ORIGINAL STUDIES
ORIGINALNI NAUČNI RADOVI

Clinical Center of Vojvodina, Eye Clinic, Novi Sad[1]
University of Novi Sad, Faculty of Medicine Novi Sad
Department of Ophthalmoplogy[2]

Original study
Originalni naučni rad
UDK 617.741-004.1-08:616.379-008.64
https://doi.org/10.2298/MPNS1808217C

OUTCOME OF CATARACT SURGERY IN DIABETIC PATIENTS

ISHOD HIRURŠKOG LEČENJA KATARAKTE KOD PACIJENATA SA DIJABETESOM

Vladimir ČANADANOVIĆ[1,2], Nikola BABIĆ[1, 2], Sofija DAVIDOVIĆ[1, 2], Aleksandar MILJKOVIĆ[1,2], Stefan BRUNET[1] and Sava BARIŠIĆ[1]

Summary

Introduction. The association between diabetes and cataract formation has been shown in many clinical studies. Development of cataract occurs more frequently and at an earlier age in diabetic patients. Due to the increasing prevalence of diabetes worldwide, the incidence of diabetic cataracts steadily rises. While the overall outcomes of cataract surgery are excellent, patients with diabetes may have poorer vision outcomes than those without diabetes. The objective of this study was to evaluate the visual outcomes (visual acuity and visual function), intraoperative and postoperative complications of cataract surgery, and to assess the final surgical outcomes. **Material and Methods.** The prospective study included 128 patients (133 eyes) with cataract and diagnosis of diabetes mellitus type 2 at least 5 years prior to cataract surgery, operated at the Eye Clinic, Clinical Center of Vojvodina, Novi Sad. A full medical history included patients' age, the time since the diagnosis of diabetes, current management of diabetes, blood pressure and assessment of glycemic control using glycosylated hemoglobin. All patients underwent complete ophthalmological examination before cataract surgery, and were re-examined 7 days, one and six months after the surgery. **Results.** The mean age of patients at the time of surgery was 63.5 years (SD ± 6.5, range 57 – 70 years) with mean duration of diabetes 8.5 years. The glycosylated haemoglobin level in the group treated with insulin was 6.8 vs. 8.2 in patients on oral medications ($p < 0.05$). Diabetes mellitus was accompanied by other systemic diseases in 81 patients (63.28%), whereas 45 of 133 operated eyes (33.83%) had other ocular diseases. Intraoperative complications occurred in 20 of 133 operated eyes (15%): posterior capsular rupture with vitreous loss, intraoperative miosis, iris hemorrhage and suprachoroidal hemorrhage. **Conclusion.** Cataract surgery with intraocular lens implantation is an effective and safe surgical procedure in diabetic patients, and sight threatening complications are rare. Our study confirmed that visual acuity after surgery in diabetic patients depends on the severity of diabetic retinopathy at the time of surgery.

Key words: Diabetes Mellitus; Cataract; Vision Disorders; Visual Acuity; Cataract Extraction; Treatment Outcome; Postoperative Complications; Phacoemulsification; Hemoglobin A, Glycosylated; Diabetic Retinopathy

