·Clinical Research·

# Cataract surgery in aged patients: phacoemul -sification or small -incision extracapsular cataract surgery

*Tao Jiang[1], Jing Jiang[2], Yang Zhou[1], Gui-Qiu Zhao[1], Hui Li[1], Shan-Yao Zhao[1]*

[1]Department of Ophthalmology, the Affiliated Hospital of Medical College, Qingdao University, Qingdao 266003, Shandong Province, China

[2]The Infectious Diseases Department, Eastern Branch of the Affiliated Hospital of Medical College, Qingdao University, Qingdao 266100, Shandong Province, China

**Correspondence to:** Jing Jiang. The Infectious Diseases Department, Eastern Branch of the Affiliated Hospital of Medical College, Qingdao University, Qingdao 266100, Shandong Province, China. doctor6666@163.com

Received:2011-01-27 Accepted:2011-06-10

## Abstract

• AIM: To evaluate the effects and safety of phacoemulsification (Phaco) or small-incision extracapsular cataract surgery (SICS) and intraocular lens (IOL) implantation for aged patients.

• METHODS: Totally 137 aged patients (149 eyes) underwent cataract operation in the case of stable systemic condition, the blood pressure less than 160/95mmHg, blood glucose less than 8mmol/L, and under the help of electrocardiogram surveillance by anesthesiologists during the operation. 106 aged patients (114 eyes) underwent Phaco while 31 aged patients (35 eyes) underwent SICS. The postoperative visual acuity, corneal endothelial cell loss, surgery time and major complications were observed and analyzed retrospectively.

• RESULTS: The best-corrected visual acuity (BCVA) of ≥ 0.6 was achieved in 135 eyes (92.6% ) at 1 month postoperatively ($\chi^2$=259.730, $P$< 0.001). For aged patients, both Phaco and SICS could significantly improve visual acuity with no significant difference ($\chi^2$=4.535, $P$ > 0.05). Postoperative corneal endothelial cell loss was 18.6% , in PHACO group, the rate was 18.5%; in SICS group, the rate was 19.0% , the difference of which was no significant ($\chi^2$=0.102, $P$>0.05). The surgery time was different in two groups. No severe complications occurred.

• CONCLUSION: Both Phaco and SICS combined with IOL implantation for aged patients are effective and safe. Before surgery, detailed physical examination should be performed. When the systemic condition is stable, cataract surgery for aged patients is safe.

• KEYWORDS:phacoemulsification;small-incision extracapsular cataract surgery; intraocular lens; aged; cataract; diabetes; hypertension

DOI:10.3980/j.issn.2222-3959.2011.05.11

Jiang T, Jiang J, Zhou Y, Zhao GQ, Li H, Zhao SY. Cataract surgery in aged patients: phacoemulsification or small-incision extracapsular cataract surgery. *Int J Ophthalmol* 2011;4(5):513-518

## INTRODUCTION

With the development of modern society, aged people become more and more. And the aged patients with cataract are often seen at clinic, especially in mature stage and hypermature stage. The systemic conditions of elderly aged patients with senile cataract are complicated, most with hypertension, coronary heart diseases, diabetes and other systemic diseases. The eye conditions are more difficult, most with harder nuclear lens, with more severe chylous of cortex in hypermature stage, with difficulty to dilate the pupil, and with suspensory ligament weakness, which affect the selection of surgery and intraoperative surgical operation. From November 2008 to October 2009, we performed phacoemulsification (Phaco) or small-incision extracapsular cataract surgery (SICS) and posterior chamber intraocular lens implantation (PCIOL) on 137 cases (149 eyes) of aged patients and achieved good results. Now we report the data as follows.

## MATERIALS AND METHODS

**Materials** There were 137 cases (149 eyes) of aged patients with senile cataract who aged from 75 to 94. The mean age was 83.6±4.5. Among the patients: male 64 cases (69 eyes), female 73 cases (80 eyes). The systemic condition: combined with hypertension in 89 cases, diabetic 62 cases, asthma 14 cases, chronic bronchitis 26 cases, renal failure 2

**Table 1 The number of patients with different nuclear densities (137 patients, 149 eyes)**

| Different nuclear densities (grade) | Ⅱ | Ⅲ | Ⅳ | Ⅴ |
|---|---|---|---|---|
| Phaco | 6(6 eyes*) | 23(23 eyes*) | 77(85 eyes*) | |
| SICS | | | 6(7 eyes*) | 25 (28 eyes*) |

$x^2$=105.207,$P$<0.001 ($P$=0.000); * $x^2$=113.014, $P$<0.001 ($P$=0.000)

cases and abnormality in electrocardiogram 73 cases, including atrial extrasystole 43 cases, paroxysmal ventricular extrasystole 8 cases and right bundle heart block 22 cases. The above-mentioned conditions might be coexisted in one patient. In the case of stable systemic condition, the blood pressure was less than 160/95mmHg, blood glucose less than 8mmol/L, and under the help of electrocardiogram surveillance by anesthesiologists during the operation, the cataract surgery was performed on the aged patients.

