

Incidence and Risk Factors of Macular Edema After Phacoemulsification in Southern Pakistan

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ABSTRACT

Objective: To determine the incidence and risk factors of macular edema (ME) after phacoemulsification at Institute of Ophthalmology, LUMHS Jamshoro Sindh.

Methodology: This descriptive cross-sectional study was conducted in Institute of Ophthalmology LUMHS, Jamshoro, from December 2020 to June 2021. Patients who underwent phacoemulsification surgery for cataract removal, aged 18 years or older, both male and female patients with adequate follow-up post-surgery were included. All patients underwent Phacoemulsification, receive standard post-operative topical medication i.e, Moxifloxacin 0.5% and Prednisolone 1% (1 hourly for 1 week, and 4 times per day after 1 week).

Results: A total of 96 patients, those who underwent phacoemulsification were studied; their mean age was 54.11 +8.97 years. Males were 58.3% and females were 41.7%. Out of all, 24.0% cases were diabetes, 8.3% were hypertensive. After surgery on 3rd post-operative week macular edema was found in 9.4% of the cases and on 6th post-operative week it was found in 19.8% of the cases. Post operative macular edema was found statistically significant according to diabetes mellitus and hypertension, ($p < 0.05$), while it was statistically insignificant according to age, gender, ME in fellow eye and high myopia on 3rd postoperative week p-values were quite insignificant ($p > 0.05$), while macular edema (6th week) was found statistically significant according to age ($p=0.038$) while statistically insignificant according to gender, diabetes mellitus, hypertension, ME in fellow eye and high myopia on 3rd postoperative week p-values were quite insignificant ($p > 0.05$).

Conclusion: As per study conclusion the occurrence of macular edema was observed to be the less frequent after phacoemulsification. Male gender, age more than 45 years and diabetes mellitus were observed to be the most common risk factors.

Key words: Macular edema, phacoemulsification, incidence, risk factors

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Introduction

Cataract stands as one of the most common reasons for blindness, which affects 17.7 million people and responsible for 47.8 percent of the global prevalence of blindness.¹ Over 100 million people have visual acuity (VA) of 6/60 or worse because of this condition, making it

a major public health concern.² Cataract-related blindness poses a significant challenge due to its scale, impact on daily functioning, erosion of self-confidence, substantial financial repercussions, and societal burdens.³ It is estimated that there are 570,000 adults in Pakistan (comprising 225,000 men and 345,000 women) who suffer from blindness caused by cataracts.⁴ A notable issue when

conducting phacoemulsification on patients with diabetic macular edema (DME) is the possibility of a temporary exacerbation of the edema following the surgery.^{5,6} Heightened inflammation and disruption of the blood-retinal barrier could contribute to the onset of macular edema following cataract removal. Evidence supporting this includes the observation of elevated levels of vascular endothelial growth factor (VEGF) within one month post-phacoemulsification.⁵ The release of angiogenic and inflammatory substances following cataract surgery might raise the permeability of retinal capillaries, leading to worsened macular edema.^{5,7}

Pseudophakic macular edema (PME), often characterized by cysts, continues to be the most common complication following surgery, leading to compromised vision.^{8,9} Several different investigations have suggested that premature ejaculation (PME) is prevalent in the population, occurs in a range of 0.2 to 20%.¹⁰ Studies have found that phacoemulsification increases the risk of macular edema (ME) and worsens diabetic retinopathy in previous studies of individuals with diabetes who underwent cataract removal either intracapsular or extracapsular cataracts extraction.¹¹ Spectral-Domain (SD) Optical Coherence Tomography (OCT) is a method of imaging that enables a thorough examination of the macular area, even when there are obstacles such as media opacity or a narrow pupil.¹² It holds promise for enhancing preoperative diagnosis in patients before phacoemulsification, which could significantly influence subsequent treatment approaches.^{12,13} Certain studies indicate that macular edema (ME) following cataract surgery, particularly in individuals with diabetes, may primarily affect those already experiencing diabetic macular edema (DME) centered in the macula. Nonetheless, other findings suggest that preexisting DME is not a prerequisite for ME to develop after surgery.^{11,12}

However, this study aims to address the gaps left by conflicting findings and limited local data by investigating the occurrence and potential risk factors associated with macular edema following phacoemulsification at the Institute of Ophthalmology, LUMHS, Jamshoro Sindh.

Methodology

This descriptive cross-sectional study was conducted in Institute of Ophthalmology LUMHS, Jamshoro. Study was done during 7 months from December 2020 to June 2021. The sample size calculation was conducted utilizing the Raosoft software, employing a proportion ranging from 0.2% to 20% for the incidence of macular edema.

With a significance level of 95% and a test power of 80%, the study determined a sample size of 96 participants.

