

Visual Outcome of Cataract Surgery in Patients with Pseudoexfoliative Syndrome in Kelantan - A 10 Year Review.

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Purpose: To investigate the visual outcome and the contributing factors post cataract surgery in patients with pseudoexfoliative syndrome (PXS).

Method: This is a retrospective study among PXS patients who underwent cataract surgery with IOL implantation in a tertiary center, Kelantan, Malaysia from 2015 to 2024. Data was retrieved from the web-based Malaysian Cataract Surgery Registry (CSR). Visual outcomes were classified as good if visual acuity was 6/12 or better, and poor if 6/18 or worse, taken from 6 weeks postoperatively onwards. Factors affecting poor visual outcomes (age group, gender, systemic comorbidity, and presence of other complications intraoperatively) were analysed using logistic regression to produce adjusted odds ratio (OR) for variables of interest.

Results: Out of 74 patients with PXS who underwent cataract surgery, 61 (83.7%) cases were qualified. Most patients 38(62.3%) achieved a good visual outcome. In the simple logistic regression, vitreous loss (OR = 4.243, P = 0.024) and type of surgery in which Extracapsular cataract extraction (ECCE) (OR = 0.215, P = 0.017) were significantly associated with visual outcomes postoperatively.

Conclusion: Cataract surgeries in patients with PXS achieved good visual outcomes. Vitreous loss and the choice of operative technique, specifically ECCE, were the significant factors influencing postoperative visual outcomes in cataract surgery with PXS. Despite the higher complication rates associated with PXS, timely identification, careful selection of surgical approach, and adoption of appropriate precautions can reduce these risks and achieve a good visual outcome.

Keywords: Cataract surgery, Pseudoexfoliative syndrome, Risk factor, Visual outcome
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Introduction

Cataracts are a leading cause of visual impairment worldwide, and cataract surgery remains one of the most commonly performed and successful interventions for restoring vision.

However, in certain ocular conditions, such as pseudoexfoliation syndrome (PXS), cataract surgery presents additional challenges. PXS is a systemic condition characterized by the deposition of abnormal extracellular material on the lens, cornea, and other ocular structures. It is frequently associated with an increased risk of complications during cataract surgery, including capsule rupture, zonular instability, and intraoperative miosis, which can affect the final visual outcome.

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PXS is one of the most common causes of cataracts in older adults and has a higher prevalence in some populations, making it a significant factor in the global burden of cataract-related visual impairment. Given the growing aging population and the increasing prevalence of PXS, understanding the factors that influence the visual outcomes of cataract surgery in these patients is critical for optimizing treatment strategies and improving patient prognosis.

This study will be conducted in a tertiary hospital under the Ministry of Health located in Kelantan. As to date, there is only one similar study published in Malaysia which was published in 2019. This study aims to evaluate the visual outcomes of cataract surgery in individuals with PXS and identify the factors that may influence post-operative visual acuity. Factors such as preoperative ocular conditions, intraoperative complications, and postoperative management strategies will be explored to provide insights into the determinants of successful surgical outcome. By better understanding of these factors, the study seeks to improve surgical planning and postoperative care for patients with PXS, ultimately contributing to better long-term visual prognosis.

Method

This retrospective cohort study obtained data from the web-based Malaysian Cataract Surgery Registry on procedures performed between January 2015 and December 2024. Source data center was from a tertiary center, Hospital Raja Perempuan Zainab II, Kelantan, Malaysia. This study was approved by Medical Research Ethics Committee of the Ministry of Health (MOH)(NMRR) on 30 April 2025, NMRR ID-25-00659-NPN. Consent for database usage was obtained from local authority. All data extracted were devoid of patient identifier. This study also complied with the guidelines of the Declaration of Helsinki.

All cases of cataract surgery with primary intraocular lens (IOL) implantation in patients with PXS were included in the study. Confounding factors that could contribute to poor visual outcomes were excluded, including patients with pseudoexfoliative glaucoma, preexisting comorbidities such as lens subluxation and zonular dehiscence, non-cataract pathologies

causing poor vision (e.g., retinopathies), and those with a history of prior ocular surgery. Cases with missing postoperative data were also excluded. Intraoperative complications studied included zonular dehiscence, posterior capsular rent, vitreous loss, and lens subluxation or dislocation. Final best visual acuity was assessed at follow-up visits of at least 6 weeks postoperatively, allowing for resolution of inflammation, refractive stabilization, and recovery from intraoperative complications. For patients with intraoperative complications, the final visual acuity was taken from the follow-up visit beyond 6 weeks at which the best vision was achieved. The visual outcome was taken as the best-corrected visual acuity (BCVA) based on refractions done by hospital-based optometrists.