The classification of nucleus of lens: grade Ⅱ 6 eyes, grade Ⅲ 23 eyes, grade Ⅳ 92 eyes, grade Ⅴ 28 eyes. And 16 cases were combined with chronic closed-angle glaucoma. The intraocular lenses were determined by the results of A ultrasound check and corneal curvature. The demands for far vision were met in general except for someone who liked reading very much. 106 patients (114 eyes) with grade Ⅱ-Ⅳ nucleus underwent Phaco while 31 patients (35 eyes) with grade Ⅳ-Ⅴ nucleus underwent SICS (Table 1).

**Methods** Preparation for routine phacoemulsification or small-incision extracapsular cataract extraction and intraocular lens implantation. After topical anesthesia or retrobulbar anesthesia was done, the routine process of Phaco or SICS was performed. For Phaco, side stab incision was done on 2 o'clock limbus, through which viscoelastic substances were injected into the anterior chamber. Lamellar or tunnel clear corneal incision was made with the crescent knife on 10 o'clock limbus, the width of which was 3.0mm. Continuous curvilinear capsulorrhexis (CCC) was performed with a bent needle or a capsulorhexis forceps. Hydrodissection was done, then rotated the nucleus. Ultrasound (U/S) was used to break the nucleus and aspirate it. Irrigation and aspiration (I/A) was used to suck out the cortex. After the viscoelastic substances were injected into the capsular bag, the foldable intraocular lens was implanted into it. Then cleaned up the residual viscoelastic substances in the anterior chamber and the bag.

For SICS, the superior rectus muscle was fixed. Fornix based conjunctiva flap was made. A 2-mm side port stab into clear limbus cornea at the 2 o'clock was made. The linear scleral incision was made, and the apex of the incision should always be 1.5mm to 2mm in the scleral side to the superior limbus. The depth was about 1/2 that of sclera. 3-mm crescent knife was used to tunnel into clear cornea. The tunnel was always trapezoidal in shape, with the inner lip about 7mm to 8mm in length. After extending the tunnel up to about 1mm of clear cornea, entered the eye with a 3.2mm keratome into the anterior chamber, making sure that a third plane in the incision was created before the final entry. The viscoelastic substances were injected into the anterior chamber. If there was posterior iris synechia, the synechia should be released first. "Open-can" cystectomy or continuous curvilinear capsulorrhexis (CCC) was performed with a bent needle. Hydrodissection, subluxated the nucleus into the anterior chamber. The nucleus should be sitting on top of the iris with ample viscoelastic substances on top and underneath it. Then widened the inner lip of the incision with the keratome. Due to the large of nucleus of the aged patients, the inner lip of the incision should be made large enough. Nucleus delivery was made with a lens loop. And cleaned up the cortex and implanted the intraocular lens into the capsular bag. Then cleaned up the residual viscoelastic substances in the anterior chamber. The incision could be left sutureless or 1 to 2 nylon stitch given when the patient came from a remote or rural area and could not come for follow-up right away or the patient could not cooperate. Subconjunctivally Gentamycin 20 000u and Dexmathasone 2.5mg were injected. Postoperatively systemic anti-biotics should be given and the steroids should be considered carefully.

**Patients Demographic Studies** Patients demographic studies included age, sex, initial and final best corrected visual acuity. The associated hypertension, diabetic, asthma, chronic bronchitis, renal failure and abnormality in electrocardiogram, including atrial extrasystole, paroxysmal ventricular extrasystole and right bundle heart block, were also examined. The clinical variable factors associated with postoperative best corrected visual acuity including corneal endothelial cells loss, surgery time were specifically analyzed.

**Statistical Analysis** Statistical analysis was carried out using SPSS 17.0 software (SPSS Inc. Chicago Ⅲ USA). Categorical variables were analyzed using $\chi^2$ and Fisher's exact test. $P$<0.05 was taken as a level of statistical significance.

