

Medical students' knowledge, attitudes, and practices concerning diabetes-related retinopathy

Meshari Mubarak Alharbi¹, Mohammad Almazyad¹, Basmah Alatni¹,
Bakr Alharbi², Abdulaziz Alhadlaq³

¹Medical Intern, Collage of Medicine, Qassim University, ²Medical Student, Collage of Medicine, Qassim University,
³Department of Ophthalmology, Qassim University, Saudi Arabia

ABSTRACT

Context: Diabetes-related retinopathy (DR), the most common complication of diabetes mellitus (DM), is a severe and preventable cause of visual loss and blindness that has been reported to be the fourth leading cause of blindness among four million cases globally. **Aims:** This study aimed to evaluate the knowledge, attitudes, and practices of fourth- and fifth-year medical students concerning patients with DR. **Methods and Materials:** This cross-sectional descriptive study was conducted at a College of Medicine in Saudi Arabia, in November 2018, and comprised 153 fourth- and fifth-year medical students of both sexes. Participants were required to complete a previously validated hard copy questionnaire. **Results:** In total, >50% of participants showed good knowledge of DR (poor participant knowledge, n = 65, 42.5%). We found 16 (10.5%) participants had poor attitudes to DR compared to 137 (89.5%) of participants with good attitudes, and 32 (20.9%) participants showed poor practices compared to 121 (79.1%) participants showing good practices. There was a statistically significant difference between the sexes and the level of practice ($P = 0.021$). **Conclusions:** More than 50% of participants in our study showed good knowledge concerning DR, with excellent attitudes and practices. Moreover, participants' age was identified as a significant factor affecting practice regarding DR. More targeted education is required to improve their knowledge base in regard to DR. Medical faculties have a significant role in the education of medical students to ensure greater awareness of DR.

Keywords: Diabetes mellitus, diabetes-related retinopathy, KAP (knowledge, attitudes, and practices), medical students, ophthalmology

Introduction

Diabetes mellitus (DM) is a worldwide health problem.^[1] It is a metabolic disorder characterized by an elevated blood sugar level.^[2] With an increasing prevalence, and it may be prevalent in the majority of people in some regions. DM carries a high risk of complications and can lead to morbidity and mortality.^[1,3] Diabetic retinopathy (DR) is a serious but preventable cause of visual loss and blindness and is the most common complication of DM.^[1,3,4] It is the fourth leading cause of blindness in the

world, being the main cause of 4 million cases of blindness.^[1] Worldwide, 34.6% of diabetic patients complain of some form of DR, and in about 1.8 million of these patients, DR leads to blindness.^[3,5] In Riyadh, Saudi Arabia, the prevalence of DR was estimated to be 31.3% of the diabetic population.^[3]

Many health care providers suggest that the best methods to prevent or delay DM-related onset of blindness are good control of DM and regular screening for complications, as well as an intensive program of education and increased awareness in the general community to prevent DM progression.^[5] We reviewed many relevant studies and found that there is still a need to estimate the knowledge, attitude, and practice (KAP)

Address for correspondence: Meshari Mubarak Alharbi, Saudi Arabia 1367.

E-mail: Meshari818@gmail.com

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of treatment and prevention of DR among healthcare providers.

Al Rasheed and Al Adel (2017) published a cross-sectional study that aimed to evaluate the knowledge and awareness on DR and to assess the practices of physicians in Riyadh. The study included a total of 216 physicians from 46 randomly selected primary care centers. The mean knowledge score was 57 ± 14 of 100, and only 19% of physicians surveyed were aware of anti-vascular endothelial growth factor injections as a modality of treatment. There was also a deficiency in the screening and follow-up of type 1 diabetics, as only 24% of primary care physicians referred type 1 diabetic patients to an ophthalmologist.^[3]

Abdulsalam *et al.* (2018) conducted a study to evaluate the KAP of physicians toward DR screening using a Likert scale questionnaire that was distributed to 105 physicians in four tertiary hospitals in northwestern Nigeria. The study showed that the majority of respondents (78.8%) were aware of the most crucial method of delaying the onset of DR, and 94.1% knew the importance of frequent eye examinations. The most critical barriers to performing a proper eye examination were a lack of ophthalmoscopes and of dilating eye drops. The study concluded that there is still a need for training physicians who manage diabetic patients on proper eye examination to reduce visual problems.^[4]

