Research Article

Accuracy of diagnosis of eye diseases referred by primary health-care physicians in Jeddah City, Saudi Arabia

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ABSTRACT

Background: Proper clinical approach of primary health-care (PHC) physicians is very important for proper diagnosis and management of ophthalmic diseases. Inaccurate diagnosis leads to unnecessary referrals. **Objective:** The objective of this study was to assess the diagnostic accuracy of eye diseases among patients referred to Jeddah Eye Hospital (JEH) and to explore differences in diagnostic accuracy in relation to patients' gender, age, and ophthalmic conditions. **Materials and Methods:** *A cross-sectional study was conducted on 316 patients referred to JEH.* The accuracy of diagnosis was evaluated by comparing *PHC physicians*' and ophthalmologists' diagnoses. **Results:** *PHC physicians* correctly diagnosed 29% of referred cases. History taking and physical examination were done in 85.1% and 21.5% of cases, respectively. The diagnosis was significantly more accurate when they were fulfilled ($P < 0.001$ and $P = 0.002$, respectively). Diagnosis of cases referred by family physicians (42.9%) was more accurate than those referred by general practitioners (27.4%). Chalazion and squint were significantly more accurately diagnosed, while the accuracy was significantly lower if the diagnosis was allergic conjunctivitis. **Conclusions:** More than two-thirds of PHC physicians' diagnoses for referred eye patients were not accurate. Diagnostic accuracy was higher with squint or chalazion when the PHC physicians performed history taking and physical eye examination. Continuing medical education in ophthalmology is highly needed, and the rotation of ophthalmology for postgraduate residents in family medicine must be enforced. Enhancing the availability of basic ophthalmic examination tools such as ophthalmoscopes and visual acuity charts in PHC clinics is recommended. The development of definite referral protocols for PHC physicians is highly recommended.

KEY WORDS: Eye Disease; Primary Health Care; Family Physician

INTRODUCTION

Patients with symptoms of acute eye disease are primarily evaluated in primary health-care centers (PHCCs) or in emergency departments of hospitals. Although most acute ophthalmic conditions that commonly present in PHCCs are of benign nature, yet, some are serious conditions that may eventually lead to blindness. Visual impairment or loss is important since this primary sense markedly controls our everyday activities.[1] Consequently, our well-being becomes disturbed, resulting in emotional distress, increased dependence, and worse quality of life.[2] Moreover, eye diseases add a heavy financial burden over the health system.[3]

The diagnosis and management performed by PHC physicians is important to ophthalmic patients' outcome.[4] Moreover, most encountered cases in general practice involve the external parts of the eye or its anterior segment. Using basic ophthalmic history taking and examination skills can help the physician reach the diagnosis without any advanced equipment, provided that the physician is well trained both at the undergraduate level and in the postgraduate training.[5]

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When referring a patient to secondary care level, ophthalmologists expect that the general practitioner (GP) should give full information about the eye problem and sufficient patient's history. On the other hand, GPs expect a clear response from the eye specialist, especially regarding the justification for the patient's course of management, while the patient expects a clear explanation of his/her diagnosis, management, and follow-up procedures. When any of these expectations are not fully met, all will become dissatisfied with the referral process.[6]

The postgraduate Saudi Board of Family Medicine provides supervised guided learning opportunities for family medicine in ambulatory care and hospital-based medicine in a 4-year, full-time, supervised residency training program. The Canadian Medical Education Directives for Specialists (CanMEDS—FM) framework is applied in the postgraduate training program. The CanMEDS—FM structure includes seven physician roles (i.e., medical expert, communicator, collaborator, manager, health advocate, scholar, and professional). Training consists of three phases. The first 2 years are designed for training mainly in major specialties (e.g., internal medicine, general surgery, pediatrics, and emergency medicine). The 3rd-year training is mainly in several small specialties, including ophthalmology. Family medicine clinical rotations are part of each training year. The 4th-year training is entirely in family medicine.[7]

The present study aimed to assess the accuracy of diagnosis of eye diseases among patients referred by PHC providers to Jeddah Eye Hospital (JEH) and to explore the difference in accuracy of diagnosis in relation to patients' gender, age, and ophthalmic conditions.

