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# Manual Small Incision Cataract Surgery Under the Lens: A Prospective Study on Surgical Complications and Visual Prognosis

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**Abstract:** ***Purpose: To evaluate the incidence and types of perioperative complications associated with Manual Small Incision Cataract Surgery (MSICS) and to assess their impact on short-term postoperative visual outcomes. Methods: This prospective observational study was conducted at a tertiary care centre in Uttar Pradesh, India, from January 2023 to June 2024. A total of 150 patients aged 40–75 years with senile cataract underwent MSICS. Comprehensive preoperative evaluation included BCVA, IOP, slit-lamp biomicroscopy, and fundus examination. A uniform surgical technique was used under peribulbar anaesthesia. Patients were followed postoperatively on Day 1, Day 3, Day 7, Week 3, and Week 6. Complications were documented and visual outcomes assessed using Snellen and LogMAR charts. Statistical analysis was performed to determine differences in BCVA between those with and without complications. Results: Intraoperative complications were noted in 14 patients (9.3%), with the most frequent being capsulorhexis extension (4.7%) and posterior capsule rupture (2%). Postoperative complications occurred in 16 patients (10.7%), most commonly corneal oedema (4.7%) and Descemet's membrane folds (3.3%). At 6 weeks, 97.3% of patients achieved BCVA of 6/6–6/9. Mean LogMAR BCVA in patients with complications (0.21 ± 0.14) was significantly poorer than in those without complications (0.08 ± 0.07; p = 0.0087), although most patients demonstrated substantial visual improvement. Conclusion: MSICS is a robust, cost-effective, and scalable technique for cataract surgery in resource-limited settings. Although perioperative complications can influence early visual recovery, timely identification and management often result in favorable outcomes. The study reinforces the value of structured MSICS training and appropriate case selection to minimize risks.***

**Keywords:** MSICS, cataract surgery, perioperative complications, visual acuity, low-resource settings, posterior capsule rupture, BCVA

## 1. Introduction

Cataract continues to be the principal cause of preventable blindness globally, accounting for nearly half of the world's blindness burden. As per the World Health Organization (WHO), over 94 million individuals live with visual impairment due to untreated cataracts [20]. The problem is especially acute in developing nations such as India, where socio-economic disparities, lack of access to trained ophthalmologists, and inadequate infrastructure exacerbate the situation.

The National Programme for Control of Blindness (NPCB) in India has emphasized surgical cataract removal as the primary strategy to eliminate avoidable blindness. However, access to modern phacoemulsification remains limited in many rural and semi-urban regions due to the high cost of equipment and consumables. In this context, Manual Small Incision Cataract Surgery (MSICS) has gained prominence as a low-cost, high-output alternative that can be performed efficiently without reliance on advanced technology.

MSICS involves the creation of a self-sealing scleral tunnel and manual expression of the lens nucleus. It has proven effective in dense cataracts where phacoemulsification may be challenging or hazardous. The technique is associated with shorter surgical times and comparable visual outcomes to phacoemulsification in developing countries [5,6]. Moreover, MSICS can be performed by surgeons in outreach programs, thereby improving surgical coverage and reducing the cataract backlog.

Despite these advantages, MSICS is not without risks. Intraoperative complications such as posterior capsule rupture (PCR), extension of the continuous curvilinear capsulorhexis (CCC), or zonular dialysis can threaten visual outcomes. Postoperative issues like corneal oedema, hyphema, or retained lens fragments can also hinder recovery. The incidence of such complications varies depending on the surgeon's experience, patient selection, and the surgical setting.

It is important to quantify and understand these complications to improve patient safety, optimize training curricula, and inform policy. This prospective study aims to evaluate the perioperative complication rate of MSICS and determine its influence on short-term visual outcomes in a real-world Indian tertiary care setting.

## 2. Materials and Methods

**Study Design and Setting**
This prospective observational study was conducted at the Department of Ophthalmology, Dr. KNS Memorial Institute of Medical Sciences, Barabanki, Uttar Pradesh, over an 18-month period from January 2023 to June 2024. Ethical clearance was obtained from the Institutional Ethics Committee. All procedures adhered to the Declaration of Helsinki. Informed written consent was obtained from each participant.

