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Demographic Characteristics and Ocular Biometrics of Cataract Surgery Patients at KMU Eye Clinic Lamongan in April 2024

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ABSTRACT
Introduction: Cataract remains the leading cause of blindness in Indonesia, accounting for over 80% of severe visual impairment. Given the substantial burden in East Java, this study aimed to characterize cataract patients' demographic and ocular biometric profiles at KMU Eye Clinic Lamongan.
Methods: A cross-sectional descriptive study reviewed the medical records of patients who underwent cataract surgery in April 2024. Inclusion criteria included patients scheduled for surgery via phacoemulsification or Small Incision Cataract Surgery (SICS). Data collected included demographics, systemic comorbidities, and ocular biometric parameters: intraocular pressure (IOP), anterior chamber depth (ACD), lens thickness (LT), intraocular lens (IOL) power, and surgery duration.
Result: A total of 192 patients were analyzed. The mean age was 63.6±8.3 years, with 50% aged 60-69 years. Hypertension (66.7%) and diabetes (17.2%) were the most common systemic comorbidities. Severe visual impairment (≤3/60) was observed in 59.9% of cases. Phacoemulsification was performed in 97% of surgeries. Mean values for ocular biometrics were: IOP 15.1±3.6 mmHg, ACD 3.2±0.4 mm, LT 4.3±0.7 mm, IOL power 19.8±4.1 D, and surgery time 9.5±3.5 minutes.
Conclusion: Most cataract patients at KMU Eye Clinic Lamongan were elderly with significant systemic comorbidities and severe visual impairment. Phacoemulsification was the preferred surgical technique. Ocular biometric analysis provided essential information for preoperative planning and optimizing cataract management.
Keywords: cataract surgery, age-related cataract, ocular biometry.

ABSTRAK
Pendahuluan: Katarak menjadi penyebab utama kebutaan di Indonesia, menyumbang lebih dari 80% kasus gangguan penglihatan berat. Mengingat beban yang cukup besar di Jawa Timur, studi ini bertujuan untuk menggambarkan profil demografis dan biometri okular pasien katarak di Klinik Mata KMU Lamongan.
Metode: Penelitian deskriptif desain *cross-sectional* dilakukan dengan meninjau rekam medis pasien yang menjalani operasi katarak pada bulan April 2024. Kriteria inklusi mencakup pasien yang dijadwalkan menjalani operasi dengan teknik fakoemulsifikasi dan Small Incision Cataract Surgery (SICS). Data yang dikumpulkan meliputi karakteristik demografis, komorbiditas sistemik, serta parameter biometrik okular: tekanan intraokular (IOP), kedalaman bilik anterior (ACD), ketebalan lensa (LT), kekuatan lensa tanam (IOL *power*), dan durasi operasi.
Hasil: Studi ini diikuti oleh 192 pasien dengan rerata usia pasien adalah 63,6±8,3 tahun dan mayoritas berusia antara 60–69 tahun (50%). Komorbiditas sistemik banyak ditemukan, terutama hipertensi (66,7%) dan diabetes (17,2%). Gangguan penglihatan berat (≤3/60) ditemukan pada 59,9% pasien. Phacoemulsifikasi menjadi teknik operasi yang paling banyak dilakukan (97%). Rata-rata IOP 15,1±3,6 mmHg, ACD 3,2±0,4 mm, LT 4,3±0,7 mm, daya IOL 19,8±4,1 D, dan waktu operasi rata-rata 9,5±3,5 menit.
Kesimpulan: Hasil penelitian menunjukkan bahwa pasien katarak di Klinik Mata KMU Lamongan adalah lanjut usia dengan prevalensi komorbiditas sistemik yang tinggi dan gangguan penglihatan berat. Fakoemulsifikasi menjadi teknik bedah pilihan. Analisis biometri okular memberikan informasi penting untuk perencanaan preoperatif dan optimalisasi manajemen katarak.
Kata kunci: operasi katarak, katarak terkait usia, biometri okular.

INTRODUCTION

Cataract remains the leading cause of visual impairment in Indonesia, contributing to 81.2% of blindness cases, 81.4% of severe visual impairment cases, and 64% of moderate visual impairment cases. In East Java, the prevalence of cataract is among the highest nationally, with 371,599 affected individuals (4.4%), of whom 279,561 experience severe visual impairment. Recognizing the burden of visual impairment, Indonesia's Roadmap for Visual Impairment Control Program (2017–2030) aims to reduce the incidence of preventable vision loss by 25%.1 To achieve this target, localized studies are necessary to better understand the demographic and clinical characteristics of cataract patients, enabling the development of more effective interventions.