Good postoperative visual outcome was defined as best-corrected visual acuity (BCVA) of 6/12 or better, while poor outcome was defined as BCVA of 6/18 or worse. Data were analyzed using IBM SPSS Statistics version 28.0. Categorical variables were presented as frequency and percentage, and logistic regression analysis was performed to identify factors associated with postoperative outcomes.

Result

The total cataract surgery in PXS from 2015 to 2024 were 74 cases. After excluding cases based on the exclusion criteria, the final cases included were 61. Table 1 illustrates the demographic characteristics of the patients. Most were Malay (88.5%), predominantly of male gender (65.6%), and aged 60–79 years (78.7%). Clinical and operative characteristics of cataract surgery with PXS were presented in Table 2. The most common systemic comorbidity was hypertension (62.3%) followed by diabetes mellitus (29.5%). Presenting visual acuity showed bimodal distribution in which 67.2% presented with BCVA worse than 3/60 and another peak at BCVA 6/24 to 6/60 (23.0%). The majority of cataracts were mature, accounting for the higher proportion of patients presenting with poor vision. Phacoemulsification constituted 59% of surgeries, whereas ECCE was performed in 26.2% of cases, possibly reflecting its selection for mature cataracts to minimize surgical complications. Although differences in surgeon experience may have contributed to outcome variability, the fact that the majority (78.7%)

of procedures were performed by specialists accredited by the Malaysian National Specialist Register suggests that operator bias was likely limited.

IOLs were implanted mostly in the capsular bag (86.9%). Additional intraoperative complications that occurred were vitreous loss (46.5%), zonular dehiscence (7.0%) and dropped nucleus (5.8%). Most of the patients achieved good visual outcomes where (62.3%) of them achieved BCVA 6/12 and better postoperatively, whereas (37.7%) achieved BCVA of 6/18 or worse postoperatively.

The binary logistic regression analysis examined factors associated with visual outcomes

post cataract surgery, adjusting for age, type of surgery, IOL and vitreous loss. In the simple logistic regression, vitreous loss (OR = 4.243, P = 0.024) and type of surgery involved, i.e. extracapsular cataract extraction (ECCE) (OR = 0.215, P = 0.017) were significantly associated with visual outcomes postoperatively. However, after adjusting for covariates, no variables remained statistically significant. Overall, while the model demonstrates strong classification ability, the lack of significant adjusted associations indicates that further research with a larger sample may be needed to clarify the independent effects of these factors on post operative visual outcomes (Table 3).

Table 1: Demographic data of cataract surgery with PXS (N = 61)

Characteristic	N	%
Age		
40 - 59	3	4.9
60 - 79	48	78.7
80 - 99	10	16.4
Gender		
Male	40	65.6
Female	21	34.4
Race		
Malay	54	88.5
Chinese	2	3.3
Indian	0	0
Others	5	8.2

Table 2: Clinical and operative characteristic of cataract surgery with PXS (N = 61)

Characteristic	N	%
Systemic comorbidity		
Diabetes Mellitus	18	29.5
Hypertension	38	62.3
Ischemic Heart Disease(IHD)	5	8.2
Pre operative BCVA		
6/6 to 6/12	2	3.3
6/18	3	4.9
6/24 to 6/60	14	23.0
5/60 to 3/60	1	1.6
2/60 and worse	41	67.2
Surgeon status		
Specialist	48	78.7
Gazetting specialist	7	11.5
Medical officer	6	9.8

Table 2: Clinical and operative characteristic of cataract surgery with PXS (N = 61) (Cont.)

Characteristic	N	%
Duration of surgery		
< 60 minutes	46	75.4
≥ 60 minutes	15	24.6
Type of surgery		
Phacoemulsification	36	59
ECCE	16	26.2
ICCE	9	14.8
IOL location		
IOL in bag	53	86.9
ACIOL	6	9.8
Iris Claw	2	3.3
Intraoperative complication		
Vitreous loss	14	23.0
Zonular dehiscence	11	18.0
Drop nucleus	2	3.3
Posterior capsular rent	6	9.8
Pupil problem	14	23.0
Post operative BCVA		
6/12 and better	38	62.3
6/18 and worse	23	37.7

BCVA = Best corrected visual acuity, ECCE = Extracapsular cataract extraction, IOL = Intraocular lens, ACIOL = Anterior chamber IOL

Table 3: Factors associated with visual outcome post cataract surgery

Variables	Simple logistic regression			Multiple logistic regression ^a		
	Crude OR	95% CI	P value	Adjusted OR	95% CI	P value
Age group						
40-59 y/o	0	0	.199	0	0	.243
60-79 y/o	3.643	.889, 14.920		5.342	.759, 37.583	
80-99 y/o (Ref)	1			1		
Gender						
Male	2.618	.803, 8.535	.110	.209	.036, 1.203	.080
Female (Ref)	1			1		
Ethnic						
Malay	1.609	.521, 4.970	.409	0	0	.999
Chinese						
Siamese (Ref)	1			1		

Table 3: Factors associated with visual outcome post cataract surgery (Cont.)

