Knowledge and Management of Ocular Chemical Injury among Family Physicians and Emergency Medicine Physicians in the Kingdom of Saudi Arabia

Turki Fehaid Algethami [1], Hanan Mustafa Makhdom [2], Raghad Mohammed Ghaban [3], Alwaleed Khalid Bardisi[4], Amenah Salman Tashkandi [5], Alhassan Abdulnasser Mawlan Ahmed 6, Alhassan Yousef Alturkestansi [7]

1- Ophthalmology Resident, King Khaled Eye Specialist Hospital and Research Center, Riyadh, Saudi Arabia
2- Associate Professor of Ophthalmology, College of Medicine, Taibah University, Medina, Saudi Arabia
3- Emergency Medicine Resident, Prince Mohammed bin Abdulaziz Hospital, Riyadh, Saudi Arabia
4- Emergency Medicine Resident, King Abdulaziz Medical City – National Guard Hospital, Riyadh, Saudi Arabia
5- Preventive Medicine Resident, AL-Madinah Health Cluster, Medina, Saudi Arabia
6- Emergency Medicine Resident, King Faisal Specialized Hospital and Research Center, Riyadh, Saudi Arabia
7- Orthopedic Resident, King Fahad Hospital, Medina, Saudi Arabia

Correspondence:
Turki Fehaid Algethami
Ophthalmology Resident, King Khaled Eye Specialist Hospital and Research Center,
Riyadh, Saudi Arabia
Email: algethamit23@gmail.com

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Abstract

Background: A chemical injury is the outcome of exposure of the eyes to a chemical substance that exceeds the protective mechanisms of the eyes. An ocular involvement constitutes a third of burn patients. The majority of them are due to chemical exposure. The high prevalence of chemical injuries and such injuries being a true emergency, they require proper evaluation and management.

Method: An observational descriptive cross-sectional institutional–based study was conducted from May 2023 to July 2023. A total of 355 participants were included in this study from PHC centers and hospitals in Saudi Arabia. Data was collected using data collecting sheets and self-administered questionnaires. The data was entered and analyzed using SPSS version 23.

Results: In our study, knowledge regarding signs of severe injury was assessed. Only 53 and 51 emergency medicine and family medicine physicians, respectively, answered correctly about the most common early symptoms of chemical injury (P=0.011). However, there was a significant difference (P= 0.001) regarding the most important sign that indicates the urgency of treatment as 52 respondents recognized the warning sign; 28 of them were emergency medicine doctors. Regarding the practice of emergency, no significant difference was found between the respondents of the two specialties. The level of knowledge regarding ocular chemical injury showed that ER consultant (19.05%), ER specialist (19.25%), family medicine consultant (26.45%), family medicine specialist (18.75%), R1 ER (21.45%), R1 family medicine (16.65%), R2 ER (25%), R2 family medicine (15.20%), R3 ER (36.65%), R3 family medicine (25%) R4 ER (30.80%), and R4 family medicine (21.05%) respectively, have different levels of knowledge. The highest level of knowledge was R3 ER residents while the lowest level was R2 family medicine residents. While the level of practice regarding ocular chemical injury showed that ER consultant (35.70%), ER specialist (37.17%), family medicine consultant (37.27%), family medicine specialist (25.53%), R1 ER (28.58%), R1 family medicine (28.90%), R2 ER (33.98%), R2 family medicine (28.98%), R3 ER (31.10%), R3 family medicine (29.63%) R4 ER (34.63%), R4 family medicine (36.83%) respectively, know the correct practice towards ocular chemical injury. The highest percentage was family consultants while the lowest percentage was family medicine specialists.

Conclusion: The study reveals a lack of knowledge and practice in family and emergency medicine physicians regarding ophthalmic chemical injuries, suggesting the need for guidelines and training to minimize complications and improve outcomes.

Key words: ocular injury, chemical, family physician, knowledge, ER physician, Saudi Arabia

Background

A chemical injury is the result of exposure of the eyes to a chemical substance that exceeds the ability of the protective mechanisms of the eyes (1). Ocular involvement constitutes a third of the burn patients. The majority are due to chemical exposure (2). The high prevalence of chemical injuries, and being a true emergency, requires proper evaluation and management (3). A frequent association that makes it hard to examine, leading to treatment delay and bad sequelae, is massive lid ecchymoses (4). Sequelae include dry eyes, ectropion, entropion, lagophthalmos, symblepharon, limbal stem cell deficiency, corneal opacity, non-healing corneal ulcer, intractable glaucoma, cataract, retinal detachment, and even phthisis bulbi. The sequalae is determined by how severe the injury was and when the treatment was initiated (5). About 7% of eye injuries are managed in hospital emergency departments. In addition to that, more than 60% of chemical injuries occur in workplace accidents, 30% occur at home and 10% are the result of an accident. Visual rehabilitation after an advanced eye injury occurs in less than 15% of the affected individuals. Men are threefold more likely to experience injuries than women; furthermore, individuals aged 16–45 years are most likely to be affected (13). A chemical injury of the eye is an acute, genuine emergency situation which requires immediate evaluation and management. Despite that, the most devastating sequelae of chemical injuries, corneal melt, limbal stem cell deficiency, and glaucoma, tend to occur over the long term. Early effective diagnosis and treatment often dictate the clinical course and can prevent tragic consequences. The goals of therapy are to restore corneal clarity, normalize the ocular surface, and prevent glaucomatous optic nerve damage (14). Therefore, proper knowledge about the injury and how to evaluate and manage such cases is essential for all medical practitioners especially those working at emergency departments or paramedics being first responders to such cases, and it is favorable for the general population to have knowledge about it, as it will lead to better management and less need for ocular surface reconstruction.