A cataract is characterized by a reduction in the optical quality of the crystalline lens, which negatively affects vision. Cataracts typically develop in one or both eyes as individuals age, with the risk increasing every decade starting from age 40. Aging is the primary factor driving the rise in cataract cases. With Indonesia's growing elderly population, the prevalence of cataracts and the demand for surgery are expected to rise. In Indonesia, the prevalence of cataracts continues to rise, particularly in rural and underserved areas, where access to healthcare is limited.[2-4]

At KMU Eye Clinic Lamongan, many cataract patients also have comorbid conditions such as hypertension and diabetes, which are known to exacerbate cataract progression and affect surgical outcomes. Understanding the demographic characteristics and ocular biometric parameters of these patients is crucial for developing effective management strategies. Additionally, having reliable data on the ocular biometric parameters of cataract patients can aid in planning surgeries and improving postoperative outcomes. This study aims to provide a comprehensive overview of the demographic characteristics and ocular biometric parameters of cataract patients at KMU Eye Clinic Lamongan. By examining the distribution of these parameters, we hope to identify trends that can inform clinical practice and public health policy. Furthermore, by considering the common comorbid conditions found in this patient population, the study seeks to highlight the importance of addressing these underlying factors to improve surgical outcomes and the quality of life for patients.

METHODS

This study used a descriptive observational design with a cross-sectional approach to examine the demographics and characteristics of cataract patients prior to surgery in KMU Eye Clinic Lamongan. Data were collected from medical records between May 3rd and May 5th, 2024. The study was conducted under the ethical approval of the Human Resources of Eyelink Group (No.566/Spem-SDM/Eyelink-SSU/V/2024). Participants were selected using a convenience sampling method, including all patients who visited the clinic and met the inclusion criteria during the study period. The inclusion criteria consisted of patients scheduled for cataract surgery using either the phacoemulsification (Phaco) technique or Small Incision Cataract Surgery (SICS), and who had complete medical records from April 1 to 30, 2024. Exclusion criteria included: (1) Missing or incomplete medical record data, and (2) Patients who did not undergo cataract surgery during the study period. Although convenience sampling was used, efforts were made to ensure that the sample adequately represented the cataract patient population at KMU Eye Clinic. However, as the participant selection was not randomized, the study results may have limitations in their generalizability to a broader population. This study considered several confounding

variables that could affect the results. Independent variables included baseline characteristics such as age, sex, systemic comorbidities, eye lateralization, preoperative visual acuity, distance of patients to the clinic and ocular biometric parameters (e.g., intraocular pressure, anterior chamber depth, lens thickness, intraocular lens power, and surgery times). However, other key factors, such as nutritional status, educational level, and environmental influences, were not examined in this study. A total of 23 participants were excluded due to incomplete medical records. Listwise deletion was applied to ensure the analysis only included complete and valid data, which may impact the statistical power of the study.

RESULT

A total of 192 patients (89.30%) were included in the study after 23 individuals (10.69%) had been excluded. Throughout the study, a total of 192 cataract operations were conducted. The average age of participants at the time of surgery was 63.6±8.3 years of which the age group that ranged from 60 to 69 years had the highest prevalence in this study, with 96 participants, accounting for 50% of the total. The group of males consisted of 74 (38.5%), while the female population consisted of 118 (61.5%). All 192 (100%) of the individuals were primarily from Lamongan. The majority of patients (67.4%) resided within 0–20 kilometers of the clinic, while 32.6% lived between 21–40 kilometers away. Notably, no patients (0%) were recorded as living beyond 40 kilometers. These findings indicate that most cataract patients seeking treatment at KMU Eye Clinic Lamongan came from nearby areas, with no representation from more distant regions.