Non-probability consecutive sampling methodology was employed. All the patients who underwent phacoemulsification surgery for cataract removal, aged 18 years or older, both male and female patients with adequate follow-up post-surgery were included. Patients with any existing anterior or posterior segment disease and preexisting macular edema were excluded. Study was done after taking ethical approval. A written consent was taken from all the cases and their attendants. A detailed medical history and base line equitable investigations in all patients was done. All the patients underwent clinical examination to evaluate Best Corrected Visual Acuity (BCVA), Intraocular pressure (IOP), Anterior segment and Posterior segment funduscopy. SS-OCT Macula was done on every patient to quantify preoperative Central Macular thickness (CMT). Macular edema is defined as the accumulation of fluid and protein deposits on or beneath the macula of the eye, leading to thickening and swelling (edema). This fluid accumulation primarily occurs in the Outer Plexiform layer due to abnormal perifoveal retinal capillary permeability. Macular edema will be identified as positive when there is thickening of the inner retinal layers and the presence of cystic spaces within the Outer Plexiform layer (OPL), as assessed by Ocular Coherence Tomography (OCT). All patients underwent Phacoemulsification, receive standard post-operative topical medication i.e. Moxifloxacin 0.5% and Prednisolone 1% (1 hourly for 1 week, and 4 times per day after 1 week). The patients were undergone routine follow up and were subjected to visual acuity measurement. The measurement of postoperative CMT by SS-OCT was done 1 week postoperatively. All OCT scans were performed by experienced operator having experience more than 5 years. All the information were recorded in the self-made proforma. All the data was entered into SPSS 20.0 version and was analyzed by using the same software. The quantitative data like age, were presented in form of mean \pm S.D. Simple frequency and percentage were computed for categorical variables. Stratification with respect to effect modifier were done. Chi-square test was applied and p-value ≤ 0.05 was considered significant.

Results

A total of 96 patients, those who underwent cataract surgery were studied; their mean age was 54.11 ± 8.97 years, minimum 31 years and maximum 79 years. Out of all study subjects, males were 58.3% and females were

41.7%. Average of central macular thickness was 251.94 ± 48.90 mm was on 3rd postoperative week and 256.53 ± 34.21 on 6th postoperative week. Out of all, 24.0% cases were diabetes, 8.3% were hypertensive, PME in fellow eye was 3.1% cases and high myopia was in also 3.1% of the cases. As per macular edema, after surgery on 3rd post-operative week macular edema was found in 9.4% of the cases and on 6th post-operative week macular edema was found in 19.8% of the cases. Table. 1

Table I: Risk factors of macular edema after phaco surgery. (n=96)

...Variable	N	%
Diabetes mellitus	23	24.0%
Hypertension	8	8.3%
Intraocular inflammation	--	--
PME in fellow eye	3	3.1%
High myopia	3	3.1%
Macular edema		
Post-operative (3 rd week)	9	9.4%
Post-operative (6 th week)	19	19.8%

Postoperative macular edema was found to be statistically insignificant in relation to age and gender on the 3rd postoperative week, with p-values of 0.918 and 0.214, respectively. However, it showed statistical significance in association with diabetes mellitus and hypertension ($p < 0.05$). Conversely, macular edema was statistically insignificant in relation to previous macular edema in the fellow eye and high myopia on the 3rd postoperative week, with p-values indicating high insignificance ($p > 0.05$). Table II.

Table II: Macular edema on 3rd week according to age, gender and risk factors. (n=96)

Variables		Post operative macular edema on 3 rd week		Total	p-value	
		Yes	No			
Age groups	30-45 years	2	15	17	0.918	
	46-60 years	5	49	54		
	>60 years	2	23	25		
Gender	Male	7	49	56	0.214	
	Female	2	38	40		
Risk factors	Hyper-tension	Yes	3	5	8	0.004
		No	6	82	88	
	Diabetes mellitus	Yes	7	16	23	0.001
		No	2	71	73	
	PME in fellow eye	Yes	1	2	3	0.148
		No	8	85	93	
	High myopia	yes	2	0	2	0.646
		no	7	87	94	

Postoperative macular edema was found to be statistically significant according to age ($p = 0.038$) while statistically insignificant according to gender on the 3rd postoperative

week, with a p-value of 0.965. Furthermore, it was found to be statistically insignificant according to diabetes mellitus, hypertension, previous macular edema in the fellow eye, and high myopia on the 6th postoperative week, with p-values indicating high insignificance ($p > 0.05$). Table III

Table III: Macular edema on 6th week according to age, gender and risk factors (n=96)

Variables		Post operative macular edema on 6 th week		Total	p- value	
		Yes	No			
Age groups	30-45 years	0	17	17	0.038	
	46-60 years	11	43	54		
	>60 years	8	17	25		
Gender	Male	11	45	56	0.223	
	Female	8	32	40		
Risk factors	Hyper- tension	Yes	8	15	23	0.221
		No	11	62	73	
	Diabetes mellitus	Yes	3	5	8	0.239
		No	16	72	88	
	PME in fellow eye	Yes	1	2	3	0.224
		No	18	75	93	
	High myopia	yes	2	0	2	0.969
		no	17	77	94	