Sažetak

Uvod. Udruženost šećerne bolesti i katarakte je dokazana u mnogim istraživanjima a razvoj katarakte kod ovih pacijenata je učestaliji i u ranijem životnom dobu. Porast obolelih od šećerne bolesti dovodi do porasta broja pacijenata sa dijabetesnom kataraktom. Cilj ovog rada bio je da se izvrši procena vida (vidna oštrina i vidna funkcija), intraoperativnih i postoperativnih komplikacija operacije katarakte i da se sagleda krajni ishod hirurškog lečenja. **Materijal i metode.** Ova prospektivna studija obuhvatila je 128 pacijenata (133 oka) sa kataraktom i šećernom bolešću tipa II u trajanju od najmanje pet godina pre izvršene operacije na Klinici za očne bolesti, Kliničkog centra Vojvodine. Evaluirani su prosečna starost, način regulacije šećerne bolesti, visina krvnog pritiska i vrednosti glikoliziranog hemoglobina. Pacijenti su praćeni preoperativno, a zatim sedam dana, jedan mesec i šest meseci nakon operativnog lečenja. **Rezultati.** Prosečna starost pacijenata u ovoj studiji iznosila je 63,5 godina (SD ± 6,5, raspon 57–70 godina) sa prosečnim trajanjem šećerne bolesti 8,5 godina. Vrednosti glikoliziranog hemoglobina u grupi na insulinskoj terapiji u odnosu na peroralnu iznosile su 6,8 vs. 8,2 ($p < 0,05$). Kod 81 pacijenta (63,28%) dijabetes melitus je bio udružen sa drugim sistemskim bolestima a kod 45, od 133 operisana oka (33,83%), postojala su i druga očna oboljenja. Intraoperativne komplikacije iznosile su 15%: rupture zadnje kapsule sočiva sa gubitkom staklastog tela, intraoperativno suženje zenice, krvarenje iz dužice i suprahoroidalno krvarenje. **Zaključak.** Operacija katarakte sa ugradnjom intraokularnog sočiva kod pacijenata obolelih od šećerne bolesti je bezbedna procedura sa niskim rizikom u pogledu nastanka komplikacija koje bi mogle dovesti do gubitka vida. Ova studija potvrđuje da postoperativna vidna funkcija pacijenata sa šećernom bolešću zavisi od preoperativnog stepena dijabetesne retinopatije.

Ključne reči: dijabetes melitus; katarakta; poremećaji vida; vidna oštrina; ekstrakcija katarakte; ishod lečenja; postoperativne komplikacije; fakoemulzifikacija; glikozilizirani hemoglobin; dijabetesna retinopatija

Corresponding Author: Prof. dr Vladimir Čanadanović, Klinički centar Vojvodine, Klinika za očne bolesti, 21000 Novi Sad, Hajduk Veljkova 1-7, E-mail: vladimir.canadanovic@mf.uns.ac.rs

Abbreviations

DM – diabetes mellitus
HbA1C – glycosylated hemoglobin
CME – cystoid macular edema
DR – diabetic retinopathy
BCVA – best corrected visual acuity

Introduction

Cataract is a common cause of visual impairment. The prevalence of all types of cataract increases with age, from 4.5% among persons in their 40s to 40 – 60% in those aged 70 years and over [1]. Senile cataract is one of the most common causes of reversible vision loss in elderly persons. Visual impairment caused by cataract affects the patient in several ways, leading to perceived difficulties in performing vision related everyday activities and decreasing the quality of life [2–4]. It is estimated that by the year 2021, the number of people affected by cataract will increase by 63%, due to population aging [5].

Cataract has a multifactorial etiology and seems to be caused by accumulation of risk factors [6, 7]. Osmotic stress caused by sorbitol accumulation in the ocular lens has long been suggested to be the major cause of this complication, since sorbitol was found to be accumulated to a substantially high level in cataractous lenses in diabetic patients. Under hyperglycemic conditions, sorbitol is formed from the reduction of glucose by the enzyme aldose reductase. The conversion of sorbitol to fructose via sorbitol dehydrogenase has also been suggested to contribute to redox imbalance in diabetes. It has been suggested that glucose autoxidation and nonenzymatic glycation, together termed glycoxidation, are the major contributors to the increase in free radicals in diabetic lenses. During diabetes, the lens antioxidant system may also be compromised. A loss of antioxidants, like vitamin C, vitamin E, and glutathione, were found in lenses under hyperglycemic condition.

The association between diabetes and cataract formation has been shown in many clinical studies, and development of cataract occurs more frequently and at an earlier age in diabetic patients [8, 9]. Two types of cataract may be associated with diabetes mellitus (DM). True diabetic cataract appears as bilateral white punctate or snowflake posterior or anterior opacities. It is the result of osmotic overhydration of the lens. In some diabetic patients cataract has the characteristics of typical senile cataract but progresses more rapidly [8].

