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COMPARISON OF THE OUTCOMES OF PHACOEMULSIFICATION AND MANUAL SMALL-INCISION CATARACT SURGERY IN POSTERIOR POLAR CATARACT – A RETROSPECTIVE STUDY

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ABSTRACT

Background
Surgical challenges arise from posterior polar cataracts (PPC) due to their unique characteristics and fragility of the posterior capsule. These cases increase the risk of posterior capsular rupture (PCR), requiring careful surgical planning and technique selection. Phacoemulsification and MSICS are used, but their efficacy and safety in posterior polar cataracts (PPC) are still being studied.
Objective: Compare intraoperative complications, visual outcomes, and postoperative recovery of phacoemulsification and MSICS in posterior polar cataract patients.

Methods
This 22-month retrospective analysis was done at Jawahar Lal Nehru Medical College and Hospital, Bhagalpur. The surgical approach divided 72 PPC patients into two groups: Group A (n=36) received phacoemulsification, while Group B received MSICS. Patient records were reviewed for demographics, intraoperative events (PCR and vitreous loss), BCVA, and postoperative sequelae.

Results
The study found that posterior capsular rupture was more common in the MSICS group (19.4%) compared to the phacoemulsification group (11.1%), but the difference was not significant ($p>0.05$). MSICS had 8.3% vitreous loss compared to 2.8% in phacoemulsification. Group A had 80.5% BCVA ≥6/12 at one month, while Group B had 77.7%. MSICS patients had slightly higher postoperative inflammation, but it subsided by the first follow-up. No dropped nucleus or endophthalmitis was reported.

Conclusion
Careful phacoemulsification and MSICS can yield positive visual outcomes in posterior polar cataract surgery. Despite its technological complexity, phacoemulsification may reduce posterior capsular issues. MSICS remains viable, especially in resource-constrained environments. For fewer complications and better results, surgery experience, technique adjustments, and postoperative awareness are essential.

Keywords: *Posterior polar cataract, Phacoemulsification, MSICS, Posterior capsular rupture, Vitreous loss, Visual outcomes.*
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INTRODUCTION

Posterior polar cataract (PPC) is a specific type of developing cataract marked by an unusual, thick, white opacity situated at the posterior pole of the lens. PPC presents a distinct surgical difficulty compared to other cataract types, owing to the inherent fragility or pre-existing dehiscence of the posterior capsule, which markedly elevates the risk of posterior capsular rupture (PCR) during the procedure (Vasavada et al., 2011; Osher, 1999; Hayashi et al., 2003). The opacity is typically attached to the capsule and is commonly linked to a weak or missing posterior capsule, rendering hydrodissection and nuclear manipulation very perilous.

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The principal objective of PPC surgery is to maintain the integrity of the posterior capsule, essential for intraocular lens (IOL) installation and postoperative visual stability. Multiple surgical alterations have been advised, such as hydrodelineation instead of hydrodissection, cautious nuclear rotation, and refraining from excessive manipulation in the lens's posterior segment (Osher, 1999; Gimbel & DeBroff, 2004; Vasavada & Singh, 1999). Notwithstanding these measures, intraoperative problems persist at elevated levels compared to other cataract varieties.

Two primary procedures employed for cataract extraction in PPC are phacoemulsification and manual small-incision cataract surgery (MSICS). Phacoemulsification provides the benefits of a closed chamber setting, regulated fluid dynamics, and accurate emulsification of the nucleus with reduced zonular strain. It has established itself as the benchmark for cataract surgery globally, particularly in institutions equipped with advanced technology and skilled professionals (Gimbel & DeBroff, 2004; Vasavada et al., 2002; Sharma et al., 2016). Nonetheless, the ultrasonic energy employed in phacoemulsification may still pose hazards in delicate PPC eyes, especially during the emulsification of the posterior plate.

Conversely, MSICS continues to be a prevalent method, particularly in resource-constrained environments. It facilitates the secure extraction of dense cataracts without dependence on phacoemulsification devices (Khokhar et al., 2013; Rao et al., 2012). In PPC instances, MSICS offers a more extensive incision that facilitates the gentle prolapse and expression of the nucleus, hence potentially alleviating tension on the posterior capsule. Nevertheless, the anterior chamber often becomes shallower after nucleus delivery, heightening the risk of capsular rupture and vitreous loss (Khokhar et al., 2013; Gogate et al., 2005). The choice of surgical procedure for PPC is frequently influenced by the surgeon's expertise, the availability of equipment, and the anatomical characteristics specific to the patient.

