

Original Research Article

EFFICACY AND SAFETY OF 5% POVIDONE-IODINE AS A PROPHYLACTIC ANTISEPTIC IN THE PREVENTION OF POSTOPERATIVE ENDOPTHALMITIS FOLLOWING CATARACT SURGERY

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ABSTRACT

Background: Postoperative endophthalmitis remains one of the most feared complications of intraocular surgery, with the potential to cause irreversible visual loss. Povidone-iodine (PVP-I), a broad-spectrum iodophor antiseptic, has been widely advocated as a simple, inexpensive prophylactic agent capable of reducing the periocular and conjunctival bacterial load prior to surgery.

Purpose: To evaluate the efficacy of 5% povidone-iodine solution as a routine antiseptic in preventing postoperative infection after cataract surgery, and to assess patient tolerance and any associated complications.

Materials and Methods: A prospective observational study was conducted on 100 patients undergoing cataract surgery. Pre-operative conjunctival swabs were obtained for Gram staining and culture prior to instillation of mydriatics. On the day of surgery, 5% povidone-iodine solution was instilled into the conjunctival cul-de-sac for 1–2 minutes and irrigated with saline; the periocular skin was separately prepared with 5% surgical povidone-iodine. Culture-positive patients underwent repeat post-operative Gram staining and culture. All patients were followed for three months with serial visual acuity assessment and monitoring for signs of infection, corneal toxicity, and other complications.

Results: The cohort was predominantly aged 41–60 years (60%) and of low socio-economic status (96%). Pre-operative cultures were positive in 3 of 100 patients (*Staphylococcus aureus*, n = 2; *Staphylococcus epidermidis*, n = 1); all three converted to culture-negative status post-operatively. No case of postoperative endophthalmitis occurred. Mild self-limiting uveitis (76%) and striate keratitis (72%) were the most frequent post-operative findings, and no patient lost more than two Snellen lines of vision or reported discomfort attributable to povidone-iodine.

Conclusion: Topical 5% povidone-iodine is a safe, effective, and low-cost antiseptic for the prevention of postoperative endophthalmitis following cataract surgery. It achieved reliable conjunctival disinfection without corneal toxicity or hypersensitivity, supporting its use as a routine step in preoperative ocular preparation, particularly in resource-limited settings.

Keywords: povidone-iodine; endophthalmitis; cataract surgery; prophylaxis; conjunctival flora; ocular antiseptics.

INTRODUCTION

Postoperative endophthalmitis is a rare but vision-threatening complication of intraocular surgery, particularly cataract surgery. Because established

infection may result in severe and irreversible visual loss, prevention through meticulous asepsis and effective ocular surface antiseptics is central to perioperative care.^[1-3] The normal conjunctival and eyelid flora includes predominantly coagulase-

negative staphylococci, *Staphylococcus aureus* and diphtheroids; these organisms can contribute to postoperative infection, making reduction of the preoperative microbial load an important preventive measure.^[4,5]

Among available antiseptics, povidone-iodine (PVP-I) has strong clinical evidence for preoperative ocular preparation. It is an iodophor that releases free iodine and has broad-spectrum bactericidal, virucidal, antifungal and sporicidal activity. The ocular-surface preparation should be distinguished from detergent-containing surgical scrub, which is not intended for conjunctival use.^[6-9] Studies have demonstrated substantial reductions in conjunctival bacterial counts after topical PVP-I, with 5% solution showing effective antimicrobial activity and acceptable ocular tolerance.^[7,10-13]

Clinical studies have supported the role of PVP-I in reducing postoperative infection. Speaker and Menikoff reported a lower incidence of endophthalmitis with topical PVP-I preparation, while subsequent studies confirmed reduction of periocular and conjunctival flora and supported its use as a routine preoperative antiseptic.^[2,7,14,15] Evidence-based reviews have identified preoperative PVP-I as the best-supported antiseptic intervention for prevention of bacterial endophthalmitis in cataract surgery.^[3,15] Comparative studies have also examined concentration, showing effective reduction of conjunctival flora with 5% PVP-I and acceptable safety at clinically used concentrations.^[10,12,13]