Variables	Simple logistic regression			Multiple logistic regression ^a		
	Crude OR	95% CI	P value	Adjusted OR	95% CI	P value
Type of surgery						
ECCE	.215	.061, .757	.017	.220	.039, 1.236	.086
Phaco (Ref)	1			1		
Diabetes						
Yes	.361	.102, 1.277	.114	2.452	.362, 16.589	.358
No (Ref)	1			1	.362, 16.589	.358
Hypertension						
Yes	1.223	.417, 3.589	.714	.293	.051, 1.699	.171
No (Ref)	1			1	.051, 1.699	.171
PC Rent						
Yes	3.789	.635, 22.607	.144	.485	.008, 29.481	.730
No (Ref)	1			1		
Vitreous loss						
Yes	4.243	1.204, 14.948	.024	.881	.021, 36.555	.947
No (Ref)	1			1		
Zonular dehiscence						
Yes	2.329	.620, 8.748	.210	1.796	.080, 40.184	.712
No (Ref)	1			1		
Pupil Problem						
Yes	1.937	.578, 6.491	.284	.295	.050, 1.745	.179
No (Ref)	1			1		

ECCE = Extracapsular cataract extraction, Phaco = Phacoemulsification, IOL = Intraocular lens

a Enter method was applied

a No multicollinerity and no interaction

a Hosmer and Lemeshow Test, P value = 0.874

a Classification table 85.2% correctly classified an Area under Receiver Operating Characteristic (ROC) curve was 87.

Discussion

Over a 10-year period in Kelantan (2015-2024), a total of 11,436 cataract surgeries were performed. Among these, only 74 cases were diagnosed with PXS and underwent cataract surgery, of which 61 met the criteria for inclusion in the analysis. The low number of PXS cases in this cohort reflects the relatively low incidence of the condition reported in other parts of Malaysia. For example, in a rural population presenting to Temerloh Hospital, Pahang, the incidence of PXS was 1.59% (26 out of 1,632 patients).¹ Similarly, an 8-year study conducted at Hospital Melaka reported that only 149 out of 12,992 cataract surgery patients (1.15%) were diagnosed with PXS.² These comparable rates suggest that while PXS remains uncommon across Malaysian populations, including in Kelantan, it continues to be a clinically important condition due to its association with increased surgical risk and complications.

The majority of these patients were aged over 60 years, which aligns with the understanding that PXS is predominantly a condition affecting the elderly as the typical white fibrillar material gradually builds up over the years. A study in Hospital Melaka² found that PXS occurred more frequently in older individuals, particularly those aged 71 years and above. Patients with PXS had a mean age that was 6.2 years higher compared to those without the condition, highlighting a strong association between age and the presence of pseudoexfoliation. This age-related trend is consistent with findings from international studies. For example, in Spain, PXS was detected in 21.6% of 1,763 eyes undergoing cataract surgery between January and July 2013, with prevalence rising from 6.0% in the 50–60 age group to 31.6% in patients over 80.³ Similarly, a study from Chennai reported a statistically significant increase in PXS incidence with advancing age ($P < 0.001$).⁴ In the Australian population, the occurrence of PXS is nearly non-existent in the middle-aged group (49–54 years), with a prevalence of 0%. However, this value rises to 6.25% among elderly patients aged 85 years and older.⁵

In our study, most patients with PXS were Malays, which likely reflects the demographic composition of Kelantan, where Malays represent the predominant ethnic group. However, evidence from other studies indicates that ethnicity

may play an independent role in the risk of developing pseudoexfoliation. For instance, a study conducted in Singapore found that individuals of Indian ethnicity were significantly more likely to develop PXS, with a 5.04-fold increased risk compared to Chinese ($P < 0.001$, 95% CI: 3.05–8.33). Malays also showed a higher likelihood, being 2.22 times more likely than Chinese to develop the condition ($P = 0.029$, 95% CI: 1.08–4.55).⁶

Findings on sex predilection in PXS have been variable across studies. Some earlier research has suggested a male predominance, whereas a study by Aravind et al. in 2003 found no significant difference between sexes.⁷ Conversely, studies by Avramides et al. reported a higher prevalence among females.⁸ In line with Aravind et al., our study also did not show any clear sex predilection, with males comprising 46% of the cases.

