

Cataracts Risk Factors and Comparison of Blood Glucose Levels in Diabetic and Non-Diabetic Patients towards the Occurrence of Cataracts

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Abstract

Citation: Harahap J, Rania R. Cataracts Risk Factors and Comparison of Blood Glucose Levels in Diabetic and Non-Diabetic Patients towards the Occurrence of Cataracts. *Open Access Maced J Med Sci.* 2019 Oct 30; 7(20):3359-3362.
<https://doi.org/10.3889/oamjms.2019.422>

Keywords: Risk factors; Hyperglycemia; Cataracts

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Received: 14-Aug-2019; **Revised:** 15-Sep-2019; **Accepted:** 16-Sep-2019; **Online first:** 14-Oct-2019

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Funding: This research did not receive any financial support

Competing Interests: The authors have declared that no competing interests exist

BACKGROUND: Cataracts are a multifactorial systemic disease that causes opacity of the optical lens. One aetiology of cataracts is chronic hyperglycemia, usually caused by uncontrolled diabetes mellitus.

AIM: The objective of this study is to identify risk factors of cataracts and to analyse if there is a significant difference in blood glucose values between diabetic patients with cataracts and non-diabetic patients with cataracts.

METHODS: This was an analytical case-control study with a sample size of 140 patients that were obtained via consecutive sampling of medical records.

RESULTS: This study found that age, high body mass index and hypertension were the dominant risk factors of cataracts. The mean value of blood glucose levels in diabetic patients with cataracts is 195.58 ± 63.9 and 109.7 ± 26.4 in non-diabetic patients with cataracts. There was a significant difference between the blood glucose values of diabetic patients with cataracts and non-diabetic patients with cataracts ($p < 0.001$). The dominant risk factors of cataracts were old age, high body mass index and hypertension. The majority of hyperglycemic patients belong in the group of diabetic patients with cataracts.

CONCLUSION: Chronic hyperglycemia can increase a patient's risk of cataracts.

Introduction

The Global Data of Visual Impairment: 2010 states that 33% of visual impairment and 51% of blindness worldwide is due to cataract [1]. Cataracts represent the world's largest cause of visual impairment and blindness (33%) after refractive problems like myopia, hyperopia and astigmatism (43%) [2]. Research on worldwide visual loss statistics shows that as many as 42% of blindness in Southeast Asia is caused by cataracts [3]. According to the *RisetKesehatanDasar* (RISKESDAS) of the Republic of Indonesia, 1.8% of the Indonesian population have cataracts, with almost 1000 new cases occurring annually. The RISKESDAS also states that 3.7% of

the people of North Sumatera have cataracts [4].

Cataracts have multiple etiologies, one of which is chronic hyperglycemia due to uncontrolled diabetes mellitus. A study was done by Mohammad-Ali Javadiet al., (2008) showed that people with diabetes mellitus are 2-5 times more at risk of cataracts at a younger age [5]. While the prevalence of cataracts varies with ethnic population and geographical location, consensually, the incidence of cataracts is higher in patients with diabetes mellitus than that of those without diabetes mellitus.

Therefore, this study aims to identify the risk factors of cataracts and to compare the levels of blood glucose in diabetic patients with cataracts and non-diabetic patients without cataracts.

Material and Methods

This study was conducted analytically with a case-control design. The population of this study were all cataract patients of Haji Adam Malik General Hospital. The sample population were 140 patients who were obtained via consecutive sampling of the patients' medical records.

Seventy patients were categorised as the case group, and another 70 patients were the control group. The control group were patients with cataracts but without diabetes mellitus, while the cases were cataract patients with diabetes mellitus diagnosed before cataracts. Diabetes mellitus in patients were confirmed with a doctor's diagnosis and high HbA1c value. A high HbA1c value is a criterion to diagnose diabetes mellitus because it denotes chronic hyperglycemia for the past three months. Then the patients' ad random blood glucose level was checked to see if they were hyperglycaemic or not.

On the other hand, the control group were non-diabetic patients with cataracts. This is because blood glucose values were not provided in the medical records for other ophthalmic diseases.

Blood glucose was observed through a patient's ad random blood glucose levels taken at least 3 months before the diagnosis of cataracts.

Results

Description of Age in Diabetic Patients with Cataracts and Non-Diabetic Patients with Cataracts

Various studies have shown that there is a significant relationship between advanced age and the incidence of cataracts. The table below shows the frequencies of patients aged > 50 years and ≤ 50 years old.