**Sample Selection**
A total of 150 patients diagnosed with senile cataract were enrolled. Inclusion criteria comprised adults aged 40–75 years with visually significant cataract in at least one eye and no history of ocular comorbidities that might affect the surgical outcome.

**Inclusion criteria:**
- Senile cataract
- BCVA <6/18
- Age 40–75 years
- Consent to participate

**Exclusion criteria:**
- Traumatic or complicated cataracts
- Congenital or developmental cataracts
- Pre-existing posterior segment pathology (e.g., retinal detachment, macular degeneration)
- History of prior intraocular surgery
- Uncontrolled glaucoma
- Poor mydriasis (<5 mm despite dilation)

**Preoperative Assessment**
Patients underwent a complete ophthalmic evaluation including:
- UCVA and BCVA using Snellen's chart
- Slit-lamp examination for anterior segment
- IOP measurement using Goldmann applanation tonometry
- Dilated fundus evaluation using indirect ophthalmoscopy or +90D lens
- A-scan biometry for IOL power calculation (SRK-II formula)

Relevant systemic conditions (e.g., diabetes, hypertension) were noted and controlled before surgery.

**Surgical Technique**
All surgeries were performed under peribulbar anaesthesia using 2% lignocaine with hyaluronidase. A fornix-based conjunctival flap was raised. A partial-thickness 6.5 mm frown-shaped scleral tunnel was created 1.5–2 mm posterior to the limbus using a crescent blade. Entry into the anterior chamber was achieved with a 3.2 mm keratome.

A 5.5–6 mm CCC was fashioned with a bent needle or Utrata forceps. Gentle hydrodissection and hydrodelineation were performed to mobilize the nucleus. The nucleus was prolapsed into the anterior chamber and delivered via viscoexpression or irrigating vectis. Residual cortex was aspirated with a Simcoe cannula. A rigid PMMA posterior chamber IOL was implanted in the capsular bag. The anterior chamber was reformed, and the wound checked for integrity.

Subconjunctival injections of dexamethasone and gentamicin were administered, and the eye patched.

**Postoperative Protocol**
Patients were evaluated on Day 1, Day 3, Day 7, Week 3, and Week 6. Each visit included:
- UCVA and BCVA
- Slit-lamp biomicroscopy
- Documentation of any complications (e.g., corneal oedema, IOL decentration, inflammation)
- Fundus examination where required

Topical medications included:
- Moxifloxacin 0.5% QID for 2 weeks
- Prednisolone acetate 1% QID tapered over 6 weeks
- Lubricants as needed

**Statistical Analysis**
Data were entered in Microsoft Excel and analyzed using SPSS version 26. BCVA was converted to LogMAR for analysis. Patients were grouped into those with and without complications. Visual outcomes were compared using independent t-tests. A p-value <0.05 was considered statistically significant. Pearson correlation was used to assess the relationship between complications and visual gain.

## 3. Results

**Demographic Profile**
1) **Mean age:** 56.8 ± 9.1 years
2) **Gender distribution:** 78 females (52%), 72 males (48%)
3) **Age group most affected:** 51–60 years (58.7%)
4) **Preoperative BCVA:**
   - <6/60: 45 patients (30%)
   - 6/24–6/60: 103 patients (69%)
   - 6/12: 2 patients (1%)

**Intraoperative Complications**
Out of 150 patients, 14 (9.3%) had intraoperative complications:
- CCC extension: 7 patients (4.7%)
- Posterior capsule rupture (PCR): 3 patients (2%)
- Premature AC entry: 2 patients (1.3%)
- Zonular dialysis: 1 patient (0.7%)
- Descemet's detachment: 1 patient (0.7%)

PCR was managed with anterior vitrectomy and sulcus IOL implantation in 2 cases.

