Evaluation of surgical outcome after cataract surgery with lens implantation using air or viscoelastic to maintain the anterior chamber

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Abstract

Introduction: Findings from specular microscope studies have demonstrated increased endothelial cell loss associated with the use of air for lens implantation. The objective of this study was to evaluate the surgical outcome after cataract surgery with lens implantation using air or viscoelastic to maintain the anterior chamber

Design: Retrospective record analysis

Subjects: Record cards of patients operated for cataract at Sakubva Eye Unit, Mutare, Zimbabwe in the period January – December 2002

Main outcome measures: Operative complications, post operative keratitis, presenting visual acuity at discharge, two and six weeks postoperatively.

Results: Record cards of 315 patients were analysed, 207 (65.7%) had lens implantation under air, 108 (34.3%) had implantation under viscoelastic. Presenting visual acuity at discharge, two and six weeks postoperatively was better or equal to 6/18 in 36.7%, 34.4% and 52% of patients implanted under air compared to 40.7%, 35.6% and 38.3% of those implanted under viscoelastic. Post operative keratitis was observed in 14% of patients implanted under air and 12% of those implanted under viscoelastic. Vitreous loss was experienced by 1.9% and 5.8% of patients implanted under air and viscoelastic respectively.

Conclusion: Despite reports of increased endothelial cell loss associated with use of air for lens implantation, this study finds no difference in surgical outcome between patients implanted posterior chamber lens under air or viscoelastic.

Introduction

Contact between intraocular lens (IOL) and the cornea during lens implantation can cause endothelial cell depletion, resulting in development of corneal oedema or bullus keratopathy with subsequent reduction in postoperative visual acuity[1-3].

Studies by Boune and Kaufman[4] have demonstrated that 40-50% of endothelial cells can be lost during intraocular lens insertion. Use of protective substances in the anterior chamber has dramatically reduced endothelial cell loss thus assuring good postoperative surgical outcome. Air used to maintain anterior chamber during lens implantation reduced endothelial cell loss from 32% in lens implantation undertaken without use of air to 15% when air was used to maintain the anterior chamber.

Viscoelastic substances were first used in human implant surgery in 1979 and further reduced endothelial cell loss to 7%. Animal and human specular microscopic studies comparing air with viscoelastic for lens implantation have demonstrated greater endothelial cell protection associated with use of viscoelastic[5].

Although viscoelastic provides better protection to the endothelium during lens implantation, its use in developing countries is limited by cost and availability. Air on the other hand costs nothing, is always available and does not require packaging or storage since it can be drawn from the atmosphere into a syringe. To our knowledge no study has evaluated surgical outcome in patients' implanted intraocular lens (IOL) under air. In this study we analysed, retrospectively, record cards of patients operated for cataract in our unit in order to identify any difference in surgical outcome between patients implanted (IOL) under air or viscoelastic.

Method

We reviewed record cards of 450 patients operated for cataract at Sakubva Eye Unit, Manicaland province, Zimbabwe, in the period January to December 2002. One hundred and thirty five cards had incomplete information on relevant variables and were excluded, leaving 315 (70.9%) for final analysis. 207 (65.7%) had lens implantation under air while 108 (35.3%) had implantation under viscoelastic.

All patients were operated at Sakubva Eye Unit, which is the referral centre for eye disease in Manicaland province. Cataract surgery followed a standard technique, which consisted of raising a fornice based conjunctival flap followed by cauterization of superficial episcleral vessels. A posterior limbal incision of approximately 10mm was made with No 15 Bard Parker blade and a short scleral tunnel dissected past the limbus into clear cornea. The anterior chamber was entered with 18-gauge needle and 360 degree can opener capsulotomy performed with bent 27-gauge needle. The nucleus was dislocated into the anterior chamber after hydrodissection and delivered through the wound by expression using simcoe irrigation/aspiratin cannula. Residual cortex was aspirated and the anterior chamber (AC) deepened with viscoelastic or air depending on availability. A single piece PMMA IOL (Aurolab India) was implanted in the bag and positioned with a metal loop. The AC was reformed with Ringers lactate and the wound closed with 10/0 nylon in a running or interrupted pattern. Subconjunctival injection of

Gentamicin 0.5ML was given and a combined steroid/antibiotic ointment applied to the fornice. Standard power intraocular lens (18-22 diopters) was used in all patients as preoperative keratometry and A-Scan biometery were not possible in Sakubva eye unit at the time. Visual acuity was assessed without correction on day one and at two and six weeks postoperatively. Slit lamp examination was performed to check for keratitis and other post operative complications.

Information was entered, checked and analysed using Stata software (Stata Corporation, 4905 Lakeway Drive, College Station, Texas 77845 USA). The proportion with visual acuity better than or equal to 6/18, operative complications and post operative keratitis was calculated and compared. Differences between proportions were compared with a student's t-test. 95% confidence interval defined the upper and lower bound of the point estimate. Any difference with a p value <0.05 was considered significant.

Results

The patient's demographic characteristics are shown in Table 1, 107 (34%) were male, mean age was 68.6±10 years, (range 14-100 years) and 69 (25.8%) had co-morbidity. Mean IOL power was 21 diopters (18-22), operative complications were experienced in 25/310 (8.1%) patients and included capsule break (1.3%), vitreous loss (3.9%) and other (2.9%).