Problem statement:
Eye injury is a leading cause of monocular blindness and is second only to cataract as the commonest cause of visual impairment. Injury is the commonest reason for eye-related emergency department visits.

Justification:
Chemical injuries are considered as one of the true ocular emergencies where timely management can save vision and years of visual rehabilitation. Thus, knowledge of the injury and its management is very important for medical professionals as well as the general population.

Objectives

General objectives:
• To assess the knowledge of health practitioners from Saudi Arabia about ocular chemical injuries.

Specific Objectives:
1. To study the socio-demographic characteristics of participants.
2. To assess the knowledge regarding signs of severe ocular injuries.
3. To assess the knowledge regarding management of chemical ocular injuries.
4. To assess the practice of participants regarding chemical ocular injuries.
5. To determine if there's a correlation between knowledge and different departments.
6. To compare the knowledge regarding chemical injuries, to different medical positions.

Literature Review

A study was conducted in Saudi Arabia in the year 2021 to assess population awareness regarding eye injuries first aid in Asser region, Saudi Arabia. 1,213 individuals participated in this study. 69% had constant eye pain, 68.3% had Foreign Body (FB) in the eye, 66.9% had torn eye lid. When asked about signs of scratched eye, 64.2% reported feeling a foreign body inside, 58% said eye pain and 55.2% complained of blurred vision. 25.7% of participants said they should blink several times in case of getting eye scratch, while 77.8% said they should rub the eye to try to remove any foreign body, 36.3% said to use soothing eye drop (13).

Another study was done in India in the year 2020 to assess the knowledge, attitude, and practices of respondents from across the population, about ocular chemical injuries. 60 individuals were divided into two groups. Residents, casualty medical officers, and paramedical staff formed the first group, while the second group included those of site supervisors from the workplace and family members of patients. Participants answered a pre-formed questionnaire. Knowledge about causative agents was better in the first group, while both groups had a similar attitude towards the signs and symptoms of injury and the practice pattern of emergency management was better in the first group (15).

In addition, another cross-sectional study was conducted in Saudi Arabia in the year 2020 to assess knowledge of Saudi Arabian residents regarding steps to be taken in cases of chemical eye injury. 888 individuals were included in this study from the Saudi community. (8.3%) had a history of chemical eye injury. Regarding the first step taken in case of chemical eye injury, (78.5%) participants indicated washing with water, (18.5%) indicated visiting the emergency department, (1.2%) indicated using eye drops, and (0.6%) indicated covering the eye immediately. (8.4%) of respondents agreed that an eye injured with an acidic material should be washed with an alkaline solution (16).

Meanwhile in the UK, a retrospective study was conducted in the year 2020 to understand the incidence, causes, management and outcomes of intentional (assault) and unintentional severe ocular chemical injuries (SOCI). Between 2011-2012, (50%), three out of six cases were due to assault. Between 2012-2013, (87.5%), seven out of eight, were due to assault, and between 2013-2014, (54.4%) six out of eleven, were due to assault. Assault was responsible for (64%) cases overall, while (32%) cases were work related. The causative agent was known to be alkali in 64% cases, while 40% did not complete the follow-up. Surgical intervention occurred in one case out of 25. The final best-corrected visual acuity was 6/12 or worse in 11/25 (44%) and was counting fingers or worse in 4/25 (16%) (17).

Lastly, a study was done in India in the year 2019 to study the incidence, pattern and management of chemical injuries of the eye in a tertiary health care center of Western Odisha. Chemical injuries of eye were encountered in 13.04% of cases. Males (73.5%) were more affected and 31-40 years age group was the most vulnerable one. Most of the cases (59.8%) presented with unilateral involvement of eye and 72 cases (70.59%) of chemical injury were caused by alkalis. Grade II injury (35.6%) was the most common finding and some post-operative complications were also encountered during the follow-up (18).

Methodology

Study Design
The study was conducted as an observational descriptive cross sectional institutional– based study.

Study Area
The study was conducted in different primary healthcare (PHC) centers and emergency departments in hospitals across the Kingdom of Saudi Arabia.