Al Wadaani (2013) performed a cross-sectional study to evaluate the KAP toward DM and DR among final-year medical students of King Faisal University in Al Hasa, Saudi Arabia. This study showed that male students scored better in knowledge and practice, whereas female students scored better in attitude. The main weakness points in knowledge were on the epidemiology of DM, follow-up of diabetic patients for screening of DR, and the onset of DR. The study concluded that there is a need to improve KAP regarding DM and DR.^[1]

AlHargan MH *et al.* (2019) published a cross-sectional study among diabetics at two primary healthcare centers in Riyadh, Saudi Arabia which aimed to assess the awareness and practice toward DR. The study showed there was a high awareness among diabetic patients regarding DR but annual check-up was done in less than half of the patients.^[5]

Abu-Amara TB *et al.* (2019) Conducted a cross-sectional study that aimed to evaluate the KAP of non-ophthalmic health care physicians regarding eye care of diabetes. The study concluded that out of a total of 355 physicians, 193 (54.3%) of them have a piece of good knowledge, attitude and excellent practice regarding DR. The study revealed also there is strongly needed to improve the KAP of primary healthcare providers regarding DR.^[6]

In spite many researchers around the world addressing this topic, there are limited data pertaining to Saudi Arabia. Our study aims

to measure the KAP of medical students toward DR in the Qassim University, Saudi Arabia.

Subjects and Methods

Study population and sampling

This cross-sectional descriptive study was conducted in the month of November 2018 at the Qassim University, Qassim region, Saudi Arabia. The option to participate in the study was offered to 262 fourth- and fifth-year clinical students using the www.surveymonkey.com website.^[7] From this group, 157 students (60%) agreed to participate.

Ethical consideration

Ethical approval was received from the appropriate Institutional Review Board. The research topic was explained to the students, who were given the option to participate or refuse. Participating students were informed that all information given by them would be secure and would be used for scientific purposes only. The procedures followed were in accordance with the Helsinki declaration of 1975.

Methods for data collection

A previously validated questionnaire was distributed to all participating students as a printed copy. Students were expected to take 20–30 min to finish answering the questions. We finished this part within 10 days. The questionnaire was validated from previous published research.^[1,3] with modifications and additional questions from the American Diabetic Association in the “knowledge” part.

Statistical analysis

Data were analyzed using Statistical Packages for Software Sciences (SPSS) Ver. 21, Armonk, NY:IBM Corporation, involving descriptive and inferential statistics. A *P* value of ≤ 0.05 was considered significant for all statistical tests. All categorical variables included in this study are presented as numbers and percentages. We conducted a Chi-square test to evaluate the association between the studied variables and the outcome variables.

To determine diabetes-related retinopathy knowledge, the participants were required to respond to six questions. A correct answer scored one point and an incorrect answer scored zero points. To determine participants' knowledge, scores in relation to responses to six knowledge questions were added (score range, zero to six points). Using three as a cut-off point, scores ranging from zero to three were classified as poor knowledge, and scores ranging from four to six were classified as good knowledge. To assess participants' attitudes to DR, participants responded to four questions, using a three-point Likert scale. The response options were as follows: “agree” (two points), “disagree” (one point), and “undecided” (zero points). To avoid bias, coding for negative answers was reversed. The attitudes score was calculated through adding the scores pertaining to all four responses, (score

range, zero to eight points). Using four as a cut-off point, a poor attitude was classified as a score ranging from zero to four points. A good attitude was classified as a score ranging from five to eight points. To measure participants' practices concerning DR, participants responded to three questions. A correct response scored one point while an incorrect response scored zero points, with a total score ranging from zero to three points. Using two as the cutoff point, poor practices were classified according to a score ranging from zero to one, and good practices were classified according to a score ranging from two to three points.

Results

In total, 153 medical students participated in this study. Table 1 shows the participants' basic demographic characteristics. The participant age range was from 22 to 25 years, with most participants aged 23 years old (35.9%). A total of 61.4% of participants were males, with 52.3% of participants in their fifth year of medical training and 47.7% in their fourth year.