A rising demand exists for comparison studies to assess the results and problems of phacoemulsification and MSICS in the treatment of posterior polar cataracts. Prior research has yielded inconsistent outcomes, predominantly constrained by restricted sample sizes or data from single institutions (Arvind et al., 2012; Osher, 1999; Sharma et al., 2016). The inquiry over whether procedure provides superior safety and visual results in PPC patients is pertinent, especially for educational institutions and high-volume surgical centers in developing nations.

This retrospective study is to compare the surgical outcomes of phacoemulsification and MSICS in patients with posterior polar cataracts, emphasizing intraoperative complications, postoperative recovery, and final visual acuity. This study aims to analyze real-world data from a tertiary care hospital to give information that informs surgical decision-making and aids in the standardization of postoperative pulmonary complication management regimens.

MATERIALS AND METHODS

Research Design and Context

This retrospective, comparative study was performed in the Department of Ophthalmology, Jawahar Lal Nehru Medical College and Hospital, Bhagalpur, Bihar. The data was gathered during a 22-month duration. The research sought to evaluate the surgical results of phacoemulsification against manual small-incision cataract surgery (MSICS) in patients with posterior polar cataracts (PPC).

Study Cohort

Seventy-two patients with clinically confirmed posterior polar cataracts who had either phacoemulsification (Group A) or manual small incision cataract surgery (MSICS) (Group B) were included. Each group comprised 36 patients selected via purposive sampling, contingent upon the availability of comprehensive surgery and follow-up records.

Eligibility Criteria

Individuals aged 18 years and older, diagnosed with posterior polar cataract after slit-lamp examination and retroillumination. Completed an uncomplicated phacoemulsification or manual small incision cataract surgery with posterior chamber intraocular lens insertion. Minimum follow-up duration of one month postoperatively

Criteria for Exclusion

Traumatic or secondary cataracts, existing posterior segment pathology (e.g., macular degeneration, diabetic retinopathy), prior intraocular surgery or laser interventions, Intraoperative transition from one surgical technique to another. Insufficient documentation or attrition in follow-up.

Overview of Surgical Technique

All procedures were conducted by seasoned surgeons adhering to established protocols:
Group A (Phacoemulsification): Following topical or peribulbar anesthetic, a transparent corneal incision was performed. Trypan blue was employed to stain the anterior capsule as required. After a regulated capsulorhexis, hydrodelineation was executed without hydrodissection. Nuclear emulsification was performed utilizing either divide-and-conquer or stop-and-chop

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methodologies. Cortical removal was meticulously performed to prevent capsular tension, and foldable acrylic intraocular lenses were inserted in the capsule where feasible.

Group B (MSICS): A superior scleral tunnel incision was performed under peribulbar anesthesia. Capsulorhexis and hydroprocedures preceded nucleus prolapse and extraction via viscoexpression. Rigid PMMA intraocular lenses were positioned in the capsular bag or ciliary sulcus according to intraoperative observations.

Performance Indicator

The primary outcomes evaluated included

Intraoperative complications: posterior capsular rupture, vitreous loss, requirement for anterior vitrectomy.

Postoperative outcomes

Best-corrected visual acuity (BCVA) at one month, inflammation, corneal edema, intraocular lens (IOL) decentration, Duration for visual rehabilitation, and any necessary supplementary therapies

Data Acquisition

Demographic information, preoperative visual acuity, surgery documentation, and follow-up records were retrieved from patient files and input into a pre-formulated data sheet. Any intraoperative or postoperative complications were documented.

Statistical Evaluation

Data were input into Microsoft Excel and analyzed utilizing SPSS version 25.0. Continuous variables were presented as mean ± standard deviation (SD) and analyzed using the independent t-test. Categorical variables (e.g., incidence of PCR) were analyzed using the Chi-square test or Fisher's exact test, as applicable. A p-value of less than 0.05 was deemed statistically significant.

RESULTS

This retrospective analysis comprised 72 patients with posterior polar cataracts, divided into two groups of 36 patients each, who had either phacoemulsification or manual small-incision cataract surgery (MSICS).