**Table 2 Comparison of BCVA preoperatively and postoperatively (149 eyes)**

| BCVA | <0.05 | 0.05-0.3 | 0.4-0.5 | 0.6-0.9 | ≥1.0 |
|---|---|---|---|---|---|
| Preoperatively | 117 | 28 | 4 | | |
| Postoperatively (1 month) | 3 | 5 | 6 | 91 | 44 |

$x^2$=259.730, $P$<0.001 ($P$=0.000)

**Table 3 Comparison of BCVA preoperatively and postoperatively in Phaco group (114 eyes)**

| BCVA | <0.05 | 0.05-0.3 | 0.4-0.5 | 0.6-0.9 | ≥1.0 |
|---|---|---|---|---|---|
| Preoperatively | 82 | 28 | 4 | | |
| Postoperatively (1 month) | 1 | 3 | 4 | 71 | 35 |

$x^2$=205.209,$P$<0.001 ($P$=0.000)

**Table 4 Comparison of BCVA preoperatively and postoperatively in SICS group (35 eyes)**

| BCVA | <0.05 | 0.05-0.3 | 0.4-0.5 | 0.6-0.9 | ≥1.0 |
|---|---|---|---|---|---|
| Preoperatively | 35 | | | | |
| Postoperatively (1 month) | 2 | 2 | 2 | 20 | 9 |

$x^2$=62.432, $P$<0.001 ($P$=0.000)

## RESULTS

The postoperative visual acuity: 128 eyes (85.9%) had best-corrected visual acuity (BCVA) of 0.3-1.0 on the first postoperative day, 112 eyes (75.2%) had BCVA of 0.6 or better on the third day, 135 eyes (92.6%) got BCVA of 0.6 or better after 1 month ($\chi^2$=259.730, $P$<0.001, Table 2). Both in Phaco group and in SICS group, the postoperative BCVA got improved significantly (Table 3, 4).

For aged patients, both Phaco and SICS could significantly improve visual acuity with no significant difference ($\chi^2$= 4.535, $P$>0.05, Table 5).

Corneal endothelial cells: The number of corneal endothelium before cataract surgery was 938-2517/mm$^2$, an average of 1514±429/mm$^2$; 1 month after cataract surgery was 681-2125/mm$^2$, an average of 1232 ±376/mm$^2$. Postoperative corneal endothelial loss was 18.6%, in Phaco group, the rate 18.5%; in SICS group, the rate 19.0%, the difference of which was no significant ($\chi^2$=0.102, $P$>0.05 ($P$=0.749, Table 6).

The surgery time: For harder nucleus, it took more time to fulfill the operation in SICS group than that in Phaco group. The difference was significant ($\chi^2$=58.649, $P$<0.001, Table 7).

The intraoperative complications: The rupture of the posterior capsule occured in 5 eyes, among which posterior chamber intraocular lens (PCIOL) could be implanted into 3 eyes and suspended IOLs were implanted into 2 eyes after vitrectomy was performed.

The postoperative complications: On the first day, 34 eyes had the mild corneal edema which was recovered with the treatment of steroid eye drops after 3 days. 3 eyes had obvious corneal endothelium edema which disappeared with the treatment of subconjunctival injection of dexamethasone

**Table 5 Comparison of BCVA between Phaco and SICS group postoperatively (1 month) (149 eyes)**

| BCVA | <0.05 | 0.05-0.3 | 0.4-0.5 | 0.6-0.9 | ≥1.0 |
|---|---|---|---|---|---|
| Phaco | 1 | 3 | 4 | 71 | 35 |
| SICS | 2 | 2 | 2 | 20 | 9 |

$x^2$=4.535,$P$>0.05 ($P$=0.338)

**Table 6 Comparison of the corneal endothelial cell loss between Phaco and SICS group postoperatively (1 month) (149 eyes)**

| Corneal endothelial cells | Preoperatively | Postoperatively | Endothelial loss rate |
|---|---|---|---|
| Phaco | 1560±412/mm$^2$ | 1271±354/mm$^2$ | 18.5% |
| SICS | 1364±463/mm$^2$ | 1105±418/mm$^2$ | 19.0% |

$x^2$=0.102,$P$>0.05 ($P$=0.749)

**Table 7 Comparison of the surgery time between Phaco and SICS group (149 eyes)**

| Surgery time(min) | <15 | 15-30 | 31-45 | 46-60 | >60 |
|---|---|---|---|---|---|
| Phaco | 61 | 48 | 5 | | |
| SICS | | 17 | 14 | 2 | 2 |

$x^2$=58.649,$P$<0.001 ($P$=0.000)

and tropicamide eye drops to dilate the pupil for 10 days. The exudation in the anterior chamber could be seen in 6 eyes on the first day which disappeared after 4 days treatment with the dilation and the steroid eye drops. Aqueous flare was observed on 46 eyes on the first day postoperatively and disappeared in the following days. No cases showed the systemic medical complications.

