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Article

Visual Acuity Comparison after Phacoemulsification in Cataract Patients with and without Diabetes Mellitus

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ABSTRACT

Phacoemulsification is a common cataract surgery that improves visual acuity. Postoperative visual outcomes may be influenced by diabetes mellitus (DM). This study aimed to compare visual acuity outcomes after phacoemulsification in cataract patients with and without DM. It used an analytic observational design with a cross-sectional approach, analyzing medical records of 60 cataract patients (30 with DM, 30 without DM). Inclusion criteria were patients with and without DM who underwent phacoemulsification and had visual acuity results 21 days post-surgery. Patients using antidiabetic drugs or insulin were included, while those with incomplete medical records, glaucoma, corneal opacities, cataract complications, diabetic retinopathy, macular degeneration, retinal detachment, hypertensive retinopathy, or chronic kidney disease undergoing hemodialysis were excluded. Data were analyzed using the Mann-Whitney test. Results showed visual acuity in both groups mostly fell within the normal category based on WHO standards (6/6–6/18), with 23 (76.7%) patients in the DM group and 27 (90%) in the non-DM group. Statistical analysis indicated no significant difference in visual acuity between groups (p = 0.150). In conclusion, there is no significant difference in postoperative visual acuity between cataract patients with and without DM undergoing phacoemulsification.

INTRODUCTION

A review of the literature suggest that the incidence of blindness has occurred in 36 million people worldwide, with more than 12 million cases are due to cataracts[1]. The World Health Organization (WHO) estimates that the global prevalence of cataract incidence is 94 million people[2]. The incidence of cataracts is significantly influenced by age, with prevalence increasing with age. Among individuals aged 55 to 64 years, the prevalence of cataracts is 3.9%, while in those aged over 80 years, it is 92.6%[3]. Rapid Assessment of Avoidable Blindness (RAAB) indicated that there are 8 million people with visual impairment in Indonesia, with 1.3 million cases are due

to cataracts. The prevalence of cataracts in Yogyakarta is 2%[4].

Visual function in cataract patient can only be improved by surgery[5]. Phacoemulsification is the first choice and most performed type of cataract surgery. Phacoemulsification employs an ultrasonic vibrator to pulverize the opaque lens and then extract it. Subsequent to this, intraocular lens is implanted so that the visual acuity will improve due to the replacement of the cloudy lens with a clearer artificial lens[6]. The outcome of the surgery will be assessed by the visual acuity after phacoemulsification. Visual acuity is defined as a person's ability to see an object[7]. Post-cataract surgery visual acuity can be affected by hypertension, renal failure, and diabetes mellitus[8].

The International Diabetes Federation (IDF) organization has estimated that in 2021, the prevalence of diabetes in the world was 10.5%. It is projected that by 2045, this prevalence will increase to 12.2%[9]. The World Health Organization (WHO) has reported that every year, there are 1.5 million cases of diabetes that result in death worldwide. Furthermore, the number of individuals diagnosed with diabetes mellitus (DM) is projected to reach 422 million worldwide. The majority of individuals with diabetes reside in countries with low and middle income[10]. The 2018 Riskesdas data, based on medical diagnoses in the population of all ages, indicates that the prevalence of DM in Indonesia is 1.5%. The highest prevalence is observed in DKI Jakarta, at 2,6%, while the prevalence of DM in the D.I Yogyakarta is 2.4%[11].

A study conducted by Putra et al in 2019 at RS Mata Bali Mandara revealed that patients with DM had significantly poorer visual acuity after phacoemulsification compared to patients without DM[12]. Moreover, the results of a study conducted by Izzudin et al in 2021 at the Klinik Mata Sabang Merauke Eye Center (SMEC) in Samarinda indicated that there was no significant difference in visual acuity after phacoemulsification between cataract patients with and without DM[13].