Due to increasing numbers of diabetics worldwide, the incidence of diabetic cataracts steadily rises. It has been estimated that up to 15% of cataract surgery is performed on diabetics. Cataract extraction is the most frequent surgical procedure in ophthalmology and continues to be one of the most commonly performed elective surgical procedures in medicine [10]. Advances in new technology have lead to the development of small incision phaco surgery. This technique has increased the efficacy of surgery with faster rehabilitation and reintegration in daily life activities. The high success rate of cataract surgery has created high expectations regarding the vision outcome and improvement in vision related everyday activities [11]. The main indications for cataract surgery are the same as for non-diabetic patients. The goal of cataract extraction and intraocular lens implantation is to improve visual acuity and visual function, with an assumption that this will improve overall quality of life [2, 13]. Cataract surgery in diabetic patients is also indicated if the lens opacity prevents fundus examination or produces excessive light scattering during laser therapy. While the overall outcomes of cataract surgery are excellent, patients with diabetes may have poorer vision outcomes than those without diabetes.

Diabetic eyes may have a bigger lens and a shallower anterior chamber in comparison with non diabetic patients, especially in eyes with diabetic retinopathy (DR) [14, 15]. The lens capsule is more fragile, with higher rate of rupture and vitreous loss [16]. Cataract surgery changes the physiology of the eye and stimulates the release of inflammatory cytokines, fluctuations of intraocular pressure which cause the alterations of ocular perfusion and the function of barrier between the anterior and the posterior segment may be compromised after surgery. The diabetic eye is more susceptible to surgical trauma due to longer duration of surgery, more pronounced miosis and a transient elevation of intraocular pressure [17, 18]. These eyes may have a higher incidence of cystoid macular edema (CME) and more pronounced postoperative inflammation than the non-diabetic eyes [19, 20].

In some patients surgery may cause acceleration of DR, induce rubeosis iridis or lead to macular changes. The worst outcomes may occur in operated eyes with active proliferative retinopathy and/or preexisting macular edema.

Material and Methods

This prospective study included 128 patients (133 eyes) with cataract and diagnosis of DM type 2 at least 5 years prior to cataract surgery, operated at the Eye Clinic, Clinical Center of Vojvodina, Novi Sad.

All diabetic patients included in this study underwent complete ophthalmological examination before cataract surgery: best corrected distance visual acuity (BCVA) testing using Snellen chart, intraocular pressure measurement using applanation tonometer, slit lamp examination of anterior and posterior segment of the eye in artificial mydriasis. All patients were re-examined 7 days, one and six months after surgery. A full medical history included the patients' age, time

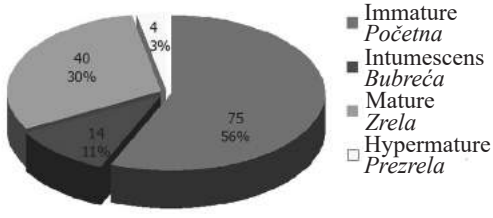

Figure 1. Maturity of cataracts
Slika 1. *Zrelost katarakte*

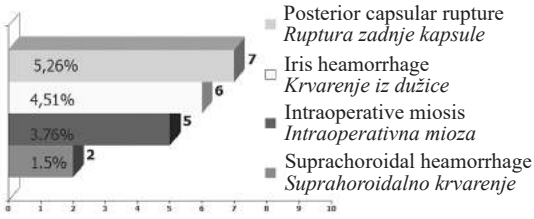

Figure 2. Intraoperative complications
Slika 2. *Intraoperativne komplikacije*

from diabetes diagnosis and current management of diabetes, blood pressure and glycemic control assessed by glycosylated hemoglobin (HbA1C) measurement. All patients included in this study were without clinical significant diabetic or CME. If present before surgery, DR was mild and non-proliferative. Patients with other ophthalmic conditions (history of any ophthalmic surgery, laser treatment, anti-vascular endothelial growth factor therapy, uveitis etc.) that might have influenced the onset and course of diabetic eye disease were excluded.

Results

A total of 128 diabetic patients (133 eyes) were enrolled in this study, 70 (55%) females and 58 (45%) males. The mean age of patients at the time of surgery was 63.5 years (SD ± 6.5, range 57 – 70 years) with mean duration of diabetes 8.5 years. The treatment of diabetes included insulin therapy in 35% and oral medications in 65%. Assessment of HbA1C values between patients receiving different diabetic therapy revealed statistically significantly higher values of HbA1C in the group treated with insulin in comparison to patients on oral medications (6.8 vs. 8.2, $p < 0.05$). DM was accompanied with other systemic diseases in 81 patients (63.28%) hypertension (67 pts), renal insufficiency (8 pts) and cardiovascular disorders (6 pts). Other ocular diseases accompanying cataract were found in 45 from 133 operated eyes (33.83%): DR (24.06%), macular degeneration (2.25%), degenerative myopia (3.01%) and glaucoma (4.51%). According to maturity, immature cataract was present in 75 (56%), intumescent cataract in 14 (11%), mature cataract in 40 (30%), and hypermature cataract in 4 (3%) eyes **(Figure 1)**.