Intraoperative Complications

Posterior capsular rupture (PCR) occurred in 4 individuals (11.1%) in the phacoemulsification cohort and 7 patients (19.4%) in the MSICS cohort. Despite being numerically greater in the MSICS group, the difference lacked statistical significance ($p > 0.05$).
Vitreous loss was observed in 1 patient (2.8%) in the phaco group and 3 patients (8.3%) in the MSICS group. The patients received anterior vitrectomy and secondary sulcus intraocular lens implantation.

Visual Results

At the one-month follow-up, 29 patients (80.5%) in the phacoemulsification cohort and 28 patients (77.7%) in the MSICS cohort attained a best-corrected visual acuity of 6/12 or above. The difference was not statistically significant, suggesting that both procedures yielded similar visual outputs when executed with due diligence.

Initial Postoperative Complications

On day 1, mild anterior chamber inflammation was observed in 5 patients (13.8%) in the phaco group and 7 patients (19.4%) in the MSICS group. All instances were cured with topical steroids within one week. Corneal edema was observed on the first postoperative day in 3 patients (8.3%) in the phacoemulsification group compared to 6 patients (16.6%) in the manual small incision cataract surgery group. These cases demonstrated enhancement by day seven. No instances of nucleus drop, endophthalmitis, or intraocular lens decentration were documented in either cohort.

Figure 1 and Table 1 compare major result factors between the two surgical procedures.

Table 1: Surgical Outcomes in Posterior Polar Cataract

Outcome Parameter	*Phacoemulsification (n=36)*	*MSICS (n=36)*	*p-value*
Posterior Capsular Rupture	4 (11.1%)	7 (19.4%)	>0.05
Vitreous Loss	1 (2.8%)	3 (8.3%)	>0.05
BCVA ≥6/12 at 1 Month	29 (80.5%)	28 (77.7%)	>0.05
Early Postoperative Inflammation	5 (13.8%)	7 (19.4%)	>0.05
Corneal Edema on Postop Day 1	3 (8.3%)	6 (16.6%)	>0.05

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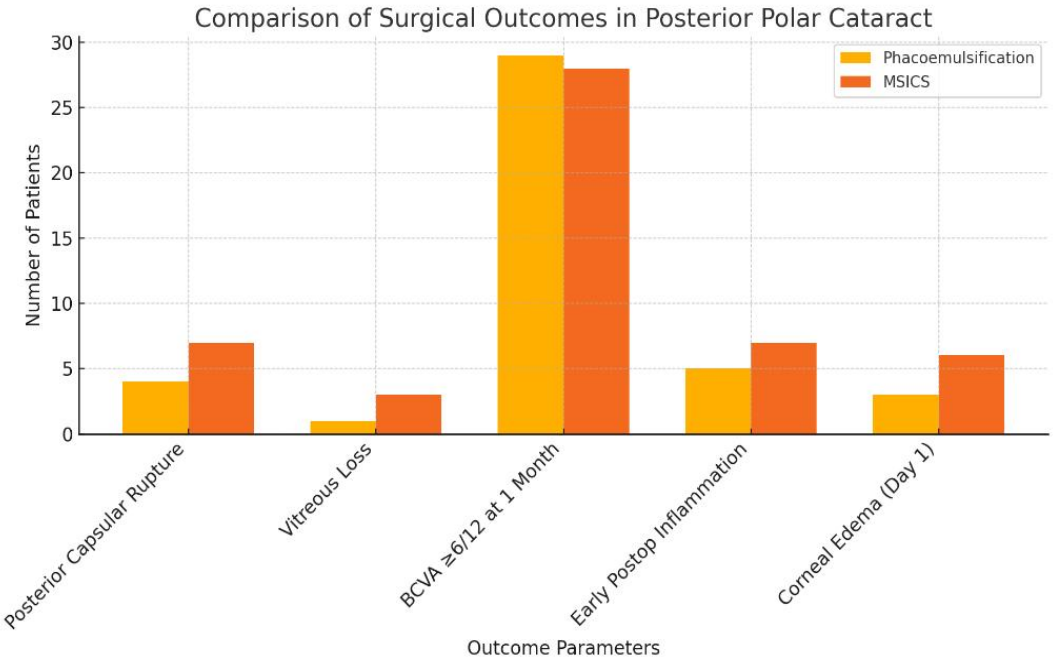

Figure 1: Bar Chart Illustrating Outcomes in Phacoemulsification and MSICS

DISCUSSION

Posterior polar cataracts (PPC) pose a distinct challenge in cataract surgery due to the inherent fragility or pre-existing dehiscence of the posterior capsule, which markedly elevates the risk of posterior capsular rupture (PCR) and associated complications (Vasavada et al., 2011; Osher, 1999; Hayashi et al., 2003). The objective of PPC surgery is to attain optimal visual rehabilitation while maintaining posterior capsular integrity, necessitating meticulous technique selection and intraoperative adjustments (Gimbel & DeBroff, 2004; Vasavada & Singh, 1999).