A study was conducted at Klinik Mata dr. Imam aims to compare the visual outcomes of cataract patients with and without DM. This is due to the fact that phacoemulsification at Klinik Mata dr. Imam is performed by a single ophthalmologist, which results in a lack of significant variation in the visual acuity observed post-procedure, unless the patient presents with comorbidities that can influence the surgical outcome, such as glaucoma, corneal opacities, cataract complication, diabetic retinopathy, macular degeneration, retinal detachment, hypertensive retinopathy, and individuals with chronic kidney disease who undergo regular hemodialysis[8]. A total of 315 cataract patients were treated at Klinik Mata dr. Imam from January 2022 to September 2023. Of these patients, 30 had DM without complications. However, research conducted at the clinic to investigate whether cataract patients with DM had a difference in visual acuity after phacoemulsification compared to cataract patients without DM is challenging. Therefore, this study aimed to investigate the impact of DM on the visual acuity of cataract patients after phacoemulsification.

METHODS

This study is analytic observational with a cross-sectional design to determine the difference in visual acuity after phacoemulsification surgery in cataract patients with DM compared to cataract patients without DM. The research subjects consisting of 60 patients which consist of 30 cataract patients with DM and 30 cataract patients without DM. This is due to the fact that of the 315 patients, only 30 had DM without complications. Therefore, 30 cataract patients without DM were required for comparison. Consequently, a total of 60 cataract patients were necessary for this study due to the limited number of DM patients without complications.

The sampling technique used was purposive sampling. The inclusion criteria in this study were cataract patients with and without DM who had undergone phacoemulsification and had results of visual acuity before phacoemulsification and results of visual acuity 21 days after phacoemulsification at Klinik Mata dr. Imam. Additionally, the study included patients with cataract patients with DM who were taking anti-diabetic drugs or insulin. The exclusion criteria for this study include cataract patients with and without DM who had incomplete medical records, as well as patients with a history of diseases, such as glaucoma, corneal opacities, cataract complication, diabetic retinopathy, macular degeneration, retinal detachment, hypertensive retinopathy, and chronic kidney disease who routinely perform hemodialysis.

This study used secondary data sourced from medical records. The data was analyzed using the Statistical Product and Service Solutions (SPSS) version 27. Univariate analysis was employed to examine age, gender, and visual acuity before and after phacoemulsification in cataract patients. Bivariate analysis was utilized to compare visual acuity after phacoemulsification in cataract patients with DM and cataract patients without DM using the Mann-Whitney test.

Patients' visual acuity was classified according to the WHO standards, which categorize visual acuity as normal, moderate, or severe. A visual acuity of 6/6 to 6/18 is indicative of normal visual acuity, while a visual acuity of <6/18 to 6/60 is indicative of moderate visual acuity, and a visual acuity of 6/60 or less is indicative of severe visual acuity.

RESULTS

Table 1 indicates that most cataract patients with DM are aged 61-70 years (50%). Similarly, the majority of cataract patients without DM are aged 61-70 years (70%), while a minority are aged 41-50 years (3.3%). The data indicate that patients with DM were more likely to be male (56.7%) than female (43.4%). In contrast, patients without DM were more likely to be female (63.3%) than male (36.7%). The cataract patients with DM had severe visual impairment

before phacoemulsification, with a total sample of 20 (66,6%) and 5 patients (16.7%) each having normal and moderate visual impairment.

Table 1. Characteristics of sample

Characteristic	Cataract Patient with DM		Cataract Patient without DM	
	n	%	n	%
Age				
41-50	1	3.3	1	3.3
51-60	8	26.7	1	3.3
61-70	15	50	21	70
>70	6	20	7	23.4
Gender				
Male	17	56.7	11	36.7
Female	13	43.3	19	63.3
Visual acuity before phacoemulsification				
Normal (6/6 – 6/18)	5	16.7	5	16.7
Moderate (<6/18 – 6/60)	5	16.7	3	10
Severe (<6/60)	20	66.6	22	73.3
Visual acuity after phacoemulsification				
Normal (6/6 – 6/18)	23	76.7	27	90
Moderate (<6/18 – 6/60)	5	16.7	3	10
Severe (<6/60)	2	6.6	0	0

In cataract patients without DM, 22 (73.3%) had severe visual impairment before phacoemulsification, 3 (10%) had moderate visual impairment, and 5 (16.7%) had normal visual acuity. Table 1 indicates that 23 (76.7%) patients had normal visual acuity after phacoemulsification, 5 (16.7%) patients had moderate visual impairment, and 2 (6.6%) patients had severe visual impairment. Among cataract patients without DM, 27 (90%) had normal visual acuity, 3 (10%) patients had moderate visual impairment, and no patients has severe visual impairment.