Intraoperative complications were found in 20 of 133 operated eyes (15%): posterior capsular rupture with vitreous loss in 7 (5.26%), intraoperative miosis in 5 (3.76%), iris hemorrhage in 6 (4.51%) and suprachoroidal hemorrhage in 2 (1.5%) **(Figure 2)**.

Seven days after cataract surgery, CME was found in 44 (33.08%), retinal detachment in 2 (1.5%), fibrin exudation in 12 (9.02%) and corneal decompensation in 14 (10.5%) operated eyes. The main postoperative complications one month after the cataract surgery were CME in 34 (25.6%), opacification of the posterior capsule in 7 (5.26%), retinal detachment in 2 (1.5%), fibrin exudation in 8 (6%) and corneal decompensation in 4 (3%) operated eyes.

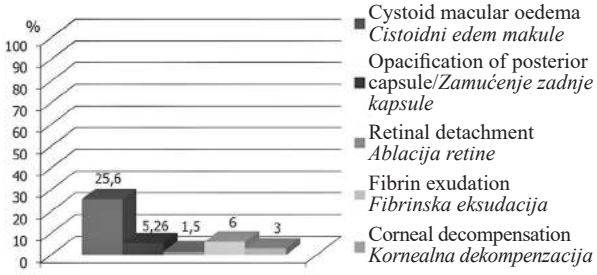

Figure 3. Postoperative complications (1 month)
Slika 3. *Postoperativne komplikacije (jedan mesec)*

The main postoperative complications one month after cataract surgery are shown in **Figure 3**.

Six months after cataract surgery, the main postoperative complications were opacification of the posterior capsule in 22 (16.54%), persistent CME in 14 (10.52%), and corneal decompensation in 3 (2.25%) operated eyes. The main postoperative complications six months after cataract surgery are shown in **Figure 4**.

At the time of surgery, BCVA was 0,4 or less in 121 (90.97%) eyes. Only 12 (9.02%) had BCVA of 0.5 or better. After surgery, the BCVA was significantly

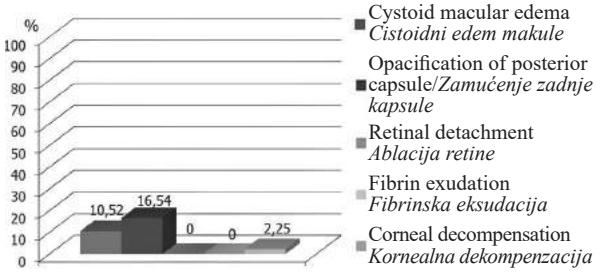

Figure 4. Postoperative complications (6 months)
Slika 4. *Postoperativne komplikacije (šest meseci)*

better; 94 (70.76%) eyes achieved a BCVA of 0.5 or better (median 0.7; range 0.5 – 1.0). The remaining 31 (23.3%) eyes had a BCVA of 0.2 or better (median 0.3; range 0.2 – 0.4) and 8 (6.01%) had BCVA of 0.1 or less due to persistent macular edema and corneal decompensation. The main preoperative and postoperative BCVA are shown in **Figure 5**.