**Postoperative Complications**
Postoperative complications were observed in 16 patients (10.7%):
- Corneal oedema: 7 patients (4.7%)
- Descemet's folds: 5 patients (3.3%)
- Hyphema: 2 patients (1.3%)
- Retained cortical matter: 1 patient (0.7%)
- IOL decentration: 1 patient (0.7%)

Corneal oedema and Descemet folds resolved with conservative management in all cases.

**Visual Outcomes**

a) BCVA at 6 weeks:
- 6/6–6/9: 146 patients (97.3%)
- 6/12–6/18: 2 patients
- 6/24–6/60: 2 patients

b) Mean LogMAR BCVA:
- With complications: 0.21 ± 0.14
- Without complications: 0.08 ± 0.07

c) Statistical significance: $p = 0.0087$

d) Pearson correlation: $r = –0.0089$

## 4. Discussion

Our findings affirm that MSICS is an effective and safe technique, particularly suited to high-volume surgical centres in resource-constrained environments. The overall complication rate of approximately 10% falls within acceptable global standards and is comparable to that reported in large studies such as those by Venkatesh et al. and Haripriya et al. [2,5].

PCR remains one of the most feared complications and is often associated with poor visualization or vigorous nucleus manipulation. Our rate of PCR (2%) was consistent with the literature [14]. Descemet's detachment and premature entry can be minimized through proper scleral tunnel construction and experience.

Interestingly, CCC extension was the most common intraoperative complication. White cataracts, poor red reflex, or overfilled anterior chambers may contribute to this. Using trypan blue dye in such cases improves safety.

Postoperative complications were mostly transient. Corneal oedema and Descemet folds resolved with corticosteroids and hydration. Retained lens matter was removed successfully in one patient. No endophthalmitis was observed in our series, affirming the importance of intraoperative sterility and postoperative vigilance.

Visual recovery was excellent. Nearly all patients reached 6/9 or better vision at six weeks. Although complications negatively affected BCVA statistically, the clinical relevance was small—emphasizing that with prompt management, good visual outcomes are still attainable.

Our results support MSICS as a vital tool in national blindness prevention strategies. It offers a pragmatic solution to the cataract burden, especially where cost and equipment are limiting factors. However, complications—though manageable—require attention, and surgical training programs should incorporate robust simulation and mentorship components [7,11].

## 5. Limitations

- The study did not evaluate long-term outcomes beyond six weeks.
- The impact of systemic comorbidities such as diabetes was not separately analyzed.
- Surgeon variability and intra-surgeon learning curves were not explored.

## 6. Conclusion

MSICS remains the cornerstone of cataract blindness alleviation in India and similar settings. Despite a modest incidence of perioperative complications, the technique consistently delivers favorable visual outcomes. The findings advocate for continued promotion of MSICS through enhanced training, standardized protocols, and public health integration. Future studies should explore long-term visual stability and patient-reported outcome measures to further validate the success of MSICS in comprehensive eye care delivery.

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**Tables**

**Table 1:** Distribution of Cases by Age Group

| Age Group (Years) | Number of Cases | Percentage (%) |
|---|---|---|
| ≤40 | 1 | 1 |
| 41–50 | 28 | 19 |
| 51–60 | 88 | 58 |
| >60 | 33 | 22 |

**Table 2:** Intraoperative Complications Observed

| Complication | Number of Cases | Percentage (%) |
|---|---|---|
| Posterior Capsular Rupture (PCR) | 3 | 2.0 |
| Capsulorhexis Extension | 7 | 4.7 |
| Premature Entry | 2 | 1.3 |
| Zonular Dialysis | 1 | 0.7 |
| Descemet Detachment | 1 | 0.7 |
| No Complication | 136 | 90.7 |

**Table 3:** Postoperative Complications and Outcomes

| Complication | Number of Cases | Percentage (%) |
|---|---|---|
| Corneal Oedema | 7 | 4.7 |
| Descemet Fold | 5 | 3.3 |
| Retained Lens Matter | 1 | 0.7 |
| IOL Malposition | 1 | 0.7 |
| Hyphema | 2 | 1.3 |
| No Complication | 134 | 89.3 |