Table 2 presents the results of the Mann-Whitney test, which indicates that there is no statistically significant difference in visual acuity after phacoemulsification in cataract patients with and without DM, since the significance value of p is 0.150 ($p > 0.05$).

Table 2. Differences in visual acuity after phacoemulsification in cataract patient with DM and without DM

Visual Acuity After Phacoemulsification	Mean Rank	Sum of Ranks	Z	p
Cataract with DM	32.60	978	-1.439	0.150
Cataract without DM	28.40	852		

DISCUSSION

The results of the Mann-Whitney test, as presented in Table 2, indicate that there is no statistically significant difference in postoperative visual acuity between cataract patients with DM and without DM at Klinik Mata dr. Imam. The p-value is 0,150, which is greater than 0,05, indicating that the observed difference is not statistically significant. The result of this study are

consistent with those of a previous study conducted by Izzudin et al at the Klinik Mata Sabang Merauke Eye Center (SMEC) in Samarinda, with a significance value of p = 0.509 (p > 0.05)[13]. Moreover, research conducted by Nabila at the Balai Kesehatan Mata Masyarakat (BKMM) revealed that the p-value was 0,451 (p > 0.05), indicating that there was no statistically significant difference in visual acuity after phacoemulsification between cataract patients with DM and without DM[14]. The similarity between this study is the characteristic of age (41 to more than 70 years old) and the surgical technique used is phacoemulsification.

In contrast to similar research conducted by Putra et al at RS Mata Bali Mandara, the result of this study demonstrated a significance value of p = 0.049 (p < 0.05). Furthermore, the research conducted by Hidayah at RS PKU Yogyakarta also showed a similar outcome with a significance value of p = 0.007 (p < 0.05)[12,15]. Both studies demonstrated a significant difference in visual acuity after phacoemulsification between cataract patients with DM and without DM. Similarly, a study conducted by Jie et al in Malaysia also revealed a difference between the two[16]. The factor that makes the difference in the conclusions is that in other trials, each patient's surgery is performed by different surgeons, so there may be differences in the results of each patient's surgery because of the different skills of each surgeon. In addition, the type of intraocular lens used may also affect the results[17].

Table 1 indicates that cataracts patients with and without DM were more likely to be aged 61-70 years. The respective proportions were 15 (50%) and 21 (70%) samples. These findings are consistent with those of Putra et al., who observed that cataract patients at RS Mata Bali Mandara were more likely to be aged 61-70 years (38.1%)[12]. The lens becomes increasingly cloudy and harder with age, which can impair vision and increase the risk of cataracts[18].

Cataract patients with DM are more likely to be male, while cataract patients without DM are more likely to be female. This finding differs from the results of the study conducted by Izzudin et al., which indicated that cataract patients were more female, with a percentage of 58.2% in cataract patients with DM and 56.4% in cataract patients without DM[13]. Women are at a greater risk of developing cataracts and DM than men. This is due to the fact that women experience a decline in the hormone estrogen, which acts as an antioxidant in lens epithelial cells during menopause. This can affect the protection of the lens and increase the risk of cataracts[13,19]. Furthermore, women who are elderly or have undergone menopause are at a greater risk of developing DM than men. This is due to the fact that women have a higher body mass index (BMI) and body fat distribution, which is more prone to accumulation following menopause due to hormonal processes[20].

Table 1 indicates that there were 2 cataract patients with DM who exhibited poor postoperative visual acuity, whereas no patients with poor visual acuity were observed among 30 cataract patients without DM. In general, cataract patients without DM tend to exhibit good

postoperative visual acuity compared to cataract patients with DM. This is attributed to several factors that can influence the visual outcome in patients with DM. One such factor is the lower endothelial cell density of cataract patients with DM compared to cataract patients without DM. Additionally, DM patients have small pupils and hard nuclei, which necessitates a longer surgical time than in cataract patients without DM. Hyperglycemia in DM patients can also interfere with corneal hydration, which can lead to decreased corneal transparency after phacoemulsification surgery[17].