Corneal safety has been evaluated in experimental and clinical studies, with appropriate dilute ocular preparations showing limited epithelial or endothelial toxicity when used correctly.^[8,12,16,20] The evidence therefore supports a brief preoperative application of 5% PVP-I to the conjunctival sac as a simple, inexpensive and broadly effective method of reducing ocular surface microbial contamination before cataract surgery. The present study evaluates its efficacy, patient tolerance and complications in 100 patients undergoing cataract surgery.

3. Aims and Objectives

- To evaluate the efficacy of 5% povidone-iodine as a routine antiseptic in preventing postoperative infection following cataract surgery.

- To assess patient tolerance of povidone-iodine preparation, with regard to comfort and safety.
- To document any complications arising specifically from the application of povidone-iodine.

MATERIALS AND METHODS

Study design and setting: This was a prospective, observational, hospital-based study conducted in the Department of Ophthalmology, in which 100 consecutive patients scheduled for cataract surgery were enrolled.

Sampling and Inclusion: Patients were predominantly aged 40–70 years. Pre-operative conjunctival swabs were collected from the cul-de-sac of the eye to be operated, at the time of ward admission and before instillation of mydriatics or anaesthetic agents used for fundus examination, tonometry, or IOL power calculation. Swabs were sent for Gram staining and aerobic culture and sensitivity.

Exclusion Criteria: Patients with overt dacryocystitis or conjunctivitis, and those who had received topical antibiotics prior to admission, were excluded. No study patient received pre-operative topical antibiotic prophylaxis, isolating the effect of povidone-iodine alone.

Intervention: On the day of surgery, 5% povidone-iodine solution was instilled into the conjunctival cul-de-sac and allowed to remain for 1–2 minutes before being washed off with saline. The periocular skin was separately prepared with 5% surgical povidone-iodine solution, after which the eye was draped with a sterile towel and cataract surgery was performed.

Follow-up: All patients were followed for three months with routine examination for signs of infection or corneal toxicity. Patients with a positive pre-operative culture underwent repeat post-operative Gram staining and culture of the conjunctival cul-de-sac. Visual acuity was recorded pre-operatively and at one week, one month, two months and three months post-operatively using Snellen's chart.

RESULTS

One hundred patients undergoing cataract surgery were studied prospectively over a three-month follow-up period.

5.1 Demographic and Socio-economic Profile

Table 3: Demographic and Socio-economic Characteristics (n = 100)

Characteristic	Category	No. of Patients (%)
Age group (years)	30–40	11
	41–50	31
	51–60	29
	61–70	18
	71–80	11
Gender	Male	44
	Female	56
Monthly income (Rs.)	0–500	96
	500–1000	4
	>1000	0

Sixty percent of patients were aged between 41 and 60 years, with a slight female preponderance (56%). The population was drawn predominantly from a low

socio-economic background — largely agricultural and manual labourers — with 96% reporting a monthly income below Rs. 500.

5.2 Clinical Profile

Table 2: Pre-operative Diagnosis and Associated Comorbidities (n = 100)

Category	Finding	No. of Patients
Lens pathology	Immature cataract	42
	Mature / hypermature cataract	42
	Lens-induced glaucoma	12
	Posterior sub-capsular / combined types	4
Systemic comorbidity	Diabetes mellitus ($\pm$ hypertension)	11
	Systemic hypertension	4
	Other (anaemia, COPD/asthma, TB, filariasis, arrhythmia)	8
Ocular comorbidity	Glaucoma / ARMD / retinopathy / optic atrophy	9

Immature and mature/hypermature cataract accounted for the great majority of cases (84% combined), with lens-induced glaucoma in 12%. Diabetes mellitus was the most frequent systemic

association (11%), consistent with prior literature identifying diabetes as a predisposing factor for postoperative infection.

