N	169	92.3	14	7.7	183	100
	%	--	26.7	--	2.2	--	28.9
Female	N	449	99.8	1	0.2	450	100
	%	--	70.9	--	0.2	--	71.1
Total		618	97.6	15	2.4	633	100

Table 2. The distribution frequency of color-blindness defect of TUMS Medical Laboratory Sciences' Students and Hospitals' Clinical Laboratories' Employees by familial defect. $X^2 = 0.272$, $P > 0.05$

Color blindness defect / History	Among family	No		Yes		Total	
		N	%	N	%	N	%
No	N	607	97.6	15	2.4	622	100
	%	--	95.9	--	2.4	--	98.3
Yes	N	11	100	--	--	11	100
	%	--	1.7	--	--	11	1.7
Total		618	97.6	15	2.4	633	100

4.6% of studied people were exposed to chemical agents. 2.2% of the were color blind and 2.4% were not color blind. There is not significant correlation between color blindness defect and exposure to chemical agents.

28.9% of the employees and students were male and 71.1% of them were females. It seems' 2.2% of males and 0.2% of females were color-blind. There is significant correlation between color-blindness defect and sex. 98.3% of studied people didn't have familial defect and all of color blinded people had history of familial defect. There is not significant correlation between color blindness defect and history of familial defect.

Approximately 50% of studied people were less than 25 years old and 33.3% of color-blinded people were in this age groups. 20% of color-blinded people were 35-40 years old . These defect were not seen in more then 55 years. There is significant correlation between color blindness defect and age but there is not significant correlation between color blindness defect and race (Table 1-4).

Table 3. The distribution frequency of color-blindness defect of TUMS Medical Laboratory Sciences' Students and Hospitals' Clinical Laboratories' Employees by Age, $X^2 = 12.148$, $P<0.05$

Color blindness defect / Age (years)		No		Yes		Total	
		N	%	N	%	N	%
<25	N	310	98.4	5	1.6	315	100
	%	--	49.1	--	0.8	--	49.8
25-30	N	116	99.1	1	0.9	117	100
	%	--	18.3	--	0.2	--	18.5
30-35	N	65	98.5	1	1.6	66	100
	%	--	10.3	--	0.2	--	10.5
35-40	N	37	92.5	3	7.5	40	100
	%	--	5.8	--	0.5	--	6.3
40-45	N	51	98.1	1	1.9	52	100
	%	--	8.1	--	0.2	--	8.2
45-50	N	23	92.0	2	8.0	25	100
	%	--	3.6	--	0.3	--	3.9
50-55	N	13	86.7	2	13.3	15	100
	%	--	2.1	--	0.3	--	2.4
>35	N	3	100	--	--	3	100
	%	--	0.5	--	--	--	0.5
Total		618	97.6	2.4	2.4	633	100

Table 4. The distribution frequency of color blindness defect of TUMS Medical Laboratory Sciences' Students and Hospitals' Clinical Laboratories' Employees by Race, X^2= 6.438 , P>0.05

Color blindness defect / Race		No		Yes		Total	
		N	%	N	%	N	%
Turkish	N	114	95	6	5	120	100
	%	--	18.7	--	1	--	19.6
Kurdish	N	17	100	--	--	17	100
	%	--	2.8	--	--	--	2.8
Lor	N	15	100	--	--	15	100
	%	--	2.5	--	--	--	2.5
Baluch	N	3	100	--	--	3	100
	%	--	0.5	--	--	--	0.5
Gilac	N	22	100	--	--	22	100
(native of Gilan)	%	--	3	--	--	--	3.6
Hyrcanian	N	18	85.7	3	14.3	21	100
	%	--	2.9	--	0.5	--	3.4
Arabic	N	1	100	--	--	1	100
	%	--	0.2	--	--	--	0.2
Turkman	N	1	100	--	--	1	100
	%	--	0.2	--	--	--	0.2
Persian	N	359	98.4	6	1.6	365	100
	%	--	58.8	--	1	--	59.6
Others	N	46	100	--	--	46	100
	%	--	7.5	--	--	--	7.5
Total		596	97.5	15	2.5	611	100