Table 1. Baseline characteristics of preoperative cataract patients in April 2024

Variable	n (%)
Age	
≤ 49	7 (3.6)
50-59	50 (26.0)
60-69	96 (50.0)
70-79	34 (17.7)
≥ 80	5 (2.6)
Sex	
Male	74 (38.5)
Female	118 (61.5)
Distance	
0-20 km	97 (67.4)
21-40 km	47 (32.6)
>40 km	0 (0)
Systemic Comorbidity	
None	31 (16.1)
Hypertension	128 (66.7)
Diabetes Mellitus	33 (17.2)
Lateralization	
Right Eye	107 (55.7)
Left Eye	85 (44.3)
Preoperative visual acuity	
≤6/12 - >6/18	0 (0)
≤6/18 - >6/60	47 (24.5)
≤6/60 - >3/60	30 (15.6)
≤3/60	115 (59.9)
Cataract surgery	
Phacoemulsification (PE)	187 (97.0)
Small Incision Cataract Surgery (SICS)	5 (3.0)
Funding	
Insurance	179 (93.2)
Non-Insurance	13 (6.8)

Systemic comorbidities were observed in 161 (83.9%) of the patients, with 128 (66.7%) having hypertension, 33 (17.2%) having diabetes, and 31 (16.1%) having neither diabetes nor hypertension. Out of all the participants, 85 (44.3%) had surgery on their left eye, while 107 (55.7%) had surgery on their right eye. The majority, 115 patients (59.9%), had profound visual impairment (≤3/60), indicating functional blindness. This highlights that most cataract patients presented with significant visual impairment prior to surgery. Phacoemulsification was performed in 187 cases (97%) and small incision cataract surgery (SICS) in 157 cases (3%). The funding sources for cataract treatment

were primarily divided into two categories. A total of 179 patients (93.2%) utilized insurance to cover the cost of their treatment. In contrast, only 13 patients (6.8%) did not have insurance and paid for their treatment through non-insurance means. This indicates that the majority of patients were covered by insurance for their cataract surgery.

Table 2. Ocular biometrics parameters before cataract surgery

Variable	n	Mean (Min –Max)
IOP (mmHg)	192	15.1±3.6 (8.0 - 26.4)
ACD (mm)	192	3.2±0.4 (2.1 - 4.2)
Lens Thickness (mm)	192	4.3±0.7 (2.1 - 6.3)
IOL Power (D)	192	19.8±4.1 (-5.0 - 27.0)
Surgery Times (minutes)	192	9.5±3.5 (5.0 - 28.0)

IOP = Intraocular pressure; ACD = Anterior chamber depth; LT = Lens thickness; IOL = Intraocular lens

The distribution data for intraocular pressure reveals a range of values between 8.0 mmHg and 26.4 mmHg, with an average of 15.1 mmHg. The depth of the anterior chamber ranges from 2.1 to 4.2 mm with an average 3.2 mm. The lens thickness has a range of values from 2.1 to 6.3 mm with an average 4.3 mm. The IOL power variable ranges from 10 D to 26 D, with an average of 20.75 D. The variable has a minimum reported value of 10 D and the highest power is 26 D. The surgery time variable, measured in minutes, ranges from 5 to 28 minutes, with an average of 9.5 minutes. The patient who underwent the longest surgery (28 minutes) experienced lens subluxation, while other patients faced difficulties during surgery (17 minutes) due to a lack of cooperation.

Table 2 showed that individuals aged 60 to ≥80 years had an average anterior chamber depth of 3.20±0.47 mm, suggesting a similar thickness among this age range. The mean total anterior chamber depth of all participants in this study was 3.45±0.45 mm. The lens thickness in the age group of 60-69 years had the highest value, measuring 4.76±6.6 mm. The average lens thickness for all patients was 4.46±2.71 mm. There were no significant differences in IOL power across different age groups. The average duration of cataract surgery throughout all age categories was 9.6±4.5 minutes, with the age group of 60-69 years exhibiting the most variability in operation duration at 9.9±7.1 minutes. According to Table 3, individuals between the ages of 60 and 69 have the highest intraocular pressure, the greatest lens thickness, the highest IOL power, and the longest duration of cataract surgery.

Table 3. Ocular Biometric Parameters per Age Group before Cataract Surgery

Age group (years)	n	IOP (mmHg)	ACD (mm)	LT (mm)	IOL Power (D)	Surgery Time (minutes)
≤ 49	7	15.05±3.6	4.20±1.35	4.30±0.7	19.70±4.23	9.4±3.5
50–59	50	15.27±4.4	3.46±0.47	4.52±3.4	19.92±4.66	9.7±4.5
60–69	96	15.51±6.8	3.20±0.47	4.76±6.6	20.16±4.21	9.9±7.1
70–79	34	15.19±3.8	3.20±0.47	4.44±2.2	19.75±4.25	9.6±3.9
≥80	5	15.04±3.7	3.20±0.47	4.29±0.7	19.69±4.26	9.4±3.5

Table 3 shows the biometric parameters of patients' eyes before cataract surgery for each age group. It shows that the average intraocular pressure among different age groups of patients doesn't differ much. The age group of 60-69 years had the highest average intraocular pressure, with 15.51±6.8 mmHg. The average total intraocular pressure is 15.21±4.5 mmHg. The anterior chamber depth thickness was found to be greater in individuals aged ≤ 49 years,

ranging 4.20±1.35 mm. This suggests a decrease in anterior chamber depth thickness with increasing age in other age groups.