5.3 Surgical Profile

Table 5: Type of Surgery and Anaesthesia (n = 100)

Category	Type	No. of Patients
Surgery	ECCE with PC-IOL	74
	SICS with PC-IOL	23
	ICCE with AC-IOL	2
	ECCE only	1
Anaesthesia	Retrobulbar with facial block	62
	Peribulbar	38

Extracapsular cataract extraction (ECCE) with posterior-chamber IOL implantation was the predominant technique (74%), followed by small-incision cataract surgery (SICS, 23%). Retrobulbar anaesthesia with facial block was used more often than peribulbar block (62% vs. 38%).

5.4 Microbiological Findings

Pre-operative conjunctival culture was positive in 3 of 100 patients: coagulase-positive *Staphylococcus*

aureus in 2 patients and coagulase-negative *Staphylococcus epidermidis* in 1 patient. No organisms were isolated in the remaining 97 patients. Following povidone-iodine preparation and surgery, all three previously culture-positive patients converted to culture-negative status on repeat post-operative Gram stain and culture — a 100% post-operative clearance rate among pre-operatively colonised eyes.

5.5 Visual Acuity Outcomes

Table 6: Visual Acuity Before Surgery and at Follow-up (No. of Patients, n = 100)

Visual Acuity	Pre-operative	1 Week	1 Month	2 Months	3 Months
< 6/60 (incl. PL/HM/CF)	100	5	1	1	1
6/60	—	41	3*	32	32
6/36 – 6/24	—	39	*	43	43
6/18 – 6/12	—	14	*	23	23
6/9 – 6/6	—	1	*	1	1

*Exact per-band figures for the one-month interval were not fully legible in the source record; the two- and three-month distributions (shown) reflect the stabilised endpoint. Nearly all pre-operative visual acuity was worse than 6/60. By one week post-operatively, the majority of patients had already

achieved 6/60 or better, and acuity continued to improve through the two-month review, after which it remained essentially stable to three months. No patient lost more than two Snellen lines of vision at any point during follow-up, and no eye failed to improve from its pre-operative baseline.

5.6 Intra-operative and Post-operative Complications

Table 5: Complications Recorded During and After Surgery (n = 100)

Phase	Complication	No. of Patients
Intra-operative	Increased positive pressure	5
	Descemet's membrane tears	4
	Posterior capsule rent with vitreous loss	2
	Hyphaema	2
	Nucleus drop / iridodialysis / zonular dialysis	0
Post-operative	Mild uveitis	76

	Striate keratitis	72
	Ruptured suture	3
	Corneal haziness / retained lens cortex / severe uveitis	2 each
	Endophthalmitis	0

Intra-operative complications were infrequent overall, the most common being transiently increased positive intraocular pressure (5%) and Descemet's membrane tears (4%). Post-operatively, mild self-limiting uveitis (76%) and striate keratitis (72%) were common, expected reactive findings after intraocular surgery and resolved without sequelae; no patient reported post-operative irritation, itching, or a hypersensitivity reaction attributable to povidone-iodine. Critically, no case of postoperative endophthalmitis occurred in the entire cohort during the three-month follow-up period.

DISCUSSION

The distinction between povidone-iodine solution and povidone-iodine surgical scrub is clinically important: the scrub formulation contains a detergent that is toxic to ocular tissue and must never be applied to the lid margins or conjunctival sac, whereas the aqueous solution used in this study caused no allergic reaction or corneal change in any patient. Povidone-iodine's broad-spectrum activity — sporicidal, bactericidal, antimycotic, virucidal and protozoacidal — stems from the slow, sustained release of elemental iodine from its polymer-bound reservoir. Because a 5% solution provides roughly 1 part in 200 free iodine, well above the germicidal threshold, brief (1–2 minute) contact time is sufficient to achieve substantial conjunctival disinfection, consistent with the 100% post-operative culture conversion observed among the three pre-operatively colonised patients in this series.^[6,12,16]

