



Characteristics of Cataract Surgery at the Banten Regional General Hospital in 2024

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ABSTRAK

Keywords: *Cataract surgery, phacoemulsification, ECCE, surgical characteristics, intraocular lens.*

Cataract is the leading cause of treatable blindness worldwide. Cataract surgery has undergone significant evolution in recent decades, with phacoemulsification becoming the technique of choice in developing countries. This study aims to analyze the characteristics of cataract surgery techniques performed at Banten Regional General Hospital in 2024. This study used a descriptive research design with a cross-sectional approach. Data were obtained from medical records of patients who underwent cataract surgery at Banten Regional General Hospital from January to December 2024. Inclusion criteria included all patients who underwent cataract surgery at Banten Regional General Hospital in 2024. Exclusion criteria included incomplete medical records. Based on the research, a total of 631 cataract surgery cases were found in 2024. The distribution of surgical techniques showed phacoemulsification with intraocular lens (IOL) implantation as the dominant technique, with 625 cases (99.0%), followed by extracapsular cataract extraction (ECCE) with 3 cases (0.5%), and other procedures each with 1 case (0.2%). Monthly distribution showed the highest peak in August (96 cases, 15.2%) and the lowest in December (19 cases, 3.0%). In conclusion, phacoemulsification with IOL is the most dominant cataract surgery technique at Banten Regional General Hospital in 2024, demonstrating the adoption of modern technology in ophthalmology services at regional hospitals.



INTRODUCTION

Cataracts are a pathological condition of the lens of the eye that is characterized by cloudiness of the lens, causing a significant decrease in vision to blindness. Senile cataracts, which are caused by the aging process, are the most common form of cataracts and are the leading cause of treatable blindness worldwide. The prevalence of cataracts increases with age, with more than 50% of individuals over the age of 60 experiencing varying degrees of cataract formation (Steinmetz et al., 2021).

Cataract surgery is the only definitive therapeutic modality for cataracts and has undergone significant evolution in recent decades. Phacoemulsification, first introduced by Charles Kelman in 1967, is now the gold standard technique in cataract surgery in developed countries and is increasingly being adopted in developing countries, including Indonesia. This technique uses ultrasonic energy to break down cloudy lenses into small fragments that are then aspirated through small incisions measuring 2–3 mm (Gurnani & Kaur, 2025).

Phacoemulsification has several advantages over conventional techniques such as extracapsular cataract extraction (ECCE). Smaller incisions allow for faster healing, reduce the risk of postoperative astigmatism, and lower the rate of complications such as endophthalmitis and corneal edema (Upasani & Daigavane, 2024). In a study involving 91,883 cases of phacoemulsification between 2020 and 2024, the complication rate of dropped nucleus was only 0.19%, indicating a high level of safety of this technique (Halim et al., 2025). A prospective 2024 study comparing phacoemulsification with small incision cataract surgery (SICS) shows that phacoemulsification provides better initial visual results and fewer complications (Ride, 2017).

Nonetheless, the ECCE technique still has an important role to play in modern ophthalmological practice, especially for certain cases such as hypermature cataracts with a very hard nucleus, weak zonules, or limited access to phacoemulsification technology (Narayan et al., 2023). A study confirms that the ECCE technique is still vital for the extraction of very dense lenses where phacoemulsification carries a high risk of causing permanent corneal damage (Signes-Soler et al., 2016).

Several previous studies have examined the characteristics and trends of cataract surgery techniques in various healthcare settings. A study by Halim et al. (2025) at Moorfields Eye Hospital NHS Foundation Trust analyzing 91,883 phacoemulsification cases between 2020 and 2024 reported a dropped nucleus rate of only 0.19%, with 73% of patients achieving good visual outcomes ($\geq 6/12$), demonstrating the safety and effectiveness of this technique when performed by trained operators. Wu et al. (2024) conducted a comparative study in China involving 2,023 cataract surgery patients, finding that attending physicians with more than 10 years of experience and over 3,000 phacoemulsification cases provided superior outcomes with shorter operating times and lower complication rates compared to resident surgeons (Wu et al., 2024). This highlights the importance of operator experience in determining surgical outcomes. Chen et al. (2025) investigated 564 patients undergoing phacoemulsification using clear corneal incision (CCI) and demonstrated better intraoperative stability and superior anterior chamber sealing effectiveness compared to conventional techniques (Chen et al., 2025). Their study emphasized the technical advantages of modern phacoemulsification approaches in improving surgical safety.