Table 1: Description of age in diabetic patients with cataracts and non-diabetic patients with cataracts

	Age	n	%
Diabetic Patients with Cataracts	> 50 years	57	81.4
	≤ 50 years	13	18.6
Total		70	100
Non-Diabetic Patients with Cataracts	> 50 years	59	84.3
	≤ 50 years	11	15.7
Total		70	100

According to Table 1, there are 57 (81.4%) diabetic patients with cataracts aged > 50 years and 13 diabetic patients with cataracts aged ≤ 50 years old. Table 1 also shows that in the control group, there are 59 (84.3%) patients aged > 50 years and 11 (15.7%) patients aged ≤ 50 years old.

The majority of patients in both case and

control groups were aged > 50 years old. This is supported by a study done in the University of Airlangga, Surabaya, Jawa Timur, Indonesia; where 66.7% of patients who required cataract surgery were aged > 60 years old [6].

Description of Sex in Diabetic Patients with Cataracts and Non-Diabetic Patients with Cataracts

A person's sex can influence their risk towards cataracts. Epidemiologically, females are more susceptible to cataracts. Table 2 shows the frequencies of male and female patients that were studied.

Table 2: Description of sex in diabetic patients with cataracts and non-diabetic patients with cataracts.

	Sex	n	%
Diabetic Patients with Cataracts	Male	40	57.1
	Female	30	42.9
Total		70	100
Non-Diabetic Patients with Cataracts	Male	37	52.9
	Female	33	47.1
Total		70	100

Table 2 shows that in the group of diabetic patients with cataracts, there are 40 (57.1%) male patients and 30 (42.9%) female patients. In the control group, there are 37 (52.9%) male patients and 33 (47.1%) female patients. Overall, there are more male than female patients.

In both the case and control groups, the majority of patients were male. However, this is contradicted by studies that have shown that female patients are more likely to get cataracts due to a decrease in estrogen levels due to menopause [7]. The higher number of male patients with cataracts in this study may be due to habitual smoking that is prevalent in Indonesian men, where studies by RISKESDAS have found that 67% of men in Indonesia are smokers [8]. Smoking tobacco can increase one's risk of getting cataracts [9].

Description of Body Mass Index in Diabetic Patients with Cataracts and Non-Diabetic Patients with Cataracts

The table below shows frequencies of body mass indices of the patients in this study.

Table 3: Description of body mass index in diabetic patients with cataracts and non-diabetic patients with cataracts

	Body Mass Index	n	%
Diabetic Patients with Cataracts	Underweight	1	1.4
	Normal	22	31.4
	Overweight	18	25.4
	Pre-obese	24	34.3
	Obese	5	7.1
Total		70	100
Non-Diabetic Patients with Cataracts	Underweight	7	10.0
	Normal	36	51.4
	Overweight	9	12.9
	Pre-obese	17	24.3
	Obese	1	1.4
Total		70	100

Table 3 shows that in the group of diabetic patients with cataracts, the majority of patients have higher than normal body mass indexes, with 18 (25.4%) overweight, 24 (34.3%) pre-obese and 5 (7.1%) obese patients. Only 22 (31.4%) of these patients had normal body mass indexes, and 1 (1.4%) patient was underweight.

On the other hand, the majority of patients in the control group have normal body mass indexes, with 36 (51.4%) patients. Nine (12.9%) of the patients were overweight, 17 (24.3%) were pre-obese, and 1 (1.4%) patient was obese. There were 7 (10.0%) patients who were underweight.

Obesity has an inconsistent relationship with the occurrence of cataracts; therefore, the causality of cataracts due to obesity cannot be proven as of now [10]. However, a cohort study by Ye et al., (2014) showed that an increase of 1 kg/m² in body mass index could increase the risk of senile cataracts by as much as 2% [11].

Description of Blood Pressure in Diabetic Patients with Cataracts and Non-Diabetic Patients with Cataracts

The pathophysiology of cataracts is influenced by severe systemic inflammation; therefore, hypertension can influence the pathogenesis of cataract formation via inflammatory mechanisms. Some theories state that hypertension can cause a permanent change in lens protein. However, epidemiologic studies have found inconsistent results for the mechanism of hypertension in cataract formation [12].