Participants' responses concerning knowledge, attitudes, and practices (KAP) regarding DR are shown in Tables 2 and 3. In terms of their general knowledge, the participants correctly identified the estimated prevalence of DR (40%) for patients with DM ($P = 0.020$). Most participants correctly identified DR as a disease of blood vessels ($P = 0.002$). The participants were well aware that the duration of DM was the most critical risk factor for developing DR. Furthermore, they were aware that to reduce the risk of DR, optimal glycemic, and blood pressure controls are required ($P = 0.021$). Approximately, 80% of participants agreed that DM-related macular edema was the most common cause of gradual and chronic visual impairment in DM patients. Many participants agreed that type 1 DM 5 years post-diagnosis and type II DM at the time of diagnosis are appropriate timeframes in which to undertake a comprehensive ophthalmic examination in DM patients ($P < 0.001$). In terms of participants' attitudes, most agreed that patients with DM should have a regular ophthalmic examination and that timely treatment for DM would likely decrease or prevent DR. Most participants disagreed with the statement: "... no need to visit an ophthalmologist if a patient has good control of their DM, and patients with DM often waste time and money in eye check-ups as most of the time the

eyes of patients with DM are healthy." However, the varying responses to the four questions concerning attitudes showed no statistical significance. Concerning participants' practices, they correctly responded that all patients with DM require a referral for an ophthalmic examination, and they appropriately ascertained that at a local hospital where a patient was identified as having DR, an ophthalmologist should visit to undertake an ophthalmic examination. The participants also were aware that patients with type I DM and patients with type II DM are at high risk of DR ($P = 0.002$).

Table 4 shows the prevalence of KAP among participants regarding DR. The mean knowledge score was 3.7 (standard deviation [SD], 1.1). Poor knowledge was identified in 65 (42.5%) participants, while 88 (57.5%) participants had scores that indicated good knowledge. The mean attitude score was 6.9 (SD, 1.4) and a poor attitude was identified in 16 (10.5%) participants, whereas 136 (89.5%) participants had a good attitude. Regarding practices, the mean practice score was 2.0 (SD, 0.7), with poor practices found in 32 (20.9%) participants, whereas good practices were identified in 121 (79.1%) participants [Figure 1].

The association between KAP and the sociodemographic characteristics of participants is shown in Table 5. Based on the results, there was a statistically significant difference between the sexes and the level of practices ($P = 0.021$), although most participants had good practices. However, no other significant difference was found between KAP among other independent factors.

Discussion

DR has been reported to be a major cause of blindness among patients with DM.^[1] Adequate knowledge of the disease is important to prevent visual impairment. In this study, we aimed to measure the KAP of medical students regarding DR.

Knowledge findings

Most participants correctly identified the estimated prevalence of DR at 40% in patients with DM, and most participants recognized DR as a disease of blood vessels. This study found that the duration of DM was rated by participants as the most critical risk factor in developing DR, that optimizing both glycemic and blood pressure control can reduce the risk of developing DR,

Table 1: Participants' sociodemographic characteristics

Study variables	n (%) (n=153)
Age (years)	
22 years	36 (23.5%)
23 years	55 (35.9%)
24 years	36 (23.5%)
≥25 years	26 (17.0%)
Sex	
Male	94 (61.4%)
Female	59 (38.6%)
Academic Year	
4 th year	73 (47.7%)
5 th year	80 (52.3%)