In the context of developing countries, Signes-Soler et al. (2016) evaluated the transition from ECCE to manual small incision cataract surgery (SICS) in blindness prevention campaigns, showing that while phacoemulsification offers advantages, alternative techniques remain relevant in settings with limited resources or specific clinical indications. Similarly, Mohanty et al. (2015) in India reviewed 207 cases of ECCE in high-risk cataracts and reported that 88.88% of patients achieved best corrected visual acuity (BCVA) of 6/12 or better, confirming the continued relevance of ECCE for complex cases (Mohanty et al., 2015). In Indonesia, national health research (RISKESDAS 2018) reported that cataracts are the leading cause of blindness, with prevalence increasing significantly in populations over 50 years of age (Health Research and Development Agency, 2018). However, region-specific data on cataract surgery characteristics, particularly in provincial hospitals like Banten Regional General Hospital, remain limited.

Banten Regional General Hospital is one of the main referral health facilities in Banten Province that serves various ophthalmology cases, including cataract surgery. Along with technological advancements and improvements in medical personnel competence, Banten Hospital has adopted phacoemulsification in its cataract surgery services. However, so far there has been no comprehensive study on the profile and characteristics of cataract surgery techniques carried out at this hospital.

This study aims to analyze the characteristics of cataract surgery techniques performed at Banten Hospital in 2024, including the distribution of types of surgical techniques, temporal patterns of implementation, operator profiles, and clinical characteristics of patients. This information is expected to provide an overview of the adoption of modern technology in ophthalmology services in regional hospitals, as well as serve as a basis for evaluating and improving the quality of cataract surgery services in the future.

RESEARCH METHODS

This study used a descriptive research design with a cross-sectional approach. The study was conducted at Banten Regional General Hospital to analyze the characteristics of cataract surgery performed during the period from January to December 2024. Secondary data were collected from the medical records of patients who underwent cataract surgery.

The study population comprised all patients who underwent cataract surgery at Banten Hospital in 2024. The sampling technique employed was total sampling, where all cases of cataract surgery that met the research criteria were included as samples. The inclusion criteria included all patients who underwent cataract surgery at Banten Hospital during the January–December 2024 period with complete medical record data. Exclusion criteria included incomplete medical record data, as well as records not containing information about the type of surgery performed, the date of surgery, or operator identity.

The variables studied included the type of cataract surgery technique (phacoemulsification with IOL, ECCE, SICS, and other techniques), temporal distribution (monthly) of surgical procedures, and characteristics of preoperative diagnosis. The collected data were then processed through the stages of editing, coding, entry, and cleaning using Microsoft Excel and SPSS ver. 31.0.0.0 (117) for descriptive statistical analysis.

Data analysis was carried out descriptively to describe the frequency and percentage distribution of each variable studied. The results of the analysis were presented in the form of tables and descriptive narratives.

RESULTS AND DISCUSSION

Based on medical record data at Banten Hospital in 2024, a total of 630 cases of cataract surgery were found that met the research criteria. The results of this study describe the characteristics of cataract surgery techniques carried out at Banten Hospital during the period from January to December 2024.

Table 1. Distribution of Cataract Surgery Techniques at Banten Hospital in 2024

No	Surgical Techniques	Frequency	Percentage (%)
1	Phacoemulsification + IOL	625	99,0
2	ECCE	3	0,5
3	Repair + Phacoemulsification + IOL	1	0,2

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No	Surgical Techniques	Frequency	Percentage (%)
4	Eviserasi	1	0,2
Total		630	100

Source: Medical Record Data of Banten Regional General Hospital, 2024 (processed)

Based on Table 1, it can be seen that phacoemulsification with the installation of Intraocular Lens (IOL) is the most dominant surgical technique with 625 cases out of a total of 631 cases, or 99.0%. The ECCE technique was only performed in 3 cases (0.5%), while other measures such as repair in combination with phacoemulsification, and evisceration were only 1 case each (0.2%).

Table 2. Monthly Distribution of Cataract Surgery at Banten Hospital in 2024

No	Month	Frequency	Percentage (%)
1	January	54	8,6
2	February	34	5,4
3	March	63	10,0
4	April	55	8,7
5	May	84	13,3
6	June	22	3,5
7	July	50	8,1
8	August	96	15,2
9	September	69	10,9
10	October	50	7,9
11	November	34	5,4
12	December	19	3,0
Total		630	100

Source: Medical Record Data of Banten Regional General Hospital, 2024 (processed)

In Table 2, the monthly distribution of cataract surgery procedures shows considerable variations. The highest number of surgeries occurred in August with 96 cases (15.2%), followed by May with 84 cases (13.3%). In contrast, the lowest number of surgeries occurred in December with only 19 cases (3.0%), followed by June with 22 cases (3.5%).