Study Population
Family medicine residents, family medicine consultants, emergency medicine residents and emergency medicine consultants who worked in PHC centers and hospitals in Saudi Arabia.

Inclusive Criteria
Family medicine residents, family medicine consultants, emergency medicine residents and emergency medicine consultants who were present at the time of data collection and who were willing to participate in this study.

Exclusive Criteria
- Non-practicing physicians.
- Physicians who refused to participate in this study.

Period of Study
The study was conducted during the period from May 2023 to July 2023.

Sample size:
Simple random sampling including 355 participants who were available and eligible during the study period.

Data collection:
Data was collected using standardized self-administered questionnaires.

Data collection tools:
A structured and self-administered electronic questionnaire was used in the study for data collection. The questionnaire had been validated and approved by an ophthalmologist, and a pilot study was done. The questionnaire consisted of three main sections; sociodemographic characteristics, physicians' attitude regarding ocular injury and the practice in PHC centers and hospitals regarding ocular chemical injury.

Plan for data analysis:
Data collected was computerized through Microsoft Excel. The data was analyzed through SPSS Version 21. The data was presented graphically (frequency tables, graphs).

Ethical consideration:
It was sought from the research technical and ethical committee at the Faculty of Medicine. Informed ethical consent was taken from the participants. No personal data or information was included in the questionnaire to ensure the participants' privacy and confidentiality.

Results

Our study included 355 participants from all regions of Saudi Arabia; 171 physicians from emergency medicine and 184 from family medicine (Figure 1). The majority of our participants were from the middle region (31.3%) and the western region (27.3%), while only 9.3% were from the southern region (Figure 2). The greatest number of respondents were level 1 residents in both specialties, as shown in Figure 3. Table 1 reveals the participants' sociodemographic characteristics.