Table 1. Demographic characteristics and operative procedures

Characteristic	All	Air	Viscoelastic
Number	315	207	108
Age (yrs) M±SD	68.6±10	69±9.2	67±9.2
Sex (Males))	34.0%	36.7%	28.7%
Operated eye (R)	42%	53%	47%
Co-morbidity (Yes)	25.8%	22.8%	(28.7%
Operative complications			
1. Capsule break	1.3%	2/14 (1%)	2/11 (1.9%)
2. Vitreous Loss	3.9%	6/14 (2.9%)	5/11 (5.8%)
3. Other	2.9%	6/14 (2.9%)	3/11 (2.9%)
Operating time (M±SD)		12.0±2.8	12.8±3.4
IOL power (M±SD)	21.0	21.2±0.7	21.1±1.3

Post operative visual acuity at discharge

Visual acuity at discharge is shown in Table 2. Two hundred and eighty five (90.5%) patients achieved visual acuity better than or equal to 6/60 while 30 (9.5%) had visual acuity less than 6/60. A non-significant difference of 4% in proportion achieving vision better than or equal to 6/18 was observed between patient implanted IOL under air and viscoelastic (95% CI -0.18 to 0.04, p=0.23). A slightly lower proportion of patients implanted under air achieved visual acuity worse than 6/60 (95% CI -0.14 to 0.01, p=0.054).

Table 2. Visual acuity at Discharge

Visual Acuity	Air No (%)	Visco-elastic No (%)	Difference	95% Conf. Interval	P-value
≥6/18	76 (36.7)	44 (40.7)	4.0%	-0.18 to 0.04	0.228
<6/18 – 6/60	116 (56.1)	49 (45.4)	10.7%	-0.01 to 0.23	0.064
<6/60 – PL	15 (7.2)	15 (13.9)	6.7%	-0.14 to 0.01	0.054
Totals	207	108			

Visual acuity at two and six weeks

Table 3. Visual acuity at 2 and 6 weeks

Visual acuity	**2 weeks** 270 patients		**6 weeks** 122 patients	
	Air	Viscot	Air	Viscot
≥ 6/18	62 (34.4%)	32 (35.6%)	39 (52%)	18 (38.3%)
<6/18-6/60	104 (57.8%)	49 (54.4%)	32 (2.7%)	24 (32%)
<6/6 -3/60	14 (7.8%)	9 (10%)	4 (5.4%)	5 (10.6%)
Totals	180	90	75	47

Table 3 shows visual acuity at two and six weeks. 270 (85.7%) returned for the two weeks' review while 122 (38.7%) returned for the 6 weeks review. Visual acuity outcome was similar in the two groups, 34% and 52% of those implanted under air achieved visual acuity better or equal to 6/18 at two and six weeks respectively compared to 36% and 38% of those implanted under viscoelastic. Similarly 7.8% and 5.4% of patients implanted under air, 10% and 10.6% of those implanted under viscoelastic achieved visual acuity less than 6/60 respectively.

Corneal oedema

Corneal oedema was observed in 42/135 (13.3%). There was no difference in the proportion with corneal oedema in the two groups, 14% in those implanted under air and 12% in those implanted under viscoelastic, t test [95% confidence interval -0.01 – 0.10, p= 0.6328].

Table 4. Postoperative corneal oedema

Post operative complications	Substances used to deepen the anterior chamber		
	Air	Viscoelastic	Total
None	173 (83.6%)	92 (85.2%)	265
Corneal oedema	29 (14%)	13 (12%)	42
Other	5 (2.4%)	3 (2.8%)	8
Total	207	108	315

Discussion

Zimbabwe like other developing countries has a growing number of patients awaiting cataract surgery. Manicaland province with a population of 1.6 million has an estimated 25,000 cases in need of surgery and every year 1600 new cases are added to this backlog. Dealing with such a growing burden of cataract blindness requires a cheaper and faster method of surgery that also guarantees good post operative visual acuity. The number of cases that can be operated at any given time is limited by the availability of a surgeon and appropriate equipment, as well as surgical sundries.

Viscoelastic is a surgical sundry that has become essential in modern cataract surgery. It protects corneal endothelium from damage, shortens surgery time and ensures good surgical outcome. Other protective substances ringers lactate and balanced salt solution (BSS) used for irrigation aspiration of lens cortex and to inflate the anterior chamber during lens implantation. Endothelial cell loss has been estimated in animal experimental studies to be as high as between 40-50% for lens implantations attempted without use of protective substances[5]. Use of air or viscoelastic reduces endothelial cell loss to 17% and 7% respectively[4].

Viscoelastic substances are expensive and their use is limited by availability. For this reason some surgeons working in resource limited settings have used air to deepen the anterior chamber during lens implantation despite reported incidents of severe endothelial depletion[2]. This study compared surgical outcome in the group of patients who were operated for cataract and either air or viscoelastic was used to inflate the anterior chamber during lens implantation.

The results of this preliminary clinical study suggest that there was no difference in visual outcome or corneal oedema between the two groups. Bourne, Brubaker and O'Fallon[2] observed in their study that all corneas were clear regardless of the amount of endothelial cell loss and visual acuity was comparable in the two groups. It could be that the difference in endothelial cell count observed in specular microscopic studies was not high enough to result in observable clinical effect such as persistent corneal oedema.

Some of the advantages of using air for lens implantation include no cost since it can be drawn into a syringe from the atmosphere. It also requires no packaging or storage and does not elevate intraocular pressure postoperatively. Used properly it can enable intra-operative visualization of the disc and macula. The main disadvantage of using air is that it easily escapes from the anterior resulting in repeated attempts at lens implantation with attendant risk of endothelial damage. To implant IOL successfully under air, one should maintain low intra-orbital pressure. This may be achieved mechanically by use of pressure weight or chemically by use of Sodium hyalorunidase (Hyanidase) to enhance redistribution of local anaesthetic into intra-orbital space.

The main limitation of this study is that it is a retrospective analysis of patient records and thus suffers from drawbacks common to this research strategy[6]. The completeness of information obtained from records is often limited and patients were not randomly allocated to each group. Cost implications for use of air for lens implantation in resource poor settings warrants further studies to validate these initial findings.

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