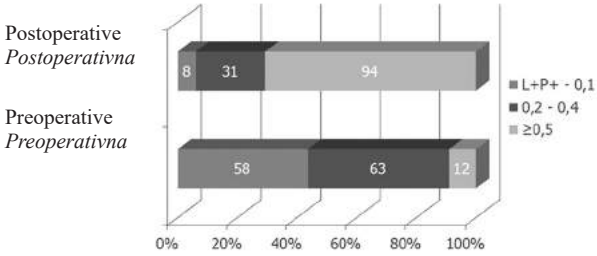

Figure 5. Preoperative and postoperative best corrected visual acuity
Slika 5. *Preoperativna i postoperativna najbolje korigovana vidna oštrina*

Discussion

The incidence of diabetes is increasing due to many factors, but the most significant are the increasing incidence of obesity and the prevalence of sedentary lifestyle. Many epidemiological and clinical studies documented a higher prevalence of cataract in diabetic patients [21, 22]. Association between diabetes and cataract is shown in the Beaver Dam Eye Study, the Blue Mountains Eye Study and the Visual Impairment Project [23, 24]. The Wisconsin Epidemiologic Study of Diabetic Retinopathy documented a direct relationship between HbA1C and cataract [25]. In our study increased level of HbA1C was found in 43.6% of diabetic patients with cataract.

In study of Raman et al. [26] the prevalence of cataract was higher in women, patients with diagnosed diabetes, and those with longer duration of diabetes. The risk factors for any type of cataract were older age and increasing HbA1C. The mean age of patients enrolled in our study was 63.5 years (range 57 – 70 years) with average value of HbA1C 7.4%. In 52.34% of operated patients diabetes was accompanied with hypertension. Patients with diabetes require regular follow-up to optimize their glycemic status, blood pressure and lipid control to prevent development and progression of DR and other diabetes-related complications [27, 28]. It is known that diabetic eyes have more complications during and after cataract surgery than nondiabetic eyes.

According to previous studies, the prevalence of posterior capsular rupture and vitreous loss varies from 1.92 – 7% [29, 30]. Interestingly, the rate of 4.4% has been reported in a study from the United Kingdom [31]. In our study, the rate of posterior capsule rupture and vitreus loss was 5.26%.

The effects of cataract surgery on the postoperative course of DR and how lens removal may affect diabetic retinal changes in operated eye is still unclear**.** Williams et al. [32] showed that lens extraction can inhibit endothelial proliferation and may induce vascular alterations resulting in neovasularisation. Jaffe and Burton reported development of severe exudative forms of diabetic macular edema following cataract extraction [33].

In the study of Pollac et al. on 44 operated eyes, 50% of eyes presented with CME 6 weeks after surgery and in 25% it was still present 1 year later. The CME occurred postoperatively only in 32% of eyes without pre-existing DR and in 81% of eyes with pre-existing DR [34]. In our study, the incidence of clinicaly significant CME, detectable on ophthalmoscopic examination one month after the cataract surgery, was 25.6%. Patients with DR prior to surgery are at higher risk for poor visual outcome after surgery [35, 36]. Aiello et al. found that patients with or without background retinopathy were at higher risk for developing vitreous hemorrhage [37]. In contrast, other authors found that cataract surgery was not associated with the progression of DR and reported similar progression in the unoperated fellow eye [38]. A considerable proportion of eyes with aggravation of retinopathy would reflect the natural course of the disease, systemic factors or both, rather than the effects of cataract surgery [39]. In our study, at the time before surgery DR was of mild non-proliferative type. Six moth after the cataract surgery we found no progression of DR. The findings of our study should be interpreted with caution, due to the small number of diabetic patients with cataract and short follow up period.

In our study, after phacoemulsification, the visual acuity was improved in the majority of operated eyes. The largest group with good visual results after cataract surgery (70.67% of operated patients with BCVA > 0.5) included patients with good glycemic control at the time of cataract surgery. Our results are similar to those reported by other researches [40].

Conclusion

The results of numerous previous clinical studies and the results of our study showed that cataract surgery with intraocular lens inplantation in diabetic patients is an effective and safe surgical procedure and sight threatening complications are rare. Our study confirmed that visual acutiy after surgery in diabetic patients depends on the severity of diabetic retinopathy at the time of surgery. The preoperative status of diabetic retinopathy may be a significant prognostic factor for the postoperative visual outcome. The risk of intraoperative and postoperative complications is related to duration of diabetes, accompanied eye diseases, maturity of cataract and increased serum level of glycosylated hemoglobin. These patients should be monitored postoperatively for early screening of diabetic retinopathy progression, and if necessary laser treatment should be considered.

References

1. Shrestha LB. Population aging in developing countries. Health Aff (Millwoord). 2000;19(3):204–12.

2. Lundström M, Stenevi U, Thorburn W. The Swedish National Cataract Register B. A 9-year review. Acta Ophthalmol Scand. 2002;80(3):248–57.