Figure 1: Participants' specialty percentages

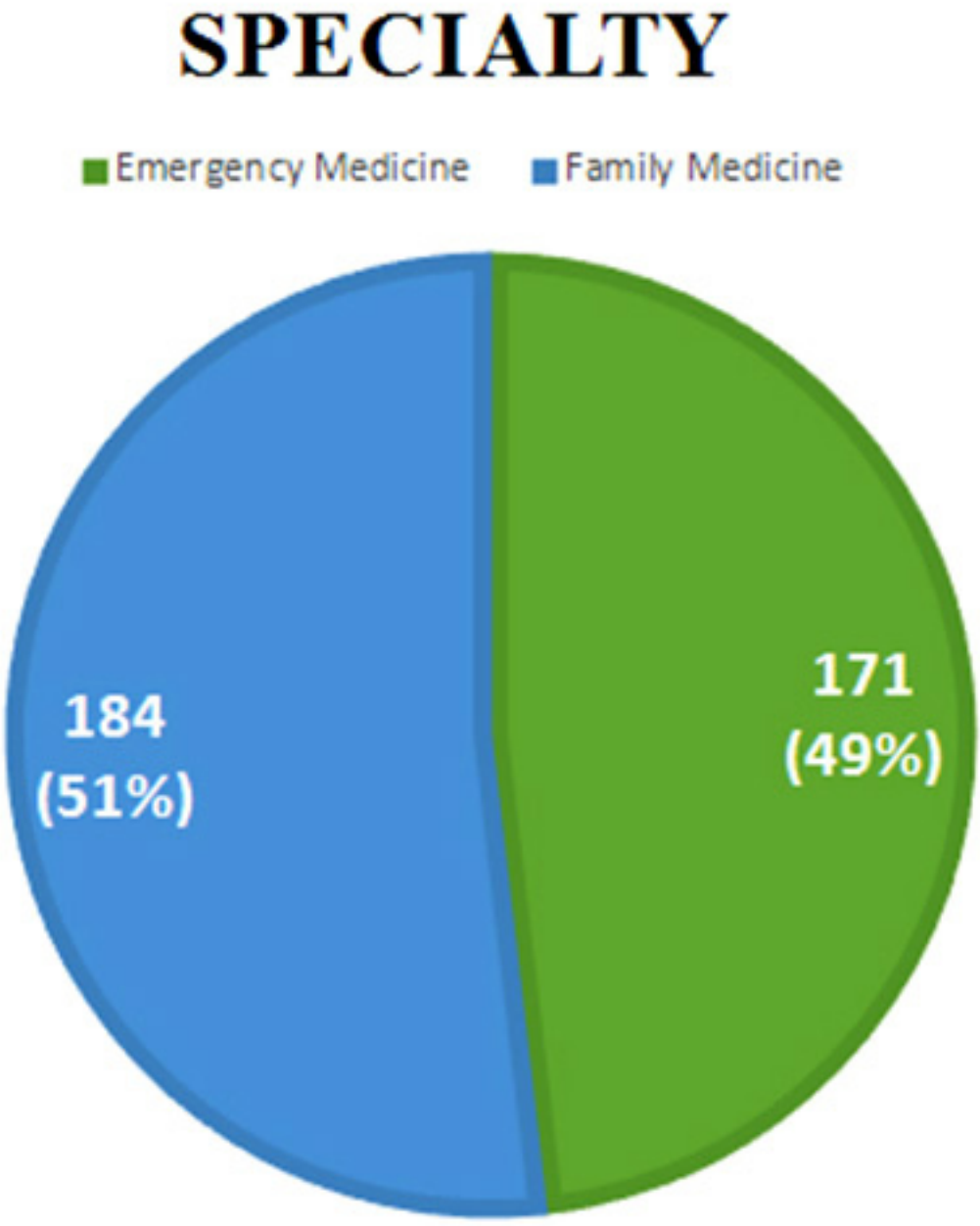


Figure 2: Participants' regions

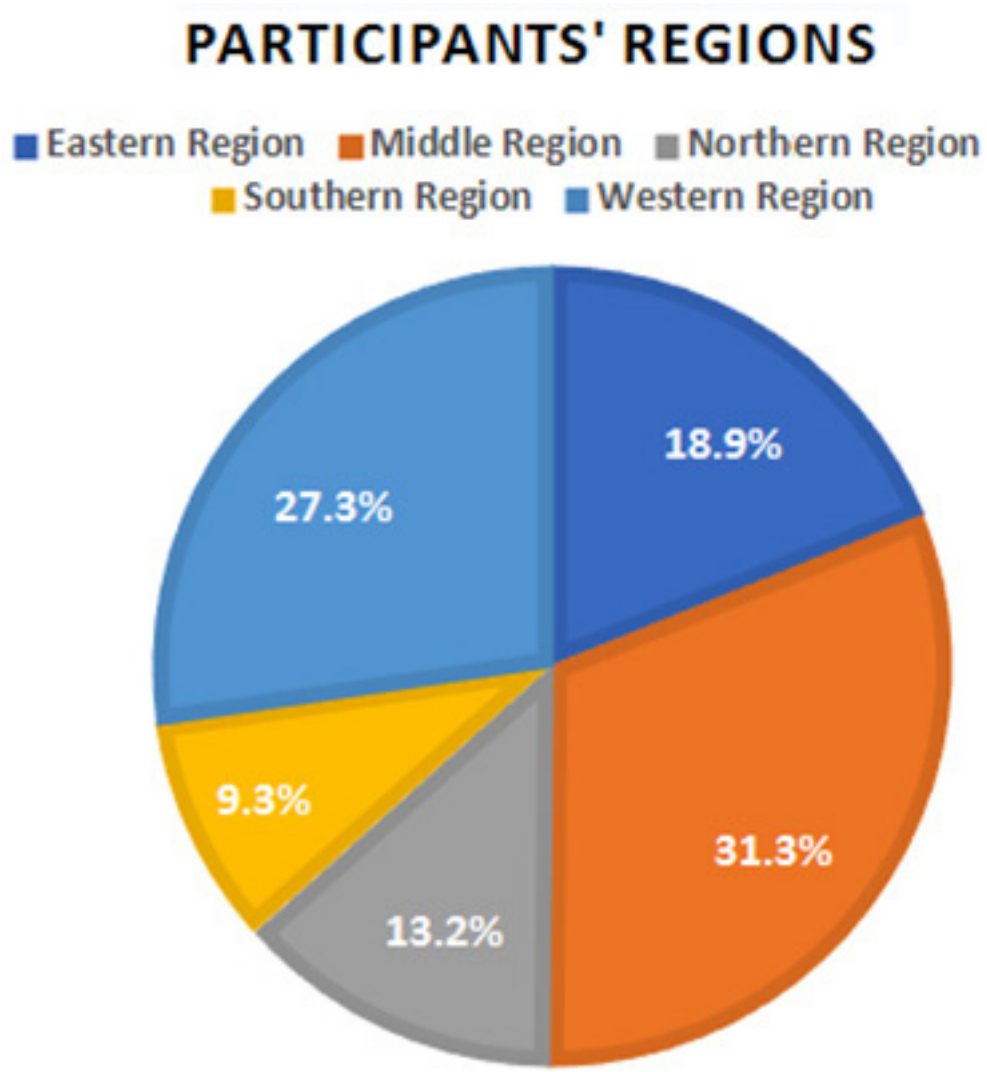


Figure 3: Participants' SCFHS classification

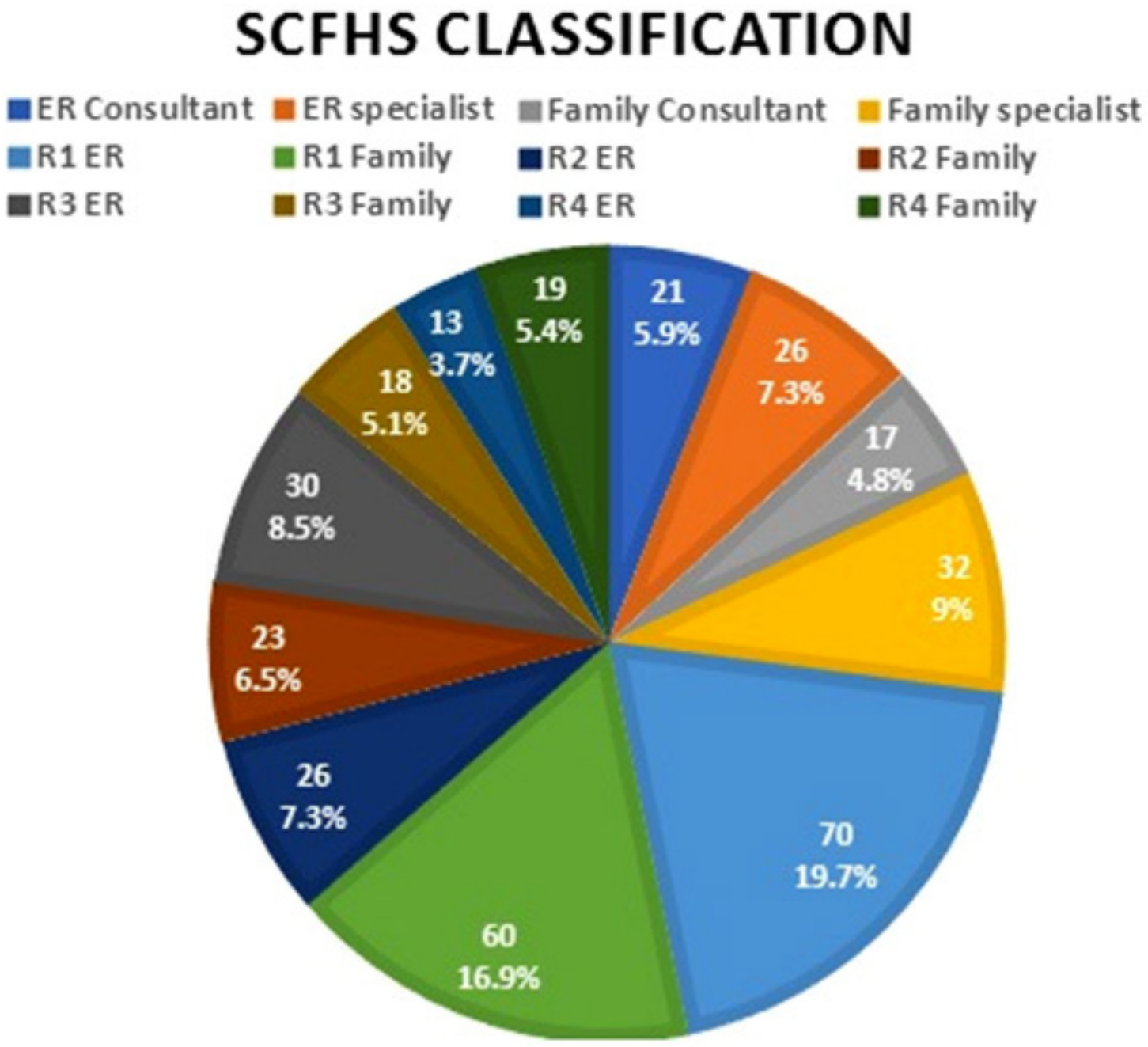


Table 1: Participants' Characteristics

Participants Characteristics	Frequency	Percent
Age		
25 - 30	241	67.9
31 - 35	53	14.9
36 - 40	31	8.7
41 - 45	13	3.7
46 - 50	10	2.8
51 - 55	5	1.4
61 - 65	2	.6
Gender		
Female	183	51.5
Male	172	48.5
Marital Status		
Divorced	12	3.4
Married	174	49.0
Single	167	47.0
Widow	2	.6

Table 2 shows the knowledge regarding signs of severe injury, which only 53 and 51 of emergency medicine and family medicine physicians respectively answered correctly about the most common early symptoms of chemical injury (P=0.011). However, there was a significant difference (P=0.001) regarding the most important sign that indicates the urgency of treatment as 52 of respondents recognized the warning sign, 28 of them were emergency medicine doctors.