This retrospective investigation of phacoemulsification and manual small-incision cataract surgery (MSICS) revealed equal visual outcomes, but minor differences in complication rates were seen. PCR was more prevalent in the MSICS group (19.4%) than in the phacoemulsification group (11.1%), although the difference lacked statistical significance. The results align with existing research, indicating that PCR rates in PPC operations vary from 7% to 36%, influenced by surgical expertise, methodology, and patient characteristics (Osher, 1999; Gimbel & DeBroff, 2004; Vasavada et al., 2011).

Phacoemulsification is typically preferred for PPC because of its closed-chamber setting, superior fluidic management, and accurate nucleus fragmentation (Vasavada et al., 2002; Sharma et al., 2016). The capacity to execute hydrodelineation without hydrodissection and utilize methods like stop-and-chop alleviates tension on the posterior capsule, hence diminishing the likelihood of rupture. Our study demonstrated that phacoemulsification resulted in a reduced incidence of vitreous loss (2.8%) and corneal edema, hence validating its safety profile when executed by skilled surgeons (Hayashi et al., 2003).

MSICS, conversely, remains a feasible alternative, particularly in resource-constrained environments, as it does not necessitate advanced technology and yields favorable results when executed with suitable adjustments (Khokhar et al., 2013; Rao et al., 2012; Gogate et al., 2005). The approach entails more variations in the anterior chamber during nucleus delivery, thus elevating the risk of posterior capsular stress and subsequent rupture.

Notably, visual outcomes at one month were comparable between the two groups, with more than 77% of patients attaining BCVA ≥6/12. This indicates that with appropriate technique and subsequent management, both surgical methods can yield satisfactory functional outcomes (Arvind et al., 2012; Sharma et al., 2016). The findings align with prior research, which determined that MSICS can yield effects comparable to phacoemulsification in specific PPC patients.

Preoperative slit-lamp examination and retroillumination are essential for diagnosing PPC, allowing surgeons to prepare for intraoperative problems (Vasavada et al., 2011). Surgical approaches, including the application of capsular dyes, the prevention of hydrodissection, and

meticulous nucleus manipulation, are essential in both methodologies (Osher, 1999; Gimbel & DeBroff, 2004).

The drawbacks of this study encompass its retrospective approach, reliance on single-center data, and a very modest sample size. Future multicentric, prospective research with larger cohorts may provide more conclusive recommendations. Our findings enhance the understanding of surgical care in PPC, highlighting that both phacoemulsification and MSICS are efficacious, with the optimal choice dependent on clinical context and surgical expertise.

CONCLUSION

This retrospective study illustrates that phacoemulsification and manual small-incision cataract surgery (MSICS) are both efficacious surgical methods for addressing posterior polar cataracts (PPC), each presenting unique benefits and difficulties. Phacoemulsification demonstrated a somewhat reduced occurrence of posterior capsular rupture and vitreous loss; nevertheless, the difference lacked statistical significance. Furthermore, visual outcomes after one month were similar across the two groups, indicating that with adequate precautions and surgical preparation, MSICS can produce good results.

Phacoemulsification provides superior fluidics control and closed-chamber stability, possibly resulting in a decreased rate of intraoperative complications. Nonetheless, it is more reliant on technology and necessitates extensive surgical proficiency, thus constraining its applicability in low-resource environments. Conversely, MSICS serves as a viable alternative in these settings, particularly when executed with care and employing modified procedures designed for PPC.

This study's findings underscore the significance of preoperative identification of PPC, suitable intraoperative techniques like hydrodelineation rather than hydrodissection, careful nucleus manipulation, and preparedness to address posterior capsular problems as they arise.

The decision between phacoemulsification and MSICS should be determined by the surgeon's expertise, available infrastructure, and specific patient considerations. With precise technique and postoperative management, both methods can attain superior visual rehabilitation in patients with posterior polar cataract.

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