MATERIALS AND METHODS

This study followed a cross-sectional study design. It was conducted in JEH. It is the only governmental eye hospital in Jeddah City, Saudi Arabia, to which almost all cases with ophthalmic diseases are referred from PHCCs. It has four clinics, which receive all referrals from different health system sectors.

The study was conducted during April 2015. It included referred cases with eye diseases from PHCCs of any health organization in Saudi Arabia, regardless of the provisional diagnosis at PHCCs. On the other hand, referrals from hospitals or other health facilities other than PHCCs to JEH and referrals for the screening of diabetic and/or hypertensive retinopathy were excluded.

The sample size for this study was calculated by the online "Rao soft sample size calculator,"[8] according to the average number of eye patients referred from PHCCs to JEH during 1 month, with 95% confidence rate and 5% error. The population size was estimated to be 2000, and the minimal sample size was estimated to be 314.

Following a simple random sampling technique, the data of 316 referred patients were included (i.e., 79 patients from each of the four clinics).

After fulfilling all necessary official and ethical approvals, data were obtained from the referral forms after the comments of the ophthalmologist were recorded, using a specially designed form. The diagnosis given by the referring physician was compared with that given by the ophthalmologist. The provisional diagnosis of any referred patient to JEH was evaluated for its accuracy in relation to the ophthalmologist's final decision.

Collected data were entered into a personal computer. Statistical analysis was performed using the Statistical Package for the Social sciences (SPSS version 21, IBM, California, Los Angeles, USA). Descriptive statistics (i.e., frequencies and percentages) were calculated. The Chi-square test was applied to test the significance of differences in diagnostic accuracy according to independent study variables. The results were considered as statistically significant if $P < 0.05$.

RESULTS

More than half of the referred patients were females (180, 57%), with a predominance of adults (185, 58.5%), while 22.8% were children and 13% were elderly patients [Table 1].

Table 2 shows that reviewed referral forms were for 269 referred cases (85.1%) who underwent history taking by the referring PHC physician, while only 68 (21.5%) underwent physical eye examination. Assessment of visual acuity had been done for only 7 referred patients (2.2%), while ophthalmoscopy was performed for 6 cases only (1.9%). The majority of the cases were referred by GPs (288, 91.1%), while family medicine specialists and consultants referred only 28 cases (8.9%). Most referrals were elective (251, 79.4%), while 23 referrals (7.3%) were urgent and 6 referrals (1.9%) were emergency ones. The

Table 1: Personal characteristics of referred patients to JEH

Personal characteristics	*n* (%)
Gender	
Male	136 (43.0)
Female	180 (57.0)
Age groups (years)	
Children (1–18)	72 (22.8)
Adults (19–60)	185 (58.5)
Elderly (>60)	41 (13.0)
Unspecified	16 (5.7)

JEH: Jeddah Eye Hospital

main reasons for referral were errors of refraction (41.8%), cataract (14.9%), and allergic conjunctivitis (13.9%), while cases of chalazion and squint constituted 5.4% and 4.4%, respectively.

Figure 1 shows that only 91 referred cases (28.8%) were correctly diagnosed by the referring PHC physician.

Table 3 shows that diagnostic accuracy of referring PHC physicians differed significantly according to patients' gender, with more accurate diagnoses for females ($P = 0.021$). Moreover, the diagnoses were more accurate for referred children than adults or elderly patients (36.1%, 28.1%, and 24.4%, respectively). However, differences in diagnoses according to age groups were not statistically significant.

It was observed that diagnoses were significantly more accurate when PHC physicians fulfilled history taking and physical examination ($P < 0.001$ and $P = 0.002$, respectively). Moreover, the accuracy of diagnoses was higher accurate when PHC physicians measured patient's visual acuity or used ophthalmoscopy. However, differences in accuracy of diagnoses according to the measurement of visual acuity or performing ophthalmoscopy were not statistically significant [Table 4].

Table 5 shows that achieved diagnostic accuracy for referred cases by family medicine specialists or consultants was higher than for those referred by a GP (42.9% and 27.4%, respectively). However, differences in diagnostic accuracy according to referring physician were not statistically significant. Moreover, the highest diagnostic accuracy was related to emergency referrals (66.7%), while the least was that for unspecified referrals (16.7%). However, differences in diagnostic accuracy rates according to the type of referral were not statistically significant.