Table 2: Participants responses regarding the knowledge of ocular chemical injury

Knowledge regarding signs of severe injuring			
	Emergency Medicine	Family Medicine	P value
What are the most common early symptoms of chemical injury?			0.011
A. Redness of eye	53	51	
B. Burning sensation of the eye	83	81	
C. Pain in the eye	34	38	
D. Don't know	1	14	
What are the most important signs to indicate the urgency of treatment?			0.001
A. Whitish opacity of cornea	76	89	
B. Whitish opacity of the conjunctiva	28	24	
C. Reddish conjunctiva	54	34	
D. Don't know	13	37	

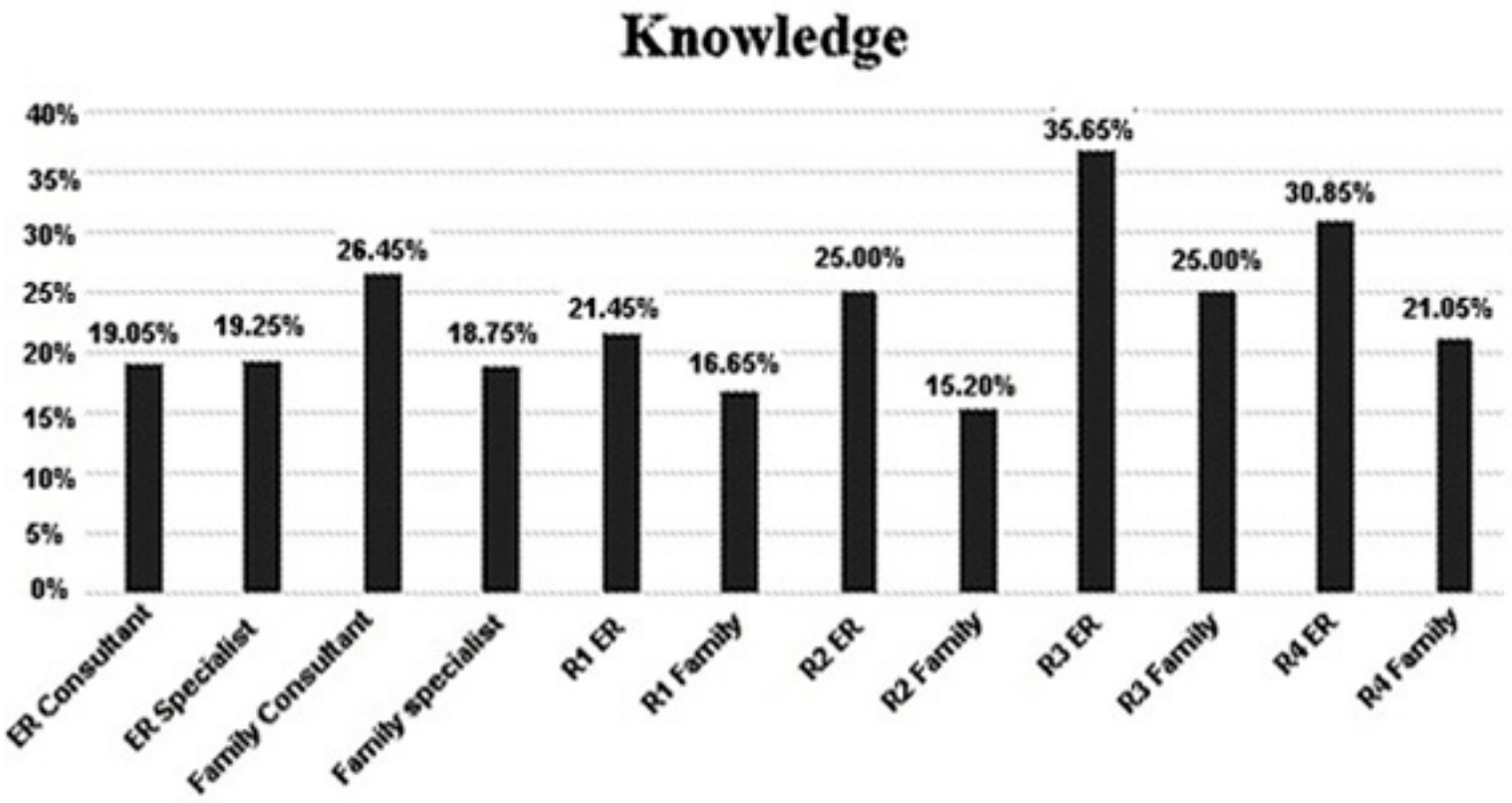
Regarding the practice of emergency management (Table 3), there was no significant difference between the respondents of the two specialties in regard to: the first step in the management (P=0.218), does the emergency management differ in cases of different categories of etiological agents (P=0.424) and the irrigating liquid that can be used to irrigate the eye (P=0.122). On the other hand, there was a significant difference in regard to how to neutralize the chemical injury (P=0.009), the minimum amount of fluid (P=0.000), and duration to irrigate the eye (P=0.005). Only 45 physicians from emergency medicine chose to dilute the chemical to neutralize the injury, while 51 of family medicine physicians responded correctly to the same question. 71 emergency medicine physicians knew the correct amount of fluid needed to irrigate the eye but only 65 of them responded correctly to the minimum duration of irrigation compared to 43 and 79 of family medicine physicians who chose the correct amount and duration.