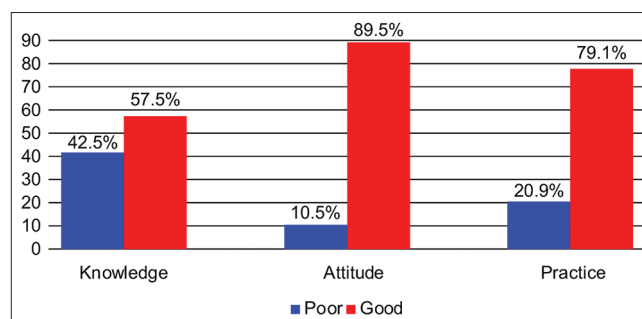


Figure 1: Knowledge, attitudes, and practice levels

Table 2: Knowledge and attitudes of the participants according to academic year

KAP Statements	Overall n (%) (n=153)	Academic year		P [§]
		4 th year n (%) (n=73)	5 th year n (%) (n=80)	
Knowledge				
K1. What is the estimated prevalence of DR for a patient with DM?				
20%	31 (20.3%)	08 (11.0%)	23 (28.8%)	0.020 **
40% [†]	99 (64.7%)	54 (74.0%)	45 (56.2%)	
70%	23 (15.0%)	11 (15.1%)	12 (15.0%)	
K2. DR is a disease of:				
optic nerves	32 (20.9%)	23 (31.5%)	09 (11.2%)	0.002 **
blood vessels [†]	119 (77.8%)	48 (65.8%)	71 (88.8%)	
increased intra-ocular pressure	02 (01.3%)	02 (02.7%)	0	
K3. The most critical risk factor in developing DR in a patient with DM is:				
duration of DM [†]	124 (81.0%)	56 (76.7%)	68 (85.0%)	0.278
hypertension	20 (13.1%)	10 (13.7%)	10 (12.5%)	
pregnancy	01 (0.70%)	01 (01.4%)	0	
nephropathy	08 (05.2%)	06 (08.2%)	02 (02.5%)	
K4. The risk of developing DR is reduced through:				
optimizing glycemic control	36 (23.5%)	10 (13.7%)	26 (32.5%)	0.021 **
optimizing blood pressure control	03 (02.0%)	02 (02.7%)	01 (01.2%)	
both [†]	114 (74.5%)	61 (83.6%)	53 (66.2%)	
K5. The most common cause of gradual and chronic visual impairment in patients with DM is:				
diabetes-related macular edema [†]	123 (80.4%)	63 (86.3%)	60 (75.0%)	0.056
vitreous hemorrhage	25 (16.3%)	10 (13.7%)	15 (18.8%)	
cataract surgery	05 (03.3%)	0	05 (06.2%)	
K6. An initial dilated and comprehensive ophthalmic examination of a patient with DM should be undertaken for:				
patients with type I DM at diagnosis and for patients with type II DM 5 years post-diagnosis	37 (24.2%)	12 (16.4%)	25 (31.2%)	<0.001 **
patients with type I DM 5 years post-diagnosis and for patients with type II DM at the time of diagnosis [†]	85 (55.6%)	54 (74.0%)	31 (38.8%)	
patients with either type I or type II DM at time of diagnosis	23 (15.0%)	02 (02.7%)	21 (38.8%)	
patients with either type I or type II DM 5 years post-diagnosis	08 (05.2%)	05 (06.8%)	03 (03.8%)	
Attitudes				
A1. A patient with DM should have a regular ophthalmic examination.				
agree	152 (99.3%)	73 (100%)	79 (98.8%)	0.338
disagree	01 (0.7%)	0	01 (01.2%)	
A2. There is no need for a patient to visit an ophthalmologist if their DM is well-controlled				
agree	11 (07.2%)	06 (08.2%)	05 (06.2%)	0.559
disagree [‡]	123 (80.4%)	60 (82.2%)	63 (78.8%)	
undecided	19 (12.4%)	07 (09.6%)	12 (15.0%)	
A3. Does timely treatment of DM decrease/prevent DR?				
agree	121 (79.1%)	63 (86.3%)	58 (72.5%)	0.111
disagree	22 (14.4%)	07 (09.6%)	15 (18.8%)	
undecided	10 (06.5%)	03 (04.1%)	07 (08.8%)	
A4. Patients with DM often waste time and money undertaking eye check-up as most of the time their eyes are healthy				
agree	14 (09.2%)	10 (13.7%)	04 (05.0%)	0.172
disagree [‡]	107 (69.9%)	49 (67.1%)	58 (72.5%)	
undecided	32 (20.9%)	14 (19.2%)	18 (22.5%)	

DM, diabetes mellitus; DR, diabetes-related retinopathy; KAP, knowledge, attitudes, and practices, [†]Signifies the correct answer. [‡]Signifies a negative answer. [§]The P value was calculated using a Chi-square test. ** Significance at P≤0.05

and most participants agreed that diabetes-related macular edema is the most common cause of visual impairment, rather than vitreous hemorrhage. Moreover, participants showed appropriate knowledge concerning the need for a comprehensive ophthalmic examination of patients with DM, which should be undertaken