Table 6 shows that accuracy of diagnosis achieved by referring PHC physicians was significantly higher when the diagnosed case was a chalazion or squint ($P = 0.024$ and $P < 0.001$, respectively). On the other hand, the accuracy of diagnosis was significantly lower if the diagnosed case was allergic conjunctivitis ($P = 0.006$). Nevertheless, the accuracy of diagnosis was not significantly different if the diagnosed case was an error of refraction or a cataract.

Table 2: Clinical examination and referrals fulfilled by PHC physicians for the referred cases to JEH

Steps	*n* (%)
History taking	269 (85.1)
Physical eye examination	68 (21.5)
Assessment of visual acuity	7 (2.2)
Ophthalmoscopy	6 (1.9)
Referring physician	
Family medicine specialist/ consultant	28 (8.9)
GP	288 (91.1)
Type of referral	
Elective	251 (79.4)
Emergency	6 (1.9)
Urgent	23 (7.3)
Unspecified	36 (11.4)
Main reasons for referral	
Errors of refraction	132 (41.8)
Cataract	47 (14.9)
Allergic conjunctivitis	44 (13.9)
Chalazion	17 (5.4)
Squint	14 (4.4)

PHC: Primary health care, JEH: Jeddah Eye Hospital, GP: General practitioner

Table 3: Accuracy of PHCPs' diagnoses of referred cases according to personal characteristics of referred patients to JEH

Referred patients' characteristics	*n* (%)		*P* value
	Accurate	Not accurate	
Gender			
Male	30 (22.1)	106 (77.9)	
Female	61 (33.9)	119 (66.1)	0.021
Age groups			
Children	26 (36.1)	46 (63.9)	
Adults	51 (28.1)	133 (71.9)	
Elderly	10 (24.4)	31 (75.6)	0.333

PHCPs: Primary health-care practitioners, JEH: Jeddah Eye Hospital

DISCUSSION

Patients who have acute eye symptoms usually first decide to consult their PHC physicians. The most occurred acute eye conditions in PHC practice are the relatively benign conditions (e.g., infective and allergic conjunctivitis). However, less frequent but more serious ophthalmic conditions (e.g., iritis, keratitis, and acute glaucoma), which can lead to permanent loss of vision, also present to PHC practice. Therefore, proper diagnosis and management of PHC physicians is important to patient's ophthalmic outcome.[4]

The current study revealed that more than two-thirds of cases referred by PHC physicians to JEH were incorrectly diagnosed. This finding is in agreement with those reported by several studies, which have shown that incorrect diagnosis of acute eye conditions by GP was not rare.[4,9,10]

To reduce the proportion of incorrectly diagnosed referred cases, the development of definite referral protocols has been

Table 4: Accuracy of PHCPs' diagnoses of cases referred to JEH according to fulfilled steps of clinical examination

Steps	*n* (%)		*P* value
	Accurate	Not accurate	
History taking			
No	2 (4.3)	45 (95.7)	
Yes	89 (33.1)	180 (66.9)	<0.001
Physical examination			
No	61 (24.6)	187 (75.4)	
Yes	30 (44.1)	38 (55.9)	0.002
Measurement of visual acuity			
No	88 (28.5)	221 (71.5)	
Yes	3 (42.9)	4 (57.1)	0.406
Ophthalmoscopy			
No	88 (28.4)	222 (71.6)	
Yes	3 (50.0)	3 (50.0)	0.360

PHCPs: Primary health-care practitioners, JEH: Jeddah Eye Hospital

Table 5: Accuracy of PHCP' diagnoses for cases referred to Jeddah eye hospital according to referral characteristics

Characteristics	*n* (%)		*P* value
	Accurate	Not accurate	
Referring physician			
Family specialist/ consultant	12 (42.9)	16 (57.1)	
GP	79 (27.4)	209 (72.6)	0.085
Type of referral			
Elective	75 (29.9)	176 (70.1)	
Emergency	4 (66.7)	2 (33.3)	
Urgent	6 (26.1)	17 (73.9)	
Unspecified	6 (16.7)	30 (83.3)	0.072

GP: General practitioner

suggested to improve the standard of referral and therefore the service provided to patients.[11]

Results of this study also showed that history taking was missing among almost 15% of referred cases, and only one-fifth of the referred patients underwent physical eye examination. Assessment of visual acuity and ophthalmoscopy for a referred eye patient were rarely performed. Moreover, it has been shown that when history taking and physical examination were fulfilled in the referral forms, significantly more accurate diagnosis was achieved.