Retinopathy: 6 patients (6 eyes) of vitreoretinopathy were identified preoperatively by fundus examination, B-ultrasound; 16 patients (23 eyes) of vitreoretinopathy were discovered postoperatively, totally 22 patients (29 eyes). Preoperatively due to different degrees of cataract, only 6 patients (6 eyes) of retinopathy were found. The degrees of retinopathy were less severe, in non-proliferative stage or early stage of proliferation. The main cause for poor visual acuity was still cataract. Considering that most elderly aged patients could not endure vitreoretinal surgery, after in

forming the patients and their families of the prognosis and their eye conditions and systemic conditions, we performed the cataract surgery on them. Postoperatively by routine fundus examination, the original undiscovered retinopathies were found and could be confirmed by the postoperative visual acuity. In total, hypertensive retinopathies were found in 3 cases (6 eyes), among them, grade Ⅰ in 2 cases (4 eyes), grade Ⅱ in 1 case (2 eyes); diabetic retinopathies were found in 19 cases (23 eyes), the incidence rate 30.6%, among them, grade Ⅰ in 6 cases (8 eyes), grade Ⅱ in 5 cases (7 eyes), grade Ⅲ in 5 cases (5 eyes) and grade Ⅳ in 3 cases (3 eyes).

**DISCUSSION**

The aged patients are weak physically and their function of organs deteriorates according to the age. The function of irritability and substitution is also weak. So when doing operations on aged patients we must pay attention to the following problems:

**Preoperative Preparation** To ensure the fulfillment of the operation, we must check the patients carefully preoperatively. Blood sugar, bleeding time, prothrombin time, blood pressure, electrocardiogram, hemoglobin, liver function, renal function, breast X-ray, etc, are all needed to be checked. Among these blood pressure and electrocardiogram are the most important which should be checked and considered carefully in case of cardiac and cerebrovascular accident caused by patients' dread and ache in the procedure of anesthesia. According to our experience, if the blood pressure is less than 160/95mmHg, no severe ventricular extrasystole shown in electrocardiogram, no short breath when a patient walks, operations can be performed smoothly under the help of electrocardiogram surveillance by anesthesiologists. If necessary, we should ask internal medicine doctors for help. In Mikolich's study [1], he used dynamic ECG recordings to detect arrhythmias and provide data for therapeutic consideration. Preoperatively the pupils should be dilated to 7-8mm by mixture of tropicamide and phenylephrine.

**During the Process of Operation**

**Corneal endothelium** The number of corneal endothelium decreases with advancing age. Severe diseases such as cancer can reduce the number. Krohn and Hovding [2] found that severe diseases like cancer, leading to cachexia and catabolism, reduce the number of endothelial cells to a greater degree than diseases that cause a more rapid death. This negative effect of cancer on endothelial cell density is aggravated by the general decline in endothelial cell density with advancing age. If the number of endothelium cells can be measured preoperatively, the procedure is the best. If the number of endothelium cells is less than 500/mm$^2$, the operation should not be performed. Some authors [3] reported that the mean central and superior endothelial cell losses at 3 months postoperatively were 16% and 22% respectively and at 12 months postoperatively were 20% and 25% respectively. In our study, the corneal endothelial cell loss was 18.6% at 1 month postoperatively, which was almost the same as the above reports. The number of endothelium cells in aged patients is less originally, so in the process of operation, we must try our best to avoid damaging the endothelium cells. When doing CCC or capsulorrhexis, U/S or nucleus depression, IOL implantation, viscoelastic substances should be injected into the eye. When doing I/A or cortex sucking, the flow of irrigation fluid should not too violent. The less time is used, the better result is got. So the protection of endothelium cells in the operation is the best demand when doing cataract operation on aged patients. If provided, Phaco can be considered to perform. Durovic [4] found that on the basis of the results obtained by specular microscopy, it was concluded that under the same conditions Phaco caused reduced operative trauma of the corneal endothelium.

**How to disassemble nucleus in Phaco or do delivery of nucleus in SICS** The process of CCC or capsulorrhexis and crushing nucleus or delivery of nucleus are hard to do to aged patients. Because of the large volume of the nucleus, high rigidity, less cortex, the frail lens zonule, small area of none-zonule, when doing CCC or capsulorrhexis, it's easy to make the zonule rupture or damage, and it's easy to make the posterior capsule rupture during the process of crushing nucleus or delivery of the nucleus. Therefore, the process of Phaco or delivery of nucleus can only be done when the complete hydrodissection and the protection of the viscoelastic substances are ready. The liquefaction of vitreous is common, and the vitreous is easily lost during the process of operation. So in Phaco, every step should be careful especially when doing U/S Phaco and I/A. In SICS, the tunnel incision especially the inner lip should be large enough in order to fulfill the delivery of nucleus just once.

**Pupil** The myotonia of pupil sphincter is common in aged patients. It's easy to make the sphincter broken or damaged in the operation. And the pupil is hard to restore to round shape and miotics injected into the anterior chamber can not get good result. Therefore, the restoration of pupil should stop where it should stop. Round pupil is not compulsory, or the postoperative reaction is severe.

**Others** One eye operated in one hospitalization is the best in case of systemic complication. If necessary, asking for help from internal medicine doctors is needed. If the patient is strong enough, the two eyes operated can also be considered.

**Postoperative Follow-up** The postoperative follow-up includs not only ophthalmological manifestation, but also systemic conditions. If the reaction in the anterior chamber is severe, dilation of pupil and subconjunctival injection of dexamethasone can be given. Systemic steroid should not be given. If used, the dosage should be controlled. Paying attention to systemic conditions, such as blood pressure, cardiac distress, cardiac function, smoothness of respiratory tract, especially cardiac and cerebrovascular accident, limbs agility. Tell patients to walk as soon as possible. The postoperative liquid supplement is not more than 500ml in order to lessen the burden of the heart.

**High Occurrence of Retinopathy** The occurrence of retinopathy in aged patients is high. These diseases include the age-related macular degeneration (AMD), optic atrophy, undiscovered glaucoma, diabetic retinopathy, hypertensive retinopathy, etc. These retinopathies are likely related to systemic diseases, such as hypertensive retinopathy. High blood pressure as well as age was a risk factor of early AMD[5]. Some authors[6] reported that diabetic retinopathy (DR) was present in 175 of 500 type II diabetes mellitus patients (35%), 130 (26%), and 45 (9%) having nonproliferative and proliferative DR, respectively. In Wong's study [7], at multivariable analysis, smaller retinal arteriolar caliber was associated with incident coronary heart disease (CHD). According to the apoptosis of ganglion cells, the number of ganglion cells decreases with the growth. Based on this, the postoperative visual acuity is difficult to achieve 1.0 in aged patients. The results of our study conform to this report.

**Comparison of Phaco and SICS for Aged Patients** In our study, there was no difference between Phaco and SICS for aged patients, except for operation time. Ruit *et al*[8] found that both phacoemulsification (Phaco) and small-incision extracapsular cataract surgery (SICS) achieved excellent visual outcomes with low complication rates. SICS was significantly faster, less expensive, and less technology dependent than Phaco. SICS might be the more appropriate surgical procedure for the treatment of advanced cataracts in the developing world. Venkatesh *et al* [9] also reported that high volume surgery using appropriate techniques and standardised protocols did not compromise quality of outcomes. The majority of the patients underwent manual small incision cataract surgery (manual SICS). Extracapsular cataract extraction with posterior chamber intraocular lens (ECCE-PCIOL) and intracapsular cataract extraction (ICCE) were also done on a few patients as clinically indicated. They got the good results that best corrected visual acuity of > or = 6/18 was achieved in 94% of the 520 patients who could be followed up on the 40th postoperative day (88% follow up rate). Another study showed that both the Phaco and the small-incision techniques were safe and effective for visual rehabilitation of cataract patients, although Phaco could give better uncorrected visual acuity in a larger proportion of patients at 6 weeks[10].

Our study showed that the postoperative visual acuity results of Phaco and SICS were similar, and the endothelial cell loss rates were almost the same; although there were differences in surgery time, they did not affect the final results of operations. Therefore, we believe that for elderly aged patients, Phaco and SICS have almost the same effect.

As long as the method is proper, cataract operation with small incision, including Phaco and SICS, can also be fulfilled in aged patients like common patients. And the complication does not increase due to small incision.

**To Choose Surgical Mode According to the Hardness of Nucleus** It's the basic principle of cataract surgery to choose surgical mode according to the hardness of nucleus, and even more so for aged patients. For nucleus grade Ⅱ to Ⅳ, Phaco is preferred; for hard nucleus such as grade Ⅳ to Ⅴ, SICS is recommended to choose. For aged patients, the surgical safety is the most important, including the security of general condition and the outcome of operation. For hard nucleus patients, since the outcomes of visual acuity are similar, and no corneal endothelial cell loss rate greatly improved, and no other serious complications, although the operation time a little longer, the choice of SICS is appropriate. If Phaco is chosen, the potential risks such as the suspensory ligament laxity, nuclear disassembly prolonged, increase in endothelial cell loss and so on may be faced. Phacoemulsification cataract surgery is the gold standard for lens removal and continuous curvilinear capsulorhexis is one of the important first steps during the procedure. Once there is capsulorhexis breach, the surgeon could continue with the procedure or convert to extracapsular extraction, with each having its advantages and disadvantages[11]. Olali *et al*'s study[11] showed that when properly managed, capsular breach during Phaco has little or no effect on the final surgical outcome. But in our study, for aged patients, to ensure the outcome of surgery, our advice

is that Phaco surgery is preferred, during the procedure of which, if capsulorhexis difficulties, capsulorhexis breach, nuclear disassembly difficulties occurred, the surgeon should convert to SICS in time to minimize the chance of complications. For hard nucleus, just directly choose SICS.

In summary, both Phaco and SICS combined with IOL implantation for aged patient are effective and safe. Before surgery, detailed physical examination should be performed. When the systemic condition is stable, cataract surgery for aged patients is safe. The selection of operation is based primarily on the nuclear hardness. In aged patients with senile cataract if the hardness of the cataract is less than grade Ⅳ and other variables such as pupil dilation allow us to do Phaco, we can extract cataractous lens with phacoemulsification, however in hard lens with more than Ⅴ density the preferred option is SICS. There is no significance between Phaco and SICS to be performed on aged patients, except for surgery time.

**REFERENCES**

1 Mikolich JR, Jacobs WC, Fletcher GF. Cardiac arrhythmias in patients with acute cerebrovascular accidents. *JAMA* 1981;246(12):1314-1317

2 Krohn J, Hovding G. The influence of donor age and cause of death on corneal endothelial cell density. *Acta Ophthalmol Scand* 2005;83(6):746-750

3 Wright M, Chawla H, Adams A. Results of small incision extracapsular cataract surgery using the anterior chamber maintainer without viscoelastic. *Br J Ophthalmol* 1999;83(1):71-75

4 Durovic BM. Endothelial trauma in the surgery of cataract. *Vojnosanit Pregl* 2004; 61(5):491-497

5 Song SJ, Youm DJ, Chang Y, Yu HG. Age-related macular degeneration in a screened South Korean population: prevalence, risk factors, and subtypes. *Ophthalmic Epidemiol* 2009;16(5):304-310

6 Salti HI, Nasrallah MP, Taleb NM, Merheb M, Haddad S, El-Annan J, Khouri A, Salti IS. Prevalence and determinants of retinopathy in a cohort of Lebanese type II diabetic patients. *Can J Ophthalmol* 2009;44(3):308-313

7 Wong TY, Kamineni A, Klein R, Sharrett AR, Klein BE, Siscovick DS, Cushman M, Duncan BB. Quantitative retinal venular caliber and risk of cardiovascular disease in older persons: the cardiovascular health study. *Arch Intern Med* 2006; 166(21):2388-2394

8 Ruit S, Tabin G, Chang D, Bajracharya L, Kline DC, Richheimer W, Shrestha M, Paudyal G. A prospective randomized clinical trial of phacoemulsification vs manual sutureless small-incision extracapsular cataract surgery in Nepal. *Am J Ophthalmol* 2007;143(1):32-38

9 Venkatesh R, Muralikrishnan R, Balent LC, Prakash SK, Prajna NV. Outcomes of high volume cataract surgeries in a developing country. *Br J Ophthalmol* 2005; 89(9):1079-1083

10 Gogate PM, Kulkarni SR, Krishnaiah S, Deshpande RD, Joshi SA, Palimkar A, Deshpande MD. Safety and efficacy of phacoemulsification compared with manual small-incision cataract surgery by a randomized controlled clinical trial: six-week results. *Ophthalmology* 2005;112(5): 869-874

11 Olali CA, Ahmed S, Gupta M. Surgical outcome following breach rhexis. *Eur J Ophthalmol* 2007;17(4):565-570