5 years post-diagnosis for patients with type I DM and at the time of diagnosis for patients with type II DM. This finding is similar to that reported in a study by Al-Wadaani.^[1] In that study, 55% of students correctly responded that both patients with type 1 DM (5 years post-diagnosis) and type II DM (at the

Table 3: Practices of the participants according to academic year

KAP Statements	Overall n (%) (n=153)	Academic year		P [§]
		4 th year n (%) (n=73)	5 th year n (%) (n=80)	
Practices				
P1. Which category of patients with DM require a referral for an ophthalmic examination				
all patients with DM [†]	120 (78.4%)	54 (74.0%)	66 (82.5%)	0.322
patients with visual symptoms only	21 (13.7%)	11 (15.1%)	10 (12.5%)	
patients with retinal changes identified on ophthalmoscopy only	12 (07.8%)	08 (11.0%)	04 (05.0%)	
P2. Should a patient with DR be referred for an ophthalmic examination undertaken by:				
a PHC general practitioner	15 (09.8%)	09 (12.3%)	06 (07.5%)	0.588
an optometrist	10 (06.5%)	05 (06.8%)	05 (06.2%)	
an ophthalmologist at a local hospital [‡]	128 (83.7%)	59 (80.8%)	69 (86.2%)	
P3. Which type of patient with DM is at high risk of developing DR?				
a patient with type I DM	22 (14.4%)	03 (04.1%)	19 (23.8%)	0.002**
a patient with type II DM	77 (50.3%)	44 (60.3%)	33 (41.2%)	
patients with either type I or type II DM [†]	54 (35.3%)	26 (35.6%)	28 (35.0%)	

DM, diabetes mellitus; DR, diabetes-related retinopathy; PHC, primary health care. [†]Signifies the correct answer. [‡]Signifies a negative answer. [§]P-value calculated using a Chi-square test. ** Significant at P≤0.05

Table 4: Prevalence of knowledge, attitudes, and practices

Predictor Variables	n (%) (n=153)
Knowledge total score (mean±SD)	03.7±01.1
Level of knowledge	
Poor	65 (42.5%)
Good	88 (57.5%)
Attitude total score (mean±SD)	06.9±01.4
Level of attitude	
Poor	16 (10.5%)
Good	137 (89.5%)
Practices total score (mean±SD)	02.0±0.7
Level of practices	
Poor	32 (20.9%)
Good	121 (79.1%)

time of diagnosis) should be referred to an ophthalmologist for a routine retinal screening examination for early detection and diagnosis of DR. Panigrahi *et al.*^[8] reported that, among Indian medical and nursing students, most students concurred that strict control of blood sugar, blood cholesterol, blood urea, and serum creatinine levels was required to prevent DR in patients with DM. They further elaborated that the duration of DM is directly related to the progression of the disease.

Findings concerning attitudes

Many participants agreed that ophthalmic examinations should be undertaken regularly and that timely treatment of DM can decrease the severity of DR or prevent DR. They disagreed with the statement that a patient with good DM control was not required to visit an ophthalmologist, and most participants did not agree with the statement that suggested resources would be wasted in the course of an eye check-up, indicating that regular check-ups were considered necessary even when a patient with DM was well-controlled. These results support those of a study by Al-Wadaani,^[1] who reported that >50% of medical students

agreed that if a patient with diabetes is treated early, DR can be prevented. However, many students strongly disagreed with the statement: 'patients with DM often waste their time and money in eye check-ups as most of the time the eyes of a patient with DM are healthy.' In another study undertaken in the Western Region of Saudi Arabia, a high proportion of general practitioners agreed that a newly diagnosed patient with DM required an eye check-up at the time of diagnosis and annually thereafter.^[9] Moreover, agreement on the need for regular eye check-ups as well as timely treatment of DM to prevent DR has been well documented from several published studies.^[1,8,10] In a Sudanese study, 75% of the respondents were reported to be of the opinion that patients with DM needed to only undergo an eye check-up when their vision was affected. Furthermore, 51% of the physicians in that study strongly agreed that an eye examination should be undertaken for pregnant patients with DM and that funduscopy can be performed for any patient with DM.^[11]