DISCUSSION

The majority of patients were elderly, with the highest prevalence (50%) in the 60-69 age group, reflecting the increasing cataract prevalence with age, in line with other studies indicating aging as a major risk factor for cataract development. These findings are consistent with a study from Central India, which showed the highest prevalence of cataracts in individuals aged 60–79 years (54%), followed by those aged 40–59 years (35.7%).[2] Most of patients came from the surrounding areas (67.4% living within 0-20 km), highlighting the clinic's accessibility to the local population. This suggests that access to care is relatively easy for the majority of patients, potentially due to the presence of the clinic in a region with good transportation networks. However, it would be valuable for future studies to explore barriers to care for patients living further away or those who do not seek treatment, as accessibility remains a challenge in rural areas.

The study found a higher prevalence among female patients (61.5%) compared to males (38.5%), consistent with the findings of Fang and Lou, who used data from Disability-Adjusted Life Years (DALYs) and the Global Burden of Disease (GBD) project in 1990-2015. Their research showed that women experience higher rates of disability and illness than men of the same age, with this disparity becoming more prominent with age. Globally, older age, being female, and lower socioeconomic status are linked to a greater cataract burden.[5,6] The higher cataract prevalence in women can be attributed to factors such as longer life expectancy and hormonal changes after menopause, particularly the decrease in estrogen, which is believed to have a protective effect on the ocular lens.[7] Additionally, a study by Geiger also highlighted differences in surgical complications, with men experiencing higher rates of posterior capsule rupture, vitreous loss, and retinal detachment. Understanding these gender specific risk factors can improve physicians' ability to provide tailored advice to cataract patients.[8]

A high prevalence of systemic comorbidities, especially hypertension (66.7%) and diabetes (17.2%), was found in this study. A study in India also revealed a high prevalence of hypertension and diabetes, among patients with age related cataracts. These comorbidities can affect surgical outcomes, with diabetic patients vulnerable to complications like decreased endothelial cell density, small pupils, pseudophakic cystoid macular edema, and posterior capsule opacification.[9,10] Hypertension, in particular, can impact intraocular pressure and vascular health, while diabetes increases the risk of cataract formation and complicates postoperative recovery. Preoperative blood pressure evaluation is crucial to assess a patient's suitability for surgery, as perioperative hypertension can increase the risk of adverse medical events like cardiovascular and neurological complications, as well as elevate the surgical risk of sight threatening hemorrhage before, during, or after cataract surgery.[11,12] Blood pressure fluctuations during phacoemulsification may result from preexisting hypertension, anesthetic absorption, or patient anxiety. An Indian study showed that topical anesthesia mainly affected systolic pressure, while peribulbar anesthesia caused significant changes in systolic, diastolic, and mean pressures. These fluctuations can lead to ocular complications, such as suprachoroidal hemorrhage, and systemic risks, including myocardial infarction or stroke. Continuous

blood pressure monitoring, especially with peribulbar anesthesia, is essential to prevent complications and ensure positive surgical outcomes.[13]

Phacoemulsification, the most commonly performed procedure in this study (97%), is consistent with modern cataract surgery trends, offering faster recovery times and better visual outcomes compared to traditional techniques like Small Incision Cataract Surgery (SICS), which was performed in only 3% of cases. Both procedures yield similar best corrected visual acuity, although studies suggest that unassisted vision may be better in patients who underwent Phaco, likely due to reduced astigmatism.[14] This suggests a preference for more advanced techniques at KMU Eye Clinic Lamongan.