3. Čanadanović V, Latinović S, Babić N, Babović S, Žikić Z, Lješević Lj, et al. Quality of life in patients with cataract - VQOL Study Group report. Patients Reported Outcomes Newsletter. 2005;34:23-4.

4. Finger RP, Fenwick E, Marella M, Dirani M, Holz FG, Chiang PP, et al. The impact of vision impairment on vision specific quality of life in Germany. Invest Ophthalmol Vis Sci. 2011;52(6): 3613-9.

5. Rochtchina E, Mukesh BN, Wang JJ, McCarty CA, Taylor HR, Mitchell P. Projected prevalence of age-related cataract and cataract surgery in Australia for the years 2001 and 2021: pooled data from two population-based surveys. Clin Exp Ophthalmol. 2003;31(3):233-6.

6. Zorić L, Elek-Vlaić S, Jovanović M, Kisić B, Đokić O, Čanadanović V, et al. Oxidative stress intensity in lens and

aqueous depending on age-related cataract type and brunescence. Eur J Ophthalmol. 2008;18(5):669-74.

7. Čanadanović V, Latinović S, Barišić S, Babić N, Jovanović S. Age related changes of vitamin C levels in aqueous humour. Vojnosanit Pregl. 2015;72(9):823-6.

8. Bowling B, editor. Kanski`s clinical ophthalmology: a systematic aproach. 8th ed. London: Elsevier; 2016.

9. Peterson SR, Silva PA, Murathi TJ, Sun JK. Cataract surgery in patients with diabetes: management strategies. Semin Ophthalmol. 2018;33(1):75-82.

10. Rana M, Shah S. Modern-day cataract surgery: can we match growing expectations? Br J Ophthalmol. 2014;98(10):1313-4.

11. Čanadanović V, Latinović S, Babić N, Miljković A, Grković D, Barišić S. Vision related problems after cataract surgery. Med Pregl. 2017;70(9-10):307-11.

12. Lundström M, Stenevi U, Thorburn W. Quality of life after first- and second-eye cataract surgery. Five-year data collected by the Swedish National Cataract Register. J Cataract Refract Surg. 2001;27(10):1553–9.

13. Tan A, Tay TW, Zheng FY, Tan AG, Wang JJ, Mitchell P, et al. The impact of bilateral or unilateral cataract surgery on vision function when does second eye surgery benefit patients. Br J Ophthalmol. 2012;96(6):846-51.

14. Brown N, Hungerford J. The influence of the size of the lens in ocular disease. Trans Ophthalmol Soc UK. 1982;102 Pt 3:359–63.

15. Sparrow JM, Bron AJ, Phelps Brown NA, Neil HA. Biometry of the crystalline lens in late onset diabetes: the importance of diabetic type. Br J Ophthalmol. 1992;76(7):428–33.

16. Kuchle M, Schonherr U, Dieckmann U. Risk factors for capsular rupture and vitreous loss in extracapsular cataract extraction. Fortschr Ophthalmol. 1989;86(5):417–21.

17. Zaczek A, Zetterström C. Cataract surgery and pupil size in patients with diabetes mellitus. Acta Ophthalmol Scand. 1997;75(4):429–32.

18. Antcliff RJ, Poulson A, Flanagan DW. Phacoemulsification in diabetics. Eye (Lond). 1996;10(Pt 6):737–41.

19. Menchini U, Bandello F, Brancato R, Camesasca FI, Galdini M. Cystoid macular oedema after extracapsular cataract extraction and intraocular lens implantation in diabetic patients without retinopathy. Br J Ophthalmol. 1993;77(4):208–11.

20. Zaczek A, Zetterström C. Aqueous flare intensity after phacoemulsification in patients with diabetes mellitus. J Cataract Refract Surg. 1998;24(8):1099–104.

21. Mukesh BN, Le A, Dimitrov PN, Ahmed S, Taylor HR, McCarty CA. Development of cataract and associated risk factors: the Visual Impairment Project. *Arch Ophthalmol.* 2006;124(1):79–85.