Practice findings

In terms of regular practice procedures, the participants considered that all patients with DM required an ophthalmology referral, and clearly understood that a patient with DM should visit an ophthalmologist at a local hospital to undergo an eye examination. Furthermore, the participants considered that both type I and type II patients with DM were at high risk of developing DR, which supports the findings of Al-Wadaani's study^[1] in which almost all the students involved in that study also agreed with this risk assessment, indicating awareness of the importance of referring all patients with DM to an ophthalmologist for routine eye examinations. This finding was similar to study results from Nepal,^[10] where it was reported that nearly all physicians agreed that all DM patients should be referred to an ophthalmologist, and those of Alrasheed *et al.*^[3] who reported that >60% of physicians routinely referred their patients with DM to an ophthalmologist. Al Ghamdi *et al.*,^[9] reported that most general practitioners advised their patients to

Table 5: The association between KAP and the sociodemographic characteristics of participants (n=153)

Factor	Knowledge		Attitudes		Practices	
	Poor n (%) (n=65)	Good n (%) (n=88)	Poor n (%) (n=16)	Good n (%) (n=137)	Poor n (%) (n=32)	Good n (%) (n=121)
Age (years)						
22 years	15 (23.1%)	21 (23.9%)	04 (25.0%)	32 (23.4%)	11 (34.4%)	25 (20.7%)
23 years	20 (30.8%)	35 (39.8%)	05 (31.2%)	50 (36.5%)	12 (37.5%)	43 (35.5%)
24 years	14 (21.5%)	22 (25.0%)	04 (25.0%)	32 (23.4%)	04 (12.5%)	32 (26.4%)
≥25 years	16 (24.6%)	10 (11.4%)	03 (18.8%)	23 (16.8%)	05 (15.6%)	21 (17.4%)
<i>P</i> [§]	0.179		0.982		0.242	
Sex						
Male	38 (58.5%)	56 (63.6%)	12 (75.0%)	82 (59.9%)	14 (43.8%)	80 (66.1%)
Female	27 (41.5%)	32 (36.4%)	04 (25.0%)	55 (40.1%)	18 (56.2%)	41 (33.9%)
<i>P</i> [§]	0.516		0.239		0.021 **	
Academic year						
4 th year	26 (40.0%)	47 (53.4%)	05 (31.2%)	68 (49.6%)	17 (53.1%)	56 (46.3%)
5 th year	39 (60.0%)	41 (46.6%)	11 (68.8%)	69 (50.4%)	15 (46.9%)	65 (53.7%)
<i>P</i>	0.101		0.164		0.491	

[§]*P* value has been calculated using Chi square test. **Significant at *P*≤0.05

undergo eye examinations at the time of diagnosis, and almost all of them advised their patients to undergo annual eye check-ups if there was no retinopathy diagnosed at the initial examination.

Prevalence of knowledge, attitude, and practice

Most participants had good knowledge (>50%), with good attitudes and practices found to be at a relatively high level (89.5% and 79.1%, respectively). Our study participants were well aware of DR. This is the first study in Saudi Arabia to determine the relationship between KAP and the basic demographic characteristics of participants; however, further research is needed to validate these results.

Significant factors in relation to knowledge, attitude, and practice

We measured the relationship between KAP and socio-demographic factors, such as age, sex, and academic year, and found that sex had a significant relationship on practice. However, no statistical difference was found between age and academic year in relation to KAP. Panigrahi *et al.*^[8] reported that sex was statistically significant in terms of both knowledge and practice, which was consistent with findings from our study.

Conclusion

In this study, >50% of the participants had good DR knowledge, and their attitudes and practices were generally excellent. Moreover, the participants' age was a significant factor in terms of their practices concerning DR. Given knowledge levels were found to be poor for a good proportion of participants, more targeted education is required to improve their knowledge base in regard to DR. Medical faculties have a significant role in the education of medical students to ensure greater awareness of DR.

DR is a major cause of blindness in diabetic patients. It is common complication that primary care physician face.

Many of Future primary care physicians should be educated about DR and how to prevent such complication.

Ethical Consideration

Ethical approval was received from the research centre in the College of Medicine, Qassim University. The research topic was explained to the students, who were given the option to participate or refuse. Participating students were informed that all information given by them would be secure and would be used for scientific purposes only.

Ethical approval number is 2018/07/02

A copy of ethical approval of this study provided.

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Conflicts of interest

There are no conflicts of interest.

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