These findings have been partly explained by Teo,[12] who stated that the limited time assigned to ophthalmology courses in both medical schools and postgraduate training programs left many non-ophthalmologists with a poor understanding and confidence in assessing acute ophthalmic conditions and partly by the unavailability of the necessary equipment for eye examination in each clinic.

Statham *et al*.[4] noted that due to the lack of ophthalmic diagnostic tools at PHCCs and the inadequate experience of GPs at general practice settings, PHC physicians usually have limited time to spend with their patients. These factors can explain the often incorrect diagnosis of eye diseases reached by referring physicians.

Teo[12] reported a significant improvement in the conjunctivitis consultation practice among PHC physicians after the implementation of certain interventions in a general practice setting in the UK (i.e., educating GPs and providing them with eye examination kits). Six weeks after the intervention, visual acuity screening and photophobia assessment increased from 35% and 6% prior to intervention to 69% and 63%, respectively, after intervention.

Results of this study also showed that the majority of cases were referred to JEH by GP, while family medicine specialists and consultants referred <10% of cases. Differences in diagnostic accuracy rates according to referring physician were not statistically significant.

This finding is most probably due to lack of undergraduate ophthalmic training and insufficient postgraduate continuing medical education programs for both GPs and family physicians. It is to be noted that the Saudi Commission for Health Specialties stated that family physicians, as graduates of the Saudi Board of Family Medicine, should develop all CanMEDS—FM core competencies while learning the basic skills of diagnosis and management of common ophthalmology conditions (i.e., red eye, strabismus, impaired vision, conjunctivitis, corneal abrasions, eye injuries, cataract, and glaucoma).[7]

Therefore, it seems that the Saudi Board of Family Medicine should enforce their courses and practical trainings for postgraduate candidates so as to fulfill the core competencies while learning the basic skills of diagnosis and management of common ophthalmology conditions.

Our study revealed that most referrals to JEH by PHC physicians were elective, while urgent and emergency ones constituted <10% of all referrals. Differences in diagnostic accuracy rates according to the type of referral were not statistically significant.

It is to be noted that permanent ocular damage or visual loss can be the consequence of management delay in case of critical acute ophthalmic conditions such as acute glaucoma or severe iritis. Shields[13] stressed that patients suffering persistent or severe eye conditions, especially those involving foreign bodies or corneal abrasions due to

Table 6: Accuracy in the diagnosis of the five main reasons for referral in relation to other referrals

Disease	*n* (%)		*P* value
	Accurate	Not accurate	
Errors of refraction			
No	50 (27.2)	134 (72.8)	
Yes	41 (31.1)	91 (68.9)	0.452
Cataract			
No	74 (27.5)	195 (72.5)	
Yes	17 (36.2)	30 (63.8)	0.226
Allergic conjunctivitis			
No	86 (31.6)	186 (68.4)	
Yes	5 (11.4)	39 (88.6)	0.006
Chalazion			
No	82 (27.4)	217 (72.6)	
Yes	9 (52.9)	8 (47.1)	0.049
Squint			
No	81 (26.8)	221 (73.2)	
Yes	10 (71.4)	4 (28.6)	<0.001

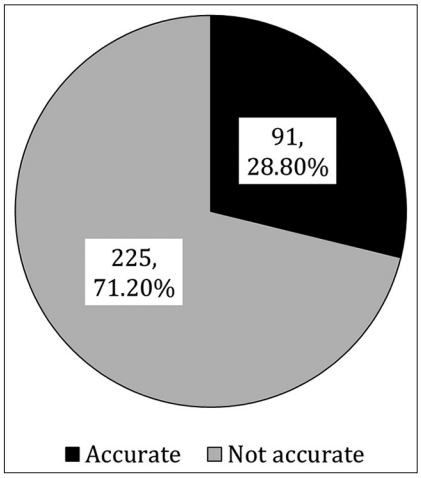

Figure 1: Accuracy of the provisional diagnosis of the cases referred by primary health-care practitioners to Jeddah Eye Hospital

high-velocity injuries, should be immediately referred to an ophthalmologist.