Discussion

Phacoemulsification is a modern technique for removing cataracts, utilizing ultrasonic energy to break down the nucleus, vacuum suction to remove the fragmented material, and irrigation and aspiration for clearing the cortex and viscoelastic substances. In instances where cataract surgery becomes complicated, it may result in vision impairment. Hence, enhancing surgical techniques could be seen as a proactive measure to prevent avoidable cases of blindness.¹⁶ On the other hand, macular edema, which is often cystoid in appearance, continues to be the surgical consequence that most frequently leads to decreased vision. This study has been conducted to determine the incidence and risk factors of macular edema after cataract surgery and a total of 96 patients, those who underwent cataract surgery were studied; their mean age was 55.16 ± 8.86 years and males were 57.3%, while females were 42.7%. in the comparison of this study Cetinkaya S et al¹⁷ reported that the mean age of the patients was 59.20 ± 11.08 , while inconsistently they found females in majority 16 (57.2%) and 12 (42.8%) males. On the other hand, Cetinkaya S et al¹⁸ reported that the mean age was 68.46 ± 8.14 , thirty (31%) were males and 66 (69%) were females. The difference in the gender

may because in our societies especially rural poor areas female are ignored on some diseases.

In this study following surgery, on the third post-operative week, macular edema was detected in 9.4% of the patients, and on the sixth post-operative week, macular edema was identified in 19.8% of the cases. This information is based on macular edema. In addition, it was revealed to be statistically significant in accordance with hypertension and diabetes, ($p < 0.05$), while it was statistically insignificant according to age, gender, PME in fellow eye and high myopia on 3rd postoperative week p-values were quite insignificant ($p > 0.05$), while macular edema (6th week) was found statistically significant according to age ($p=0.038$). like this study Seth I et al¹⁹, it was found that the incidence of postoperative cystoid macular edema (PCMO) increased over time, with 8.2% of eyes diagnosed at 2 weeks, 9.4% at 4 weeks, and 10.6% at 6 weeks after surgery. Conversely, Sandeep Jain et al²⁰ found that the occurrence of CME ranged from 1.2% to 2% in extracapsular cataract surgeries. Several studies propose that prolonged surgery duration may contribute to CME development. Factors such as residual lens material and extended exposure to microscope light during surgery are implicated in the onset of CME following cataract surgery. Samanta A et al²¹ conducted a study focusing on individuals with diabetes who underwent phacoemulsification, aiming to assess the postoperative progression of CME along with associated risk factors. Their findings revealed that CME occurred after surgery in 47% of cases without pre-existing diabetic retinopathy (DR) and in 55% of eyes with pre-existing DR ($p<0.05$).

They observed a positive correlation between certain comorbidities such as hypertension ($p<0.01$) and diabetic nephropathy ($p<0.05$) and the incidence of postoperative CME. Additionally, they noted lower levels of antioxidant enzyme activity in patients with DR compared to diabetic patients, although catalase activity was highest among these individuals. Ultimately, they suggest that post-phacoemulsification, the likelihood of CME development is higher in individuals with DR compared to those with diabetes alone. Furthermore, they highlight that the development of CME is significantly associated with reduced antioxidant levels, increased ROS activity, hypertension, diabetic nephropathy, and hyperlipidemia.²¹

Contemporary phacoemulsification techniques have transformed the results of cataract surgery. Thanks to cutting-edge and high-quality intraocular lenses, cataract surgery has emerged as the leading refractive surgery globally. This advancement has elevated both patient

expectations and surgeon proficiency. It's imperative for every cataract surgeon to prioritize ethical practice and strive for optimal visual outcomes for every patient. Patients should be thoroughly informed about the potential risks and advantages of cataract surgery, including the benefits of modern phacoemulsification methods.²² It is the responsibility of the doctor to ensure that the patient has a comprehensive understanding of the phacoemulsification procedure, the various foldable and premium intraocular lens options, and which lens will be of the greatest benefit to the patient. Furthermore, for patients with risk factors such as Fuch's dystrophy, small pupils or compromised endothelium, it is advisable to discuss the potential necessity for supplementary tools and aids such as iris hooks and viscoelastic devices during preoperative counseling.²³ In the event that an intraoperative issue arises, the patient should be given a thorough explanation of the intraocular error, as well as recommendations for the intraoperative and postoperative procedures that would produce the best possible visual outcome.

Conclusion

As per the study conclusion, macular edema was found to occur less frequently following phacoemulsification. Male gender, age over 45 years, and diabetes mellitus were identified as the most common risk factors. However, due to several limitations, particularly a small sample size, further large-scale studies are recommended to validate the findings.

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