The predominant preoperative visual acuity recorded was severe visual impairment which was worse than 3/60 in 115 eyes (59.9%). This study was similar to a study conducted in Nigeria. The majority of the patients were 50 years old or older, and approximately 96.8% of the eyes that underwent cataract surgery had severe visual impairment (preoperative visual acuity < 3/60).[15] This suggests that many patients seek treatment only after significant functional blindness, emphasizing the need for early detection and intervention programs, especially in underserved areas. The study also indicated that geographic accessibility affects healthcare utilization, with patients living closer to the clinic more likely to attend, facilitating early diagnosis and timely treatment, crucial for preventing disease progression like cataracts.[16]

Ocular biometric parameters provide critical information for determining the appropriate intraocular lens (IOL) power and predicting postoperative outcomes. In this study, the average ACD was 3.2±0.4 mm. A study conducted in Ethiopia found the ACD in cataract patients to be 2.88 mm.[17] The ACD is important for determining the position of the intraocular lens (IOL) after surgery and is a key factor in predicting postoperative refractive errors. A regression formula for ACD can help predict these errors in clinical settings.[18] Furthermore, research from China showed that in eyes affected by pseudoexfoliation, an ACD of less than 2.5 mm increases the risk of intraoperative complications. A deeper anterior chamber reduces this risk. Shallow ACD may indicate zonular instability, prompting caution in cataract surgery.[19] This study also observed a decrease in ACD with increasing age, with the deepest ACD seen in individuals under 49 years old. This finding aligns with Lei's 2021 study, which reported a negative correlation between age and ACD. Certain biometric factors, such as shallow ACD, shorter axial length, and higher central corneal thickness, have been linked to a narrower anterior chamber angle and are considered risk factors for angle-closure glaucoma.[20] The mean intraocular pressure (IOP) in this study (15.1 mmHg) falls within the normal range for a healthy eye, suggesting that most patients did not present with glaucomatous complications at the time of surgery.

The average lens thickness in this study was 4.3±0.7 mm, with a range from 2.1 to 6.3 mm. This result is similar to a study in China where the average lens thickness was 4.52±0.45 mm. In the 60-69 age group, the lens thickness was greatest compared to the older age groups. A study by Lei in 2021, also found a direct correlation between lens thickening and increased age. Lens thickness can influence both ACD and axial length, which are important parameters for cataract surgery.[21]

The IOL power in this study ranged from 10 D to 26 D, with an average of 20.75 D. In comparison, a study in Ethiopia found the average refractive power of IOL to be 19.34 D. Accurate biometry is essential for determining the correct IOL power in

cataract surgery. This process involves measuring parameters like corneal power and axial length, and using formulas to calculate the necessary IOL power. Other factors, such as ACD, lens thickness, and patient age, also impact the final refractive outcome.[22,23]

The duration of cataract surgery in this study ranged from 5 to 28 minutes, with an average of 9.5 minutes. The patient who underwent the longest surgery (28 minutes) experienced lens subluxation, while other patients faced difficulties during surgery (lasting 17 minutes) due to a lack of cooperation. A study in France reported an average surgery duration of 13.9±5 minutes using phacoemulsification with topical anesthesia. The duration of surgery is influenced by the surgeon's experience and the patient's pain perception.[24]

Despite the valuable insights offered by this study, several limitations should be acknowledged. First, the study's observational, cross sectional design limits the ability to draw causal conclusions. Second, the use of convenience sampling means that the results may not fully represent the broader population of cataract patients, especially those who do not seek treatment at KMU Eye Clinic. Additionally, while the study considered several important factors such as systemic comorbidities and ocular biometric parameters, other potential confounders such as nutrition, lifestyle factors, and genetic predispositions were not accounted for. Lastly, the lack of randomization in patient selection introduces potential biases that could affect the study's generalizability.

CONCLUSION

This study provides demographic characteristics and ocular biometric parameters of cataract patients at KMU Eye Clinic Lamongan. The majority of patients were elderly, predominantly in the 60–69 year age group, female, and lived within a 20 km radius of the clinic, reflecting the impact of aging and local accessibility on cataract incidence. A high prevalence of systemic comorbidities, particularly hypertension and diabetes, was observed, underscoring the importance of managing these conditions to optimize surgical outcomes. Most patients presented with severe visual impairment prior to surgery, highlighting the need for earlier detection and intervention. Phacoemulsification was the preferred surgical technique, indicating the clinic's adherence to modern cataract management standards. The analysis of ocular biometric parameters, including anterior chamber depth, lens thickness, intraocular pressure, and intraocular lens power, offers valuable insights for preoperative planning and improving postoperative outcomes. These findings emphasize the need for targeted public health strategies and clinical practices that address demographic trends, comorbidities, and biometric variations to enhance cataract management and reduce preventable visual impairment in the local population.

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