Pane[14] stressed that full clinical assessment of eye patients should be achieved by PHC physicians and a special attention should be paid by them regarding sentinel warning symptoms (e.g., pain, photophobia, or blurred vision), since these warning symptoms mostly denote a serious acute ophthalmic condition. Patients presenting with any of these symptoms should be urgently referred to an ophthalmologist.

The main reasons for referral of patients by PHC physicians in this study were those affecting the anterior segment of the eye, for example, errors of refraction, cataract, allergic conjunctivitis, chalazion, and squint. The accuracy of diagnoses reached by referring PHC physicians was significantly higher if the referred patient was a case of chalazion or squint, whereas their accuracy was significantly lower when the referred patients were diagnosed as allergic conjunctivitis by the ophthalmologist in the JEH. These findings strongly indicate that PHC physicians' clinical knowledge and skills regarding the diagnosis and management of allergic conjunctivitis cases needs to be improved.

Statham *et al*.[4] argued that there is a common perception among ophthalmologists that GPs consider any red eye as "conjunctivitis." Therefore, they usually prescribe topical antibiotics for its treatment. In addition to contributing to a serious delay in patients' referral, using antibiotics unnecessarily promotes antibiotic resistance of organisms.

Within the Birchwood Medical Practice, the UK, Teo[12] introduced the acronym "P.A.L.S" in the interventional study to improve acute eye consultations. This acronym signifies pain, acuity, light (photophobia), and side (unilateral or bilateral). These are considered the "red flag" findings that would recognize patients who require referral for the same-day ophthalmology assessment.

Findings of this study showed that more than half of the referred patients were females, and PHC physicians' diagnoses were significantly more accurate for the referred female cases.

It is to be noted that in Saudi Arabia, female patients at PHCCs are usually examined by female physicians, while male patients are usually examined by male physicians. Therefore, the significantly higher diagnostic accuracy for referred female patients reflects a significantly higher accuracy of diagnosis achieved by referring female PHC physicians. However, this gender-based difference needs further exploration to be explained.

Gilbert and Foster[15] stressed that primary eye health care comprises the promotion of eye health, actions in the community to prevent diseases which may cause blindness, recognition, and management of common ophthalmic diseases by well-trained PHC physicians, and the correct detection of those who need referral for ophthalmological diagnosis and management.

CONCLUSION

More than two-thirds of PHC physicians' diagnoses for eye patients referred to JEH are not accurate. PHC physicians mostly do not fulfill history taking or physical examination of their eye patients, while assessment of visual acuity and ophthalmoscopy is rarely performed. Most ophthalmological referral are elective, which are commonly referred by GP, while urgent and emergency referrals are rare. The accuracy of diagnosis for referred eye patients is higher when the

referred patient is a female with squint or chalazion and when the PHC physician performs history taking and physical eye examination. On the other hand, the accuracy of diagnosis is lower when the referred patient is a male with allergic conjunctivitis and when the PHC physician did not perform history taking or physical eye examination.

Therefore, continuing medical education and frequent training courses on ophthalmology are highly needed for PHC physicians. The Postgraduate Family Medicine Program should enforce the ophthalmology rotation which should be focused on common eye diseases' approach and management in PHC practice. Basic ophthalmological examination tools (e.g., ophthalmoscopes and visual charts) should be provided at PHC clinics.

In addition, it is essential to support good communication and proper referral systems to the higher levels of eye care, where diagnostic equipment and facilities, as well as trained personnel specialized in the treatment of eye diseases, are usually available. In order to reduce the proportion of incorrectly diagnosed cases referred to JEH, the development of definite referral protocols for PHC physicians is highly recommended. Furthermore, the development of electronic referral tool would facilitate the process of information transmission and improve communication between physicians. In addition, efforts must be combined between ophthalmologists and PHC physicians since primary eye health-care physicians cannot operate successfully in isolation.

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