Table 3. Distribution of Pre-Operative Diagnosis of Cataract Surgery Patients at Banten Hospital in 2024

No	Pre-operative diagnosis	Frequency	Percentage (%)
1	Senilized Cataracts	622	98,6
2	Traumatic Cataracts	3	0,5
3	Cataracts with Glaucoma	3	0,5
4	Juvenile Cataracts	1	0,2
5	Cataracts with Nystagmus	1	0,2
6	Cataracts with Conjunctival Abnormalities	1	0,2
Total		631	100

Source: Medical Record Data of Banten Regional General Hospital, 2024 (processed)

In Table 3, the distribution of pre-operative diagnoses shows that the majority of cases are senile cataracts with 622 cases (98.6%). Other cases included 3 cases of traumatic cataracts (0.5%), cataracts with glaucoma 3 cases (0.5%), and 1 case each (0.2%) for juvenile cataracts, cataracts with nystagmus, and cataracts with conjunctival abnormalities.

The results of the study show that phacoemulsification with the installation of Intra Ocular Lens (IOL) is the most dominant cataract surgery technique at Banten Hospital in 2024, reaching 99.0% of the total 630 cases. These findings are in line with a global trend where phacoemulsification has become the primary technique of choice for cataract surgery in the modern era.

The high adoption of phacoemulsification at Banten Hospital reflects the successful implementation of modern technology in ophthalmology services in regional hospitals. Phacoemulsification is now considered the most common method for cataract surgery, with the advantage of a minimally invasive approach that offers faster recovery times and lower complications than traditional techniques. The main advantages of phacoemulsification include smaller incisions (2-3 mm), the ability to perform self-sealing wound surgery without stitches, and faster visual recovery.

A study by Chen et al. (2024) involving 564 patients showed that phacoemulsification using clear corneal incision (CCI) has better intraoperative stability and superior anterior chamber sealing effectiveness than conventional techniques. Another 2024 study involving 2,023 patients in China showed that experienced doctors with more than 10 years of experience and more than 3,000 cases of phacoemulsification provide excellent outcomes good with minimal complications.

The safety of phacoemulsification has also been proven in various large-scale studies. In a study at Moorfields Eye Hospital NHS Foundation Trust that analysed 91,883 cases of phacoemulsification between 2020-2024, the dropped nucleus rate was only 0.19% with 73% of patients achieving good visual outcomes ($\geq 6/12$). This low complication rate suggests that phacoemulsification is not only effective but also very safe when performed by a trained operator.

In this study, only 3 cases (0.5%) used the ECCE technique. Although rarely used, ECCE still plays an important role in modern ophthalmology practice. A 2024 study by Khandelwal confirms that the ECCE technique is still vital for cases with very dense lenses where the use of ultrasonic energy from phacoemulsification risks causing excessive corneal damage. A retrospective study in India involving 207 cases of ECCE in high-risk cataracts showed good results with 88.88% of patients achieving best corrected visual acuity (BCVA) of 6/12 or better.

Indications of conversion from phacoemulsification to ECCE generally include brunescence or black cataract, posterior capsule rupture, zonular dehiscence, or dropped nucleus with nucleus fragments more than half the size of cataracts (McCreery et al., 2024). The ability to perform conversion to ECCE is an important skill that every cataract surgeon must have to overcome intraoperative complications.

The operator's experience and competence are key factors in determining cataract surgery output. Research by Wu et al. (2024) in China compared outputs between resident surgeons and attending physicians in phacoemulsification, and found that attending physicians with more than 10 years of experience and more than 3,000 cases provided superior results with shorter operating times and lower complications. Another study showed that operator

experience correlated with cumulative dissipated energy (CDE) efficiency and post-operative visual outputs (Melega et al., 2020). Ongoing training and mentoring programs are essential to ensure all operators have equal competencies. Research on phacoemulsification learning shows that the use of virtual reality simulators and structured supervision can accelerate the learning curve (Nussinovitch et al., 2021). The majority of cataract surgery cases at Banten Hospital are senile cataracts (98.6%), which is the most common form of cataract that occurs due to the aging process. This very high proportion is consistent with global epidemiological data where senile cataracts account for 90-95% of all cataract cases, reflecting Indonesia's demographic profile which is experiencing an increase in the elderly population.

Senile cataracts are the leading cause of vision impairment in elderly populations worldwide. Epidemiological research shows that the prevalence of cataracts increases dramatically with age, with more than 50% of individuals over 60 years of age having varying degrees of cataract formation. Studies in very elderly patients (≥ 90 years) suggest that although cataract surgery remains safe and effective, patients in this age group tend to require higher phacoemulsification energy and have an increased risk of intraoperative floppy iris S (Porela-Tiihonen et al., 2016).