Cystoid macular edema (CME) is one of the most prevalent complications after cataract surgery. Patients with diabetic retinopathy and DM are most likely to experience postoperative CME. CME results in intraocular inflammation that can reduce the visual acuity after phacoemulsification surgery[21,22]. Furthermore, non-compliance with postoperative cataract control and poorly controlled blood sugar can also affect the visual acuity of cataract patients after phacoemulsification surgery[23].

However, this study demonstrated that there was no difference in the visual outcomes after phacoemulsification surgery in patients with and without DM. This could be attributed to several factors, including the phacoemulsification technique, which has been shown to offer advantages in terms of visual acuity improvement after cataract surgery[6]. This is due to the minimal incision performed in the phacoemulsification technique, which is 2.5–3 mm[24]. Additionally, the operator's skill level influences the outcome of the surgery. Phacoemulsification surgery performed by a single operator on different patients minimizes differences in surgical skill, resulting in comparable visual acuity outcomes between patients[25]. It is also beneficial for cataract patients with DM to be compliant with blood sugar control before and after phacoemulsification surgery. This can facilitate a faster recovery and result in a visual acuity comparable to that of cataract patients without DM[23].

This study has limitation such as the limited number of DM patient samples so that researchers must take research sampled from 2022-2023 to be able to get 30 DM patient samples according to the inclusion criteria. Furthermore, there is currently no blood sugar data on patients scheduled for phacoemulsification surgery. Consequently, this study is unable to draw conclusions based on the DM history data contained in the medical record.

CONCLUSION

This study aimed to evaluate visual acuity outcomes following phacoemulsification in cataract patients with and without diabetes mellitus. The findings indicate that the majority of cataract patients, regardless of their diabetic status, achieved normal visual acuity after undergoing phacoemulsification. Furthermore, statistical analysis revealed no significant

difference in visual acuity improvement between diabetic and non-diabetic patients postoperatively. These results suggest that phacoemulsification is an effective and reliable procedure for restoring visual acuity in cataract patients, irrespective of diabetes mellitus. However, further research is needed to assess long-term visual outcomes and potential complications in diabetic patients. Continuous postoperative monitoring and optimal glycemic control may still be essential to ensure the best possible visual prognosis for diabetic individuals undergoing cataract surgery.