In our study, 45.9% of cases had intraoperative complications during cataract surgery, with vitreous loss (OR = 4.243, $P = 0.024$) significantly associated with visual outcomes postoperatively. Other issues included zonular dehiscence, dropped nucleus, posterior capsule rent. Similarly, Thevi et al.,² Zare et al.⁹ and Chen et al.¹⁰ reported that PXS was associated with an increased risk of vitreous loss, largely due to factors such as zonular instability and poor pupil dilation. However, Nagashima et al.¹¹ found no significant difference in vitreous loss rates between patients with and without PXS.

A meta-analysis by Vázquez-Ferreiro et al.¹² reported that the presence of PXS during cataract surgery carries a greater than 10% risk of posterior capsule rupture (PCR) or zonular dialysis. To mitigate this risk, the use of capsular tension rings (CTRs) is recommended. Supporting this, a study by Bayraktar et al.¹³ found that none of the eyes in the CTR group experienced intraoperative zonular separation ($P = 0.02$).

A properly centered capsulorhexis of at least 5–5.5 mm in size is essential for successful cataract surgery. A smaller capsulorhexis can cause difficulty in prolapsing the nucleus into the anterior chamber, placing excessive stress on the zonules, which may result in zonular dialysis, capsular bag prolapses, and vitreous loss. Poor pupillary dilation can impair peripheral visualization, leading to an inadequately sized

capsulorhexis in relation to the cataract, thus increasing the risk of intraoperative complications. In our study, 23% of patients had pupillary dilatation issues. Excessive intraoperative manipulation and vitreous prolapse may also contribute to postoperative complications such as corneal edema, iritis, and ultimately, poor visual outcomes. Careful preoperative and intraoperative assessment is recommended to reduce the risk of complications, with particular attention to signs such as phacodonesis, anterior chamber asymmetry, and excessive lens mobility.²

Of the patients analyzed, 37.7% experienced poor visual outcomes, defined as vision worse than 6/18, a relatively high proportion compared to the visual outcome rates generally reported in the broader cataract surgery population.¹⁴ Thevi et al.² reported that patients with PXS had poorer visual acuity compared to those without, likely due to the higher rate of intraoperative complications associated with PXS. In their study, better visual outcomes were observed in cases without complications.^{15,16} Similarly, Dwivedi et al.¹⁰ found that on postoperative day one, best corrected visual acuity (BCVA) measured with a Snellen chart and pinhole was significantly better in the control group than in the PXS group ($P = 0.027$) following phacoemulsification. However, findings across studies are mixed. Sufi et al.¹⁷ observed no significant difference in visual outcomes between groups at six months post-surgery ($P > 0.05$), while Drolsum et al.¹⁸ reported better outcomes in patients with PXS compared to those without.

Other than that, we found that extracapsular cataract extraction (ECCE) (OR = 0.215, $P = 0.017$) was significantly linked to favorable postoperative visual outcomes. This aligns with findings by Abdullah et al.¹⁹ who reported that ECCE is a safe and effective approach for managing mature and hypermature cataracts in patients with PXS, allowing for good visual recovery with low risk and cost. They highlighted the effectiveness of ECCE in challenging cases, particularly when zonular integrity is uncertain due to the presence of PXS.

Cataract surgery, performed by medical officers, gazetted specialists, and specialists in local centers, requires significant experience,

especially given the steep learning curve of phacoemulsification. The risk of intraoperative complications can be minimized through effective preoperative and intraoperative planning. This includes assessing patient risk and assigning cases based on surgeon expertise, with routine cases managed by medical officers and gazetted specialists, while complex cases are handled by specialists. Preoperative measures like wet-labs, a structured curriculum, and virtual reality simulators help junior surgeons improve their skills. Having a senior surgeon present for consultation and intervention if needed is also beneficial. These strategies have been effective, as shown by a study at Kymenlaakso Central Hospital, Finland, which reported positive outcomes over 9 years (2009-2017) involving 14,520 cataract surgeries.²⁰

A key limitation of our study was the small sample size. Long-term follow-up is needed to assess improvements in visual acuity and to identify any late complications. Additionally, as cataract surgeries were performed by different surgeons, the results may have been influenced by some degree of selection bias.

Conclusion

In conclusion, the majority of cataract surgeries in patients with PXS achieved good visual outcomes. However, careful preoperative identification of pseudoexfoliation and the adoption of appropriate surgical precautions are essential to minimize complications and optimize visual results. This study found that Vitreous loss and the choice of operative technique, specifically ECCE, were the only significant factors influencing postoperative visual outcomes in cataract surgery with PXS. Cataract surgery in the presence of PXS carries a heightened risk of complications, as the accumulation of pseudoexfoliative material on ocular structures leads to progressive zonular weakness and compromised lens support. A well-planned surgical approach can substantially reduce the likelihood of these intraoperative complications and improve final visual outcomes.

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