**Figures**

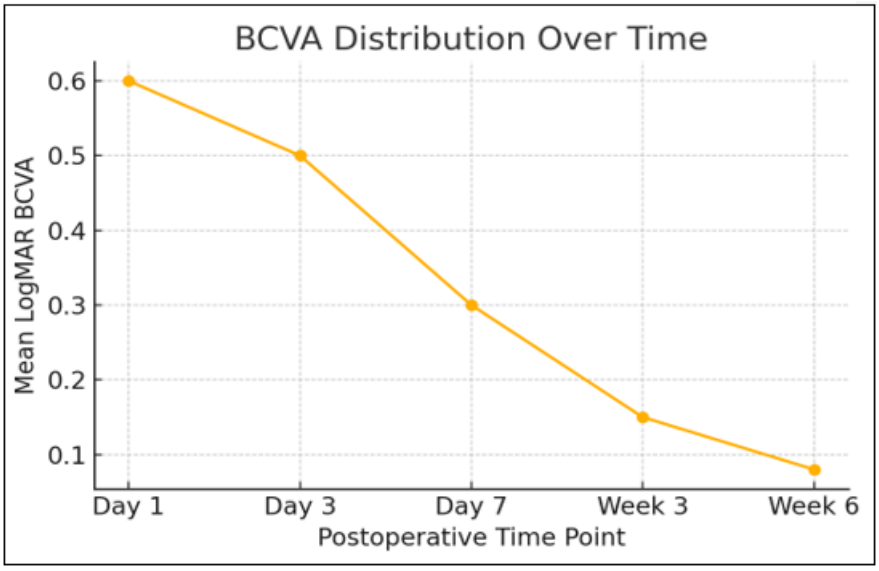


**Figure 1:** BCVA Distribution Over Time

This line graph illustrates the improvement in mean LogMAR BCVA over time from Day 1 to Week 6.

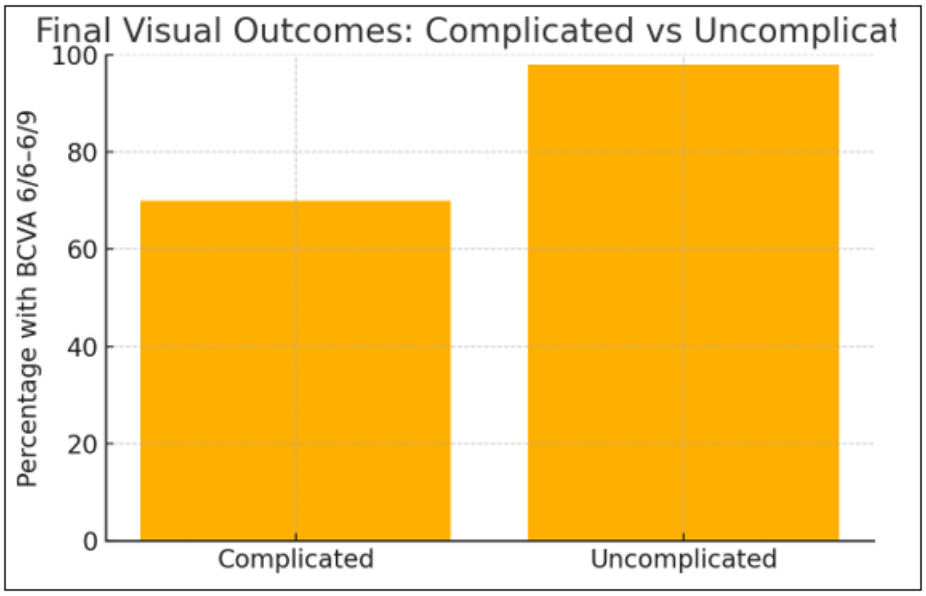


**Figure 2:** Final Visual Outcomes: Complicated vs Uncomplicated Cases

This bar chart compares the final visual outcomes (percentage achieving 6/6–6/9 BCVA) between patients with and without perioperative complications.