REFERENCES

1. Hashemi H, Pakzad R, Yekta A, et al. Global and regional prevalence of age-related cataract: a comprehensive systematic review and meta-analysis. *Eye Journal*. 2020;34(8):1357-1370. doi:10.1038/s41433-020-0806-3
2. WHO. Blindness and vision impairment. Published 2022. Accessed June 11, 2023.
3. Fang R, Yu YF, Li EJ, et al. Global, regional, national burden and gender disparity of cataract: findings from the global burden of disease study 2019. *BMC Public Health*. 2022;22(1):1-16. doi:10.1186/S12889-022-14491-0/TABLES/2
4. Badan Litbangkes Kementerian Kesehatan RI. 2018. *Rapid Assessment of Avoidable Blindness (RAAB) di Indonesia*. Jakarta: Kemenkes RI
5. Harianja GM, Fatmawati NK, Sulistiawati. Penurunan Tekanan Intraokular Pascaoperasi Katarak dengan Teknik Fakoemulsifikasi di Klinik Mata SMEC Samarinda. *Jurnal Kedokteran Mulawarman*. 2020;7(3).
6. Astari P. Katarak: Klasifikasi, Tatalaksana, dan Komplikasi Operasi. *Cermin Dunia Kedokteran*. 2018;45(10):748-753.
7. Julita. Pemeriksaan Tajam Penglihatan pada Anak dan Refraksi Siklopegik: Apa, Kenapa, Siapa? *Jurnal Kesehatan Andalas*. 2018;7(1). http://jurnal.fk.unand.ac.id
8. Yong GY, Mohamed-Noor J, Salowi MA, Adnan TH, Zahari M. Risk factors affecting cataract surgery outcome: The Malaysian cataract surgery registry. *PLoS ONE Journal*. 2022;17(9). doi: 10.1371/JOURNAL.PONE.0274939
9. IDF. *International Diabetes Federation Diabetes Atlas*. 10th ed.; 2021. www.diabetesatlas.org
10. WHO. Diabetes. Published 2023. Accessed June 11, 2023. https://www.who.int/health-topics/diabetes#tab=tab_1
11. Kementerian Kesehatan. *Laporan Nasional Riset Kesehatan Dasar.*; 2018. https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/1/Laporan%20Riskesdas%202018%20Nasional.pdf
12. Putra PGW, Sunariasih NN, Ningrum RK. Perbedaan Tajam Penglihatan Pascaoperasi Fakoemulsifikasi Pada Pasien Katarak Dengan Diabetes Melitus dan Tanpa Diabetes Melitus. *Aesculapius Medical Journal* |. 2022;2(1).
13. Izzuddin MA, Fatmawati NK, Nugroho H. Perbedaan Tajam Penglihatan Pascaoperasi Fakoemulsifikasi antara Pasien Katarak dengan Diabetes Mellitus dan Tanpa Diabetes Mellitus. *Jurnal Medika Karya Ilmiah Kesehatan*. 2022;7(2):2541-4615.
14. Nabila AN. Perbedaan Tajam Penglihatan Pasca Fakoemulsifikasi pada Pasien Katarak Senilis dengan Diabetes Mellitus Non-Retinopati dan tanpa Diabetes Mellitus di Balai Kesehatan Mata Masyarakat (BKMM) Cikampek. *Jurnal Penelitian UMJ*. 2022;27(1):1-10.
15. Hidayah A. *Perbedaan Tajam Penglihatan Pasca Operasi Fakoemulsifikasi Pada Pasien Katarak Dengan Diabetes Melitus Dan Tanpa Diabetes Melitus Di RS PKU Yogyakarta Unit 1*. Universitas Muhammadiyah Yogyakarta; 2015.
16. Jie LJ, Salowi MA, Adnan TH, Anuar N, Ngah NF, Choo MM. Visual outcomes after Phacoemulsification with Intraocular Implantation surgeries among patients with and without Diabetes Mellitus. *Med J Malaysia*. 2021;76(2).

17. Grzybowski A, Kanclerz P, Huerva V, Ascaso FJ, Tuuminen R. Diabetes and Phacoemulsification Cataract Surgery: Difficulties, Risks and Potential Complications. *J Clin Med*. 2019;8(5). doi:10.3390/JCM8050716
18. Ilyas HS, Yulianti SR. *Ilmu Penyakit Mata*. 5th ed. Fakultas Kedokteran Universitas Indonesia; 2018. Accessed October 20, 2022.
19. Detty AU, Artini I, Yulian VR. Karakteristik Faktor Risiko Penderita Katarak. *Jurnal Ilmiah Kesehatan Sandi Husada*. 2021;10(1):12-17. doi:10.35816/jiskh. v10i1.494
20. Rita N. Hubungan Jenis Kelamin, Olah Raga dan Obesitas dengan Kejadian Diabetes Mellitus Pada Lansia. *Jurnal Ilmu Kesehatan*. 2018;2(1).
21. Soeprajogo MP. *Cystoid Macular Edema Pasca Operasi Katarak*. Universitas Padjadjaran; 2018.
22. Chen XY, Song WJ, Cai HY, Zhao L. Macular edema after cataract surgery in diabetic eyes evaluated by optical coherence tomography. *Int J Ophthalmol*. 2016;9(1):81. doi:10.18240/IJO.2016.01.14
23. Siswoyo, Hakam M, Purnami MES. *The Correlations Between the Implementation of Discharge Planning with Treatment Complianceon Client Postoperative Cataract in RSD Dr. Soebandi Jember*.; 2016.
24. Riordan-Eva P, Augsburger JJ. *Vaughan & Asbury's General Ophtalmology*. 19th ed. McGraw Hill; 2017.
25. Hanis N, Mayani G, Hanina. Gambaran Perbaikan Visus Serta Komplikasi Intraoperasi atau Pascaoperasi Pada Pasien Operasi Katarak Senilis di RSUD H. Abdul Manap Kota Jambi Periode Januari 2021-Desember 2021. *Journal of Medical Studies*. 2023.;3(1)