Discussion

This study describes the examination of a cross-sectional study in TUMS Medical Laboratory Sciences' students and Hospitals' Clinical Laboratories' Employees. We expect the findings from this study will show the status of color-blindness defect in these groups and highlight the people who should be targeted by intervention programs for prevention of this visual impairment . However, this is the first study to determine the prevalence of color-blindness in these groups. 2.4% of TUMS Medical Laboratory Sciences' Students and Hospitals' Clinical Laboratories' Employees are color-blind. Also , There is significant correlation between color blindness defect and their sex and age. However, the results are less than the reports of prevalence of color blindness from United Kingdown. But It would be a wide range of difficulties by color-blinded students and employees in their practice of laboratory diagnosis and techniques with a potentially of errors.

Visual impairment has a profound impact on society. The Majority of virtually impaired people live in developing countries and their control is a priority in these countries (14).

A population based study was conducted to determine the prevalence of color deficiencies in secondary- school students in Tehran. The results agree with reports of prevalence of congenital color blindness from Western Europe (15).

Several authors described their experience to suggest that doctors and medical students with color vision deficiency should take special care to ensure safe clinical practice and the case for screening (16-19).

"Spalding" revealed a wide range of difficulties experienced by color vision defective doctors in their practice of medicine with a potentially for errors (20).

Clinical laboratory testing is crucial to detecting and diagnosing diseases. Laboratory employees as technicians and technologists examine and analyze the chemical content of fluids, tissues and cells, look for microorganisms, match for transfusions, and use automated equipment and sophisticated, microscope and cell counters. Lab employees also maintain glassware , instruments, logs and record books. Good vision are

keys to success in this vocation. Color blindness can be a prohibitive factor in some cases (21).

"poole and etal" determined that 13% of histopathologist and 10% of medical laboratory technologists in the United Kingdom have deficient color vision which make more errors in slide interpretation than those with normal color vision. They concluded histopathologists and medical laboratory technologists and technicians should have their color vision tested (22, 23). However, our research results are less than the reports of prevalence of color-blindness from United Kingdom. In conclusion, medical Laboratory Sciences' student and laboratories' employees should be tested for color vision defects as color-blindness before employment.

Color is often used as a sign in medicine , yet there have been few studies into the effects of color vision deficiency (CVD) on medical profession. Using a literature search, the results indicate the prevalence of color-blindness in the medical profession and its effects on medical and paramedical skills in the United Kingdom. The results are more than the reports of prevalence of color-blindness from TUMS Hospitals' Medical Laboratory Technologists and Students. Because of certain feathers of their work , medical and paramedical profession may have special problems. Thus , it is concluded that they should be screened for the deficiency and advised about it (24).

Ideally histopathologist, pathologists and medical laboratory technicians and technologist should have their color vision tested before employment. Medical laboratory sciences, students that should have their color vision tested at medical school may have problems with colorimetric blood or urine testing .

Medical laboratory technologists and students with color-blindness should discuss this condition with their physician before pursuing a career in medical laboratory sciences. The ability to clearly differentiated color is essential for working in clinical laboratories. Because color-blindness can be a prohibitive factor in some cases , Medical laboratory technicians or technologists need to possess good vision (25-29).

It seems a wide range of errors and difficulties experienced by color vision defective lab employees in their practice with a potentially for errors. Although, there is a number of publications on this subject , the profession has made little response to them . This suggested that is inhibiting appropriated action. Though , the advantage of screening of medical Laboratory employees and students are proposed (30).

We suggest color-blindness as a medical conditions should restrict employment choices for medical laboratory technicians and technologists jobs in Iran. They should take special care to ensure precise and safe laboratory practice and the case for screening.

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