22. Chang JR, Koo E, Agron E, Hallak J, Clemons T, Azar D, et al. Risk factors associated with incident cataracts and cataract surgery in the Age-related Eye Disease Study (AREDS): AREDS report number 32. Ophthalmology. 2011;118(11):2113-9.

23. Rowe NG, Mitchell PG, Cumming RG, Wans JJ. Diabetes, fasting blood glucose and age-related cataract: the Blue Mountains Eye Study. Ophthalmic Epidemiol. 2000;7(2):103–14.

24. Klein BE, Klein R, Wang Q, Moss SE. Older-onset diabetes and lens opacities: the Beaver Dam Eye Study. Ophthalmic Epidemiol. 2005;2(1):49–55.

25. Klein BE, Klein R, Moss SE. Incidence of cataract surgery in the Wisconsin Epidemiologic Study of Diabetic Retinopathy. Am J Ophthalmol. 1995;119(3):295–300.

26. Raman R, Pal SS, Adams JS, Rani PK, Vaitheeswaran K, Sharma T. Prevalence and risk factors for cataract in diabetes: Sankar Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study, report No. 17. Invest Ophthalmol Vis Sci. 2010;51(12):6253-61.

27. Ting DS, Cheung GC, Wong TY. Diabetic retinopathy:global prevalence, major risk factors, screening practices and public health challenges: a review. Clin Exp Ophthalmol. 2016;44(4):260-77.

28. Keenum Z, McGwin G Jr, Witherspoon CD, Haller JA, Clark ME, Owsly C. Patients' adherence to recommended follow-up eye care after diabetic retinopathy screening in a Publicly Funded County Clinic and factors associated with follow-up eye care use. JAMA Ophthalmol. 2016;134(11):1221-8.

29. Abbasoğlu OE, Hoşal B, Tekeli O, Gürsel E. Risk factors for vitreous loss in cataract surgery. Eur J Ophthalmol. 2000;10(3):227–32.

30. Lai FH, Lok JY, Chow PP, Young AL. Clinical outcomes of cataract surgery in very elderly adults. J Am Geriatr Soc. 2014;62(1):165–70.

31. Desai P, Minassian DC, Reidy A. National cataract surgery survey 1997–8: a report of the results of the clinical outcomes. Br J Ophthalmol. 1999;83(12):1336–40.

32. Williams GA, Eisenstein R, Schumacher B, Hsiao KC, Grant D. Inhibitor of vascular endothelial cell growth in the lens. Am J Ophthalmol. 1984;97(3):366-71.

33. Jaffe GJ, Burton TC. Progression of nonproliferative diabetic retinopathy following cataract extraction. Arch Ophthalmol. 1988;106(6):745-9.

34. Pollack A, Leiba H, Bukelman A, Oliver M. Cystoid macular oedema following cataract extraction in patients with diabetes. Br J Ophthalmol. 1992;76(4):221-4.

35. Cheour M, Mazlout H, Falfoul Y, Chakroun I, Marrakchi A, Skhiri M, et al. Progression of diabetic retinopathy after cataract surgery by phacoemulsification. J Fr Ophtalmol. 2013;36(1):62-5.

36. Haddad NM, Sun JK, Abujaber S, Schlossman DK, Silva PS. Cataract surgery and its complication in diabetic patients. Semin Ophthalmol. 2014;29(5-6):329-37.

37. Aiello LM, Wand M, Liang G. Neovascular glaucoma and vitreous hemorrhage following cataract surgery in patients with diabetes mellitus. Ophthalmology. 1983;90(7):814-20.

38. Sebastyen JG. Intraocular lenses and diabetes mellitus. Am J Ophthalmol. 1986;101(4):425-8.

39. Kato S, Fukada Y, Hori S, Tanaka Y, Oshika T. Influence of phacoemulsification and intraocular lens implantation on the course of diabetic retinopathy. J Cataract Refract Surg. 1999;25(6):788-93.

40. Zaczek A, Olivestedt G, Zetterström C. Visual outcome after phacoemulsification and IOL implantation in diabetic patients. Br J Ophthalmol. 1999;83(9):1036–41.

Rad je primljen 2. VII 2018.
Recenziran 8. VII 2018.
Prihvaćen za štampu 9. VII 2018.
BIBLID.0025-8105:(2018):LXXI:7-8:217-221.