Table 3: Participants' responses regarding emergency management of ocular chemical injury

The practice of emergency management			
	Emergency Medicine	Family Medicine	p - value
What is the first step in the management of chemical injury			
A. History taking	31	42	0.218
B. Primary ocular survey	23	14	
C. **Start irrigation**	110	123	
D. don't know	7	5	
Does the emergency management differ in cases of different categories of etiological agents?			0.424
A. Yes	67	81	
B. No	28	21	
C. Depends on the situation	60	60	
D. Don't know	16	22	
How will you neutralize the chemical after the injury has occurred?			
A. Balance the pH	61	39	0.009
B. **Dilute the chemical**	45	51	
C. Depends on the situation	54	70	
D. Don't know	11	24	
What is the irrigating liquid can be used to irrigate the eye post chemical exposure?			
A. Ringer lactate / BSS	49	48	
B. Tap water	89	99	0.122
C. Any non – toxic liquid	18	10	
D. Don't know	15	27	
How much minimum fluid is needed to irrigate?			
A. 100 ml	33	29	0.000
B. 500 ml	35	46	
C. 1000 ml	71	43	
D. Don't know	32	66	
What is the minimum duration of irrigation?			
A. 5 min.	25	28	0.005
B. 15 min.	65	79	
C. 30 min.	63	40	
D. don't know	18	37	

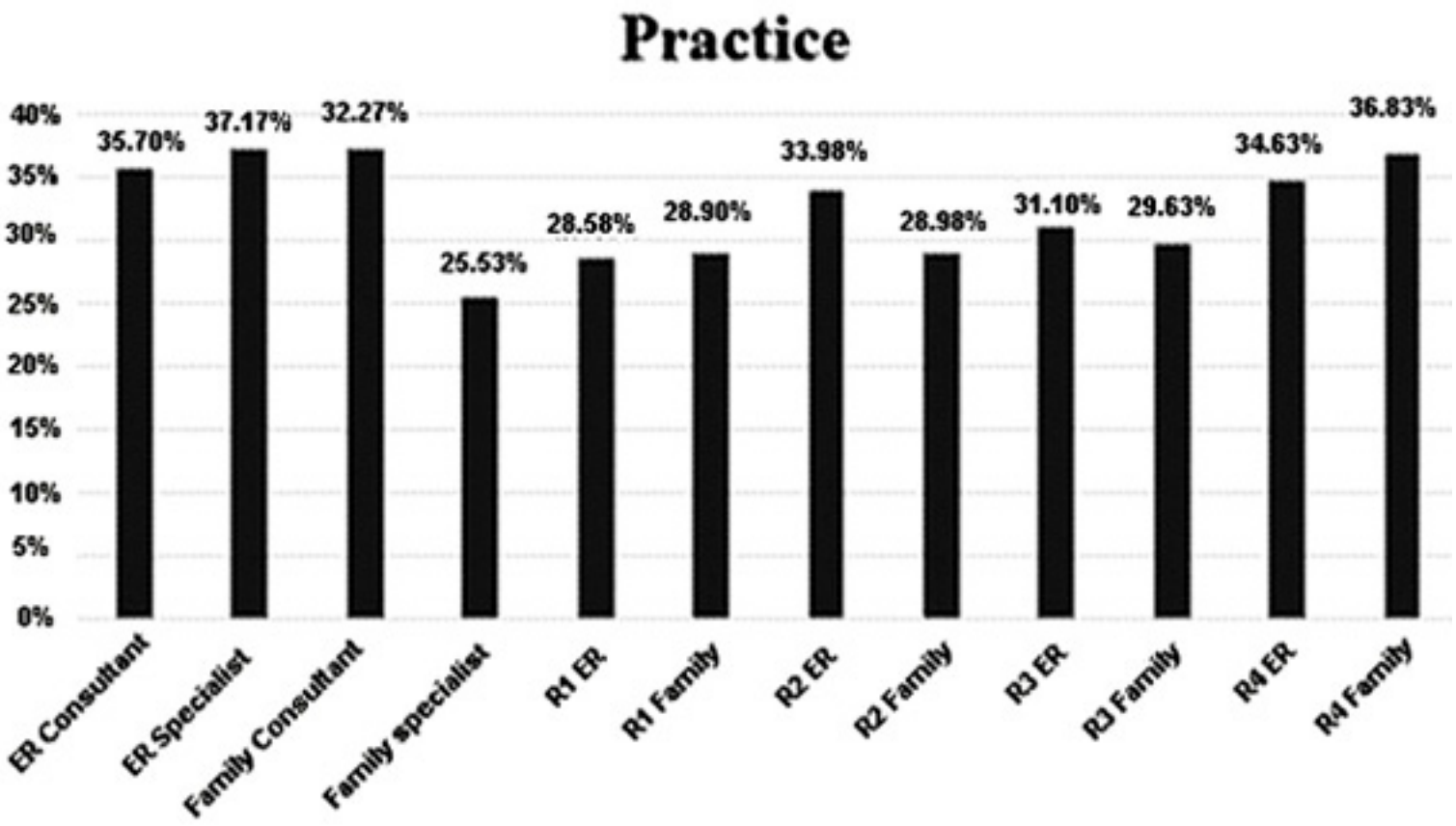
The level of knowledge regarding ocular chemical injury is shown in Figure 4. The figure shows that ER consultant (19.05%), ER specialist (19.25%), family medicine consultant (26.45%), family medicine specialist (18.75%), R1 ER (21.45%), R1 family medicine (16.65%), R2 ER (25%), R2 family medicine (15.20%), R3 ER (36.65%), R3 family medicine (25%) R4 ER (30.80%), R4 family medicine (21.05%) respectively have different levels of knowledge. The highest level was R3 ER residents while the lowest level was R2 family medicine residents.