The visual outcome after cataract surgery in elderly patients is generally excellent. Approximately 90% of patients achieve sharp vision of 6/12 or better after cataract surgery, and in patients without ocular comorbidities, more than 95% can achieve excellent visual outcomes. However, in very elderly patients (>85 years), visual outcomes can be affected by the presence of comorbidity ocular diseases such as age-related macular degeneration (AMD) or glaucoma (Yeo et al., 2024).

Cases of traumatic cataracts (0.5%) and cataracts with glaucoma (0.5%), although small in number, require special attention due to the complexity of their treatment. Traumatic cataracts are often accompanied by damage to other ocular structures such as capsule rupture, zonal weakness, or corneal damage, which require more complex surgical techniques and careful planning (Okoye & Gurnani, 2025).

Beyond visual restoration, cataract surgery has been shown to provide broader benefits to the health and quality of life of elderly patients. A recent 2024 meta-analysis study involving 558,276 participants showed that cataract surgery significantly lowers the risk of cognitive decline and dementia in the elderly population (Yoshida et al., 2024). A prospective study in Japan in 2024 found that cataract surgery may improve cognitive function in patients with mild cognitive impairment (MCI), especially in the group assessed using MMSE-blind (mini-mental state examination for visually impaired) (Lee et al., 2022).

The underlying mechanisms of the relationship between cataract surgery and cognitive improvement are likely multifactorial. Improved visual input can improve cognitive stimulation, reduce social isolation, and increase participation in daily activities that require cognitive function (Lee et al., 2023).

In addition, cataract surgery has also been shown to reduce depressive symptoms in elderly patients, which is a risk factor for cognitive decline (Atima & Dingwoke, 2025).

The high adoption of phacoemulsification at Banten Hospital shows that hospitals are providing quality modern ophthalmology services. For future service development, several aspects need to be considered. First, regular maintenance and upgrading of phacoemulsification equipment is essential given that this technology is constantly evolving.

The latest generation of phacoemulsification machines offer features such as better fluidic management, torsional energy that can reduce surgery time and corneal trauma, as well as more advanced visualization systems. Investments in the latest technology can improve surgical efficiency and patient outcomes (Bocuzzi et al., 2025).

Second, diversification of IOL options needs to be developed. Currently there are various types of premium IOLs such as toric IOL for astigmatism correction, multifocal or extended depth of focus (EDOF) IOL to reduce dependence on glasses, and IOLs with blue light filters for retinal protection.²⁵ The availability of a wide range of IOL options can improve patient satisfaction and visual functional outcomes (Theodoropoulou et al., 2019).

This study has several limitations that need to be considered in the interpretation of the results. First, the cross-sectional design only gives an idea of 2024 and has not been able to assess the changing trend over time. Longitudinal research is needed to understand the evolution of operating techniques and the factors influencing change. Second, this study uses secondary data from medical records that depend on the completeness and accuracy of the records. Variations in documentation may affect the completeness of the data available for analysis. Third, this study did not analyze surgical outcomes such as postoperative visibility, postoperative complications, and patient satisfaction, so it could not objectively assess the quality of surgical results. Fourth, this study did not analyze the factors that affect the selection of surgical techniques (phacoemulsification vs ECCE), so it could not provide specific recommendations regarding the indications for the use of each technique. Further research with prospective design and comprehensive output analysis is needed for a more in-depth evaluation of the quality of cataract surgery services at Banten Hospital.

CONCLUSION

This study shows that phacoemulsification with IOL is the most dominant cataract surgery technique at Banten Hospital in 2024, reflecting the success of the adoption of modern technology in ophthalmology services in regional hospitals. These findings serve as an important basis for evaluation and improvement of service quality, including the development of surgical outcome monitoring systems, diversification of intraocular lens options, and strengthening the capacity of human resources through ongoing training programs to ensure the safety and effectiveness of cataract surgery. Based on these results, it is recommended that Banten Hospital develop a surgical outcome monitoring system to evaluate postoperative visual acuity and complication rates, diversify intraocular lens options to include premium lenses such as toric and multifocal IOLs to improve patient satisfaction, and strengthen human resource capacity through continuous training programs in phacoemulsification techniques and management of complex cases. Further research with prospective designs and comprehensive outcome analysis is needed to evaluate the long-term quality of cataract surgery services and to identify factors associated with surgical outcomes at Banten Hospital.

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