Table 4: Description of blood pressure in diabetic patients with cataracts and non-diabetic patients with cataracts

	Blood Pressure	N	%
Diabetic Patients with Cataracts	Normal	14	20.0
	Pre-hypertension	23	32.9
	Hypertension 1	19	27.1
	Hypertension 2	14	20.0
Total		70	100
Non-Diabetic Patients with Cataracts	Normal	18	25.7
	Pre-hypertension	42	60.0
	Hypertension 1	6	8.6
	Hypertension 2	4	5.7
Total		70	100

Table 4 shows that in the group of diabetic patients with cataracts, the majority of patients had higher than normal blood pressure, where 23 (32.9%) of patients were pre-hypertensive, 19 (27.1%) had type 1 hypertension and 14 (20.0%) had type 2 hypertension. Only 14 (20.0%) of patients in this group had normal blood pressure.

Forty-two (60.0%) of patients in the control group were pre-hypertensive, 6 (8.6%) had type 1 hypertension, and 4 (5.7%) had type 2 hypertension. There were 18 (25.7%) patients who had normal blood pressure in this group.

A meta-analysis by Yu et al., involving 25 other studies shows that the risk of cataracts is higher

in populations with hypertension in cohort studies (RR 1.08: 95% CI: 1.05 – 1.12), and case-control or cross-sectional studies (RR 1.28: 85% CI: 1.12 – 1.45) [12].

Description of Ad Random Blood Glucose in Diabetic Patients with Cataracts and Non-Diabetic Patients with Cataracts

The following table shows the frequencies of ad random blood glucose levels of the patents in the study.

Table 5: Description of ad random blood glucose in diabetic patients with cataracts and non-diabetic patients with cataracts

	Blood Glucose Status	n	%
Diabetic Patients with Cataracts	Normal	41	58.6
	Hyperglycemia	29	41.4
Total		70	100
Non-Diabetic Patients with Cataracts	Normal	69	98.6
	Hyperglycemia	1	1.4
Total		70	100

Table 5 shows that in the group of diabetic patients with cataracts, 41 (58.6%) of patients had normal ad random blood glucose, while 29 (41.4%) of the patients were hyperglycemic. The table also shows that in the control group, 69 (98.6%) of the patients had normal ad random blood glucose while only 1 (1.4%) patient was hyperglycaemic.

The minority of diabetic patients with diabetes mellitus have normal blood glucose levels. This is most probably due to the medication taken by diabetic patients to control their blood glucose levels. However, studies have shown that the incidence rate of cataracts in diabetic patients is 20.4 per 1000 person-years but is 10.8 per 1000 person-years in non-diabetic patients [13]. Another study by Raman et al., (2010) showed that 2 / 3 of 1283 patients with type 2 diabetes mellitus had cataracts [14].

Comparison of Ad Random Blood Glucose in Diabetic Patients with Cataracts and Non-Diabetic Patients with Cataracts

The pathophysiology of cataracts due to uncontrolled diabetes mellitus is due to the chronic hyperglycemia that occurs. The following table shows the results of the Mann-Whitney-U test

Table 6: Comparison of ad random blood glucose in diabetic patients with cataracts and non-diabetic patients with cataracts

	Mean ± Standard Deviation	Mean Difference	p-value
Diabetic Patients with Cataracts	195.58 ± 63.9	85.88	0.001
Non-Diabetic Patients with Cataracts	109.7 ± 26.4		

Table 6 shows the results of the Mann-Whitney U test, where the p-value obtained was p = 0.001. Therefore, there is a significant difference in blood glucose levels between diabetic patients with cataracts and non-diabetic patients with cataracts. Since the mean value of blood glucose levels is higher in diabetic patients with cataracts as compared to non-diabetic patients with cataracts, there is a

significant relationship between blood glucose levels and cataract occurrence in diabetic patients. This is due to the pathophysiology of cataracts due to uncontrolled diabetes mellitus, where chronic hyperglycemia occurs and increases the risk of cataract incidence.

Discussion

The results of this study are supported by a study done by Kahloun et al., where significant visual impairment can occur to patients who have had diabetes for more than 10 years ($p < 0.001$) [15]. This study also showed that fasting blood glucose levels is related to 10-year incidence rates of cortical cataracts. Another study by Jingi et al., states that a patient who has had diabetes mellitus for more than 10 years is 1.42 times more likely to experience cataracts than patients who have had diabetes for less than 10 years [16].

This study found that cataracts have multiple risk factors which are old age, high body mass index and hypertension. Chronic hyperglycemia can increase a patient's risk of cataracts. The majority of hyperglycemic patients belong in the group of diabetic patients with cataracts. Healthcare providers and patients should be more aware of the risk factors of cataracts and work together to handle those risks appropriately.

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