Figure 4: Level of knowledge of ocular chemical injury



The level of practice regarding ocular chemical injury is shown in Figure 5. The figure shows that ER consultant (35.70%), ER specialist (37.17%), family medicine consultant (37.27%), family medicine specialist (25.53%), R1 ER (28.58%), R1 family medicine (28.90%), R2 ER (33.98%), R2 family medicine (28.98%), R3 ER (31.10%), R3 family medicine (29.63%) R4 ER (34.63%), R4 family medicine (36.83%) respectively know the correct practice towards ocular chemical injury. The highest percentage was family consultants while the lowest percentage was family medicine specialists.

Figure 5: The correct practice towards ocular chemical injury



Discussion

Twenty-five thousand chemical compounds have the ability to cause burns out of 150 million catalogued chemical compounds according to American Chemical Society (ACS) (6,7). In the industrial environment, acids have been reported to be the superior of substances to cause chemical insult by Colby, in which Sulphuric acid is the commonest etiology to cause this insult (8,9). Redness of the eye indicates serious ophthalmic insult which is the earliest sign to appear after the chemical injury. About 29% of emergency medicine and family medicine physicians answered this correctly. Paleness of the conjunctiva is the symptom that suggests the severity of ophthalmic injury in which the urgency of treatment is indicated (3,4,8,10). There was a lack of knowledge about the most important sign that indicates urgency of treatment as 85% of the respondents were wrong. The majority of chemical harm is treated by society's habit of washing the eye as soon as something goes into it (11). 65.6% of both specialties have chosen irrigation of the eye as the first step in management. No significant differences between the respondents of the two specialties in regard to the first step in the management were identified (P=0.218). In regard to the management of different categories of etiological agents 13.8% were correct. Exothermic reaction could be caused by chemical correction of pH. Correction by a huge amount of irrigation is the method of choice to neutralize pH to prevent the consequence of the chemical method (11,12). 27% of the participants were aware of the right method of the pH neutralization. A total of 92% of the physicians were wrong about the irrigating liquid that can be used to irrigate the eye post chemical exposure. Any nontoxic fluid could be used as there are no differences between them (5). Irrigation with 1000 ml of fluid for about 15 minutes is the minimal accepted strategy to eliminate the chemical insult from the eyes, while the recommended method is to irrigate by two litres of liquid over half an hour (1). 41.5% of emergency medicine physicians knew the correct amount of fluid needed to irrigate the eye but only 38% of them responded correctly to the minimum duration of irrigation compared to 23% and 43% of family medicine physicians who chose the correct amount and duration respectively.

The study was done on 355 physicians which showed that the level of knowledge regarding ocular chemical injury was the highest among all participants in R3 ER residents (36.65%) followed by R4 ER residents (30.80%) while the lowest level of knowledge was in R2 Family residents (15.20%). Meanwhile the level of practice regarding ocular chemical injury among the participants, Family consultants were on top (37.27%) and the lowest percentage was in Family medicine specialists (25.53%).
This study aimed to explore the knowledge and management of ocular chemical injury and to compare the competency of managing ocular injury between family physicians and ER physicians. This study could be the first step towards better understanding of knowledge and management between these two groups. The authors acknowledge that the current study is not without its limitations. The study is limited to the knowledge and management and did not consider the awareness of long-term complications such as corneal opacity, phthisis, and glaucoma, which have a tremendous effect on the quality of life.

Conclusion

The study has shown that there is a lack of knowledge regarding ophthalmic chemical injuries in both family physicians and emergency medicine physicians, as well as some insufficiency in their practice and attitude regarding the appropriate management of chemical injuries. The authors suggest that guidelines should be formulated on how to handle such cases, and the physicians have to be trained and well informed of these guidelines in order to minimize the complications and improve the outcomes of ophthalmic chemical injuries.

Recommendations:
• Knowledge regarding chemical ocular injuries should be raised.
• Practice and management regarding chemical ocular injuries should be assessed and improved among physicians in order to improve the quality of life,
• More studies regarding this topic should be conducted in order to assess the situation.

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