These findings align closely with the wider literature reviewed above. Speaker and Menikoff's landmark 1991 trial and the subsequent Chennai-based series by Mohan Raj and Balasubramaniam both reported that topical povidone-iodine alone reliably prevented postoperative endophthalmitis, matching the zero-endophthalmitis outcome recorded here despite a cohort weighted toward older, lower socio-economic status patients with limited access to pre-admission eye care — a population that might otherwise be expected to carry a higher baseline infective risk. The absence of any endophthalmitis case, together with the elimination of pre-operative bacterial colonisation in all three culture-positive patients, supports the conclusion that povidone-iodine achieves dependable disinfection independent of continuous pre-operative antibiotic dosing, which — unlike a single antiseptic application — carries the theoretical disadvantage of selecting for resistant organisms without necessarily eradicating them.^[2,3,17] The safety profile observed here — no corneal toxicity, no hypersensitivity, no patient discomfort — mirrors rabbit-model and clinical corneal-toxicity data from earlier studies, reinforcing that 5% povidone-iodine solution, correctly distinguished

from the cytotoxic scrub formulation, is well tolerated on the ocular surface. The high rates of mild post-operative uveitis and striate keratitis in this cohort are consistent with expected reactive inflammation following extracapsular and small-incision cataract extraction rather than with any adverse antiseptic effect, since these findings were self-limiting and unaccompanied by culture positivity or progressive visual loss.^[12,16,20]

Taken together with the reviewed literature, the present findings support combining a single pre-operative application of povidone-iodine with a brief course of pre-operative topical antibiotic where feasible, and consider its use at the conclusion of surgery as a plausible further step to reduce residual infective risk, an application that has been suggested but was outside the scope of the present study. Extension of povidone-iodine prophylaxis to related indications — ophthalmia neonatorum, bacterial conjunctivitis, and bacterial or fungal keratitis — also merits dedicated evaluation.^[3,15]

Limitations: This was a single-centre, non-randomised, non-comparator study without a concurrent control arm receiving an alternative or no antiseptic, which limits causal inference regarding the specific contribution of povidone-iodine relative to aseptic surgical technique alone. The sample size (n = 100), while adequate to demonstrate feasibility and safety, is underpowered to detect the true, very low baseline incidence of endophthalmitis (historically well under 1% even without antiseptic prophylaxis), and larger, ideally randomised and multi-centric studies would be needed to establish statistically robust efficacy estimates.

CONCLUSION

In this prospective study of 100 patients undergoing cataract surgery with routine 5% povidone-iodine antiseptics, the majority of patients were aged 40–60 years (60%), female (56%), and of low socio-economic status (96%). Immature or mature cataract accounted for 84% of cases, and diabetes mellitus was the most common systemic comorbidity (11%). Extracapsular cataract extraction with posterior-chamber IOL implantation was the predominant surgical technique (74%). Pre-operative visual acuity was worse than 6/60 in all cases; intra-operative complications were infrequent, the most notable being increased positive pressure (5%) and Descemet's membrane tears (4%).

Pre-operative culture was positive in three patients (Staphylococcus aureus in two, Staphylococcus epidermidis in one); all converted to culture-negative status post-operatively. Mild uveitis (76%) and striate keratitis (72%) were the principal post-operative findings, both self-limiting. No case of postoperative endophthalmitis was recorded, no

patient lost more than two Snellen lines of vision, and no patient reported irritation or showed signs of hypersensitivity to povidone-iodine.

These findings support the conclusion that 5% povidone-iodine is a safe, effective, and economical agent for pre-operative ophthalmic antisepsis, capable of markedly reducing conjunctival bacterial colonisation and, by extension, the risk of postoperative endophthalmitis, without causing hypersensitivity, corneal toxicity, or patient discomfort. Its low cost and simplicity make it particularly well suited to routine use in cataract surgery, including in resource-limited settings. Combination with a short pre-operative course of topical antibiotic, and possible application at the conclusion of surgery, may further optimise outcomes and warrant dedicated future study, as does its extended use in ophthalmia neonatorum and infective conjunctivitis/keratitis

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