ORIGINAL ARTICLE

Endothelial Cell Loss Following Conventional Extra Capsular Cataract Extraction and Phacoemulsification in the Local Population

Arif Rabbani[*], Kainat Saleem[**], Asim Ateeq[***], Muhammad Ali Tahir[****]

ABSTRACT

Objective: To compare severe loss of corneal endothelial cell following Extra capsular cataract extraction (ECCE) and Phacoemulsification.

Methods: It was an observational case series study, conducted at the Department of Ophthalmology, Jinnah Post Graduate Medical Centre Karachi, from 15th September 2009 to 15th March 2010, on 80 patients that were included according to the inclusion and exclusion criteria, 4o of them underwent phacoemulsification while 4o underwent ECCE. Informed and written consent was taken for surgery and for inclusion in the study. Risk and benefits of both Phacoemulsification and ECCE were explained to all patients prior to enrollment. Researcher took history and filled the proforma. Patient of both groups underwent non-contact specular microscope, to count corneal endothelial cell density (MCD) preoperatively and postoperative after 1st week and after 3rd week. The data obtained was statistically analyzed and results were tabulated.

Results: Among the 80 patients who underwent cataract extraction, 21(26.3%) had severe decrease in endothelial cell count. Among patients who underwent ECCE only 6 patients had severe endothelial cell loss compared to 15 patients who underwent phacoemulsification (p value of less than 0.05). Severe corneal endothelial cell loss following Phacoemulsification is significantly higher than the Extra capsular cataract extraction (ECCE).

Key Words: Phacoemulsification, Extra Cpsular Cataract Extraction (ECCE), Endothelial Cell Loss

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INTRODUCTION:

Cataract is the foremost cause of blindness worldwide. Majority the cases are in the developing countries[1]. Till now no effective non-surgical treatment for cataract is available. Surgeries for the treatment of cataract are the commonest procedures performed in ophthal mology[2]. During Phacoemulsification (Phaco) additional ultrasonic energy and time are required to remove hard nucleus than softer one, thus the risk of surgical induce trauma, especially corneal endothelium dysfunction is higher[3].

Which is around 9.74% (range 8%to 17%)[4]. Phacoemulsification shows reduced surgically induced astigmatism than conventional Extra-capsular cataract extraction (ECCE)[5]. The astigmatism changed was 0.92 ± 1.08D(p=0.001) with ECCE and 0.25 ± 0.74(p=0.087) D with phaco[6].

A healthy corneal cell count is vital for corneal clarity[7]. Corneal endothelial cells are unable to regenerate if injured. Normal density of endothelial cell is around 2500 cells/mm². The corneal edema is likely to occur when preoperative cell density is reduced to between 300 and 700 cells/mm² and unlikely to occur when cell density is at least 1000 cells/mm².[8] Hence postoperative reduction of corneal endothelial cell count to <1000 cells/mm² considered as severe cell loss. During cataract extraction endothelial injury may occur due to various factors; e.g. corneal distortion, ricocheting

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of nuclear fragments, intraocular lens contact and release of free radicals[9]. Repairment is achieved by residual cells hypertrophy, division of amitotic nuclei, migration and rosette phenomenon as a result of which the cell density is reduced, mean size of the cell is increased and the normal hexagonal pattern is distorted. The endothelial cell count is usually described as the corneal health marker[10]. In past some researchers have found significant differences between Phacoemulsification and ECCE, although in comparison to Phacoemulsification the cell loss is less in ECCE[11]. It is documented in a study that five hundred patients, of 40years and above were randomize into two groups in which 249 underwent conventional Extra capsular cataract extraction (ECCE) and 251 underwent phacoemulsification. Phacoemulsification caused a significantly increased risk (OR: 3.7, P=0.045) of marked cell loss in 45 cases with hard cataract in comparison ECCE (52.6% vs. 23%; chi-square test, P=0.041) with the both procedures showing same post-operative visual outcome[12].

The rationale of our study was to determine whether the modern Phacoemulsification is safe for the cataract surgery as compared to ECCE. There are numerous international and local studies on the comparison between Phacoemulsification and ECCE, but in terms of severe corneal endothelial cell loss, very few international and no local studies have been found. It will also generate local data which will be useful in making decisions in future regarding which procedure in better.

METHODS:

The study was an observational case series, conducted at the Department of Ophthalmology, Jinnah Post Graduate Medical Centre Karachi, from 15th September 2009 to 15th March 2010. 80 patients were included in the study [sample size calculation was done using proportion of severe cell loss in phacoemulsification =0.53[12], proportion of Severe cell loss in ECCE = 0.23[12], Sample sizes of 80 (40 in each groups) achieve 80% power to detect a difference of (0.53-.23=.30) 0.30 with a 95% confidence interval]. Patients included were older than 40 year of age, with history of cataract less than one year, either gender, best corrected vision less than 6/18, endothelial cell density more than 1000 cells/mm². Patients excluded for the study were, with a previous history of ocular trauma and ocular surgery, any associated ocular disease, glaucoma, uveitis, pseudo exfoliation or uncontrolled diabetes, uncontrolled hypertension, corneal dystrophies. Patients coming to the outpatient department of ophthalmology JPMC, having cataract, meeting inclusion and exclusion criteria were selected for this study. Informed written consent was taken before surgery and before inclusion in the study. Risk and benefits of both Phacoemulsification and ECCE were explained to all patients prior to enrollment. Researcher took history and filled the proforma. These patients were randomly divided in two groups by using lottery method. A box was placed in operation theater, containing 40 chits of group A and 40 chits of group B. A person, who was not involved in this study use to pick up the chit and in this way two groups were randomly made. Group A fixed for ECCE and Group B for Phacoemulsification. Retrobulbar anesthesia and PMMA Intra Ocular Lens (IOL) was used for both groups. Phacoemulsification machine (PULSAR 2: OPTIKON, ITALY) was used and both procedures were done by single surgeon having more than ten years of surgical experience and researcher assisted all cases. Confounding variable was controlled by the exclusion criteria and stratification. Patient of both groups underwent non-contact specular microscope (SPOI: CSO, ITLY), to count corneal endothelial cell density (MCD) preoperatively and postoperative after 1st week and after 3rd week, were examined by the researcher. Sever cell loss was measured in 3rd postoperative week. This whole procedure including specular microscopy, ECCE and Phacoemulsification was free of cost.

The data analyzed by statistical packages for social science (SPSS-13). Frequency and percentage was computed for categorical variables like gender and severe corneal endothelial cell loss (<1000 cell/mm²). Mean and standard deviation was computed for quantitative variables like age, endothelial cell count. Chi-square test was applied to compare proportion difference in severe corneal endothelial cell loss (<1000 cell/mm²) between phacoemulsification and ECCE. P<0.05 was considered as significance. Confounding variables like age, gender, duration of cataract was controlled by stratification.

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RESULTS:

During six months of study period, 80 patients were included. All patients fulfilled the inclusion and exclusion criteria. The study population consists of 39 (48.8%) males and 41(51.2%) females, with a mean age of 53.65 years. Out of 80 patients included in the study 24 (30%) had hard cataract, 35 (43%) patients had less dense cataract while only 21 (26%) had soft cataract (figure 1). Out of these 80 patients 40(50%) underwent extra capsular cataract extraction, while the rest of the 40(50%) patients were gone for phacoemulsification cataract surgery. Mean endothelial cell count among all the patients before the surgery was 2487.21 cells /mm^2, with minimum cell count of 1923 cells /mm^2 and maximum cell count of 3010 cells /mm^2 (standard deviation = 273.310). Mean endothelial cell count among all the patients after the surgery was 1660.54 cells /mm^2, with minimum cell count of 521 cells /mm^2 and maximum cell count of 2540 cells /mm^2 (standard deviation = 625.397). Comparison of pre and postoperative mean endothelial cell count among the 2 groups (ECCE/Phacoemulsification) is shown in figure 2 and 3. Among the 80 patients who underwent cataract extraction, 21(26.3%) had severe decrease in endothelial cell count (table-1). Among patients who underwent ECCE only 6 patients had severe endothelial cell loss compared to 15 in patients who underwent phacoemulsification (p value of less than 0.05). A comparison of no of patients having severe endothelial cell loss among the 2 groups (ECCE/Phacoemulsification) is shown in figure 4 and 5.

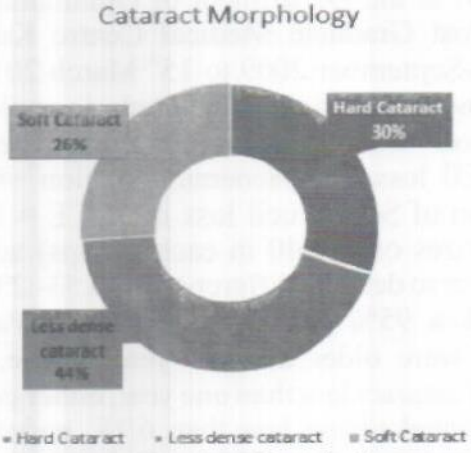

Fig-I: Cataract Morphology

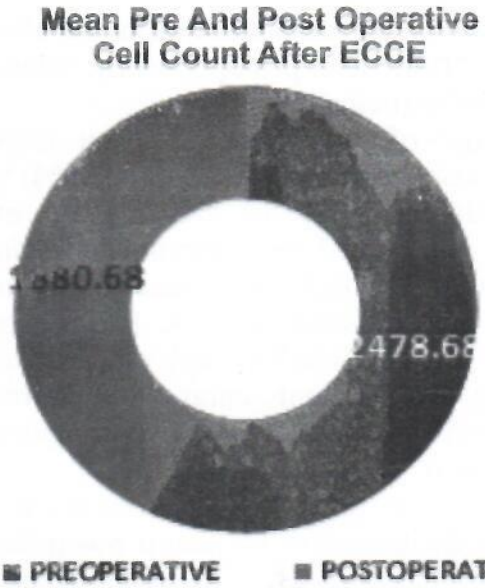

FIG-II: Comparison of Pre And Post-Operative Mean Endothelial Cell Count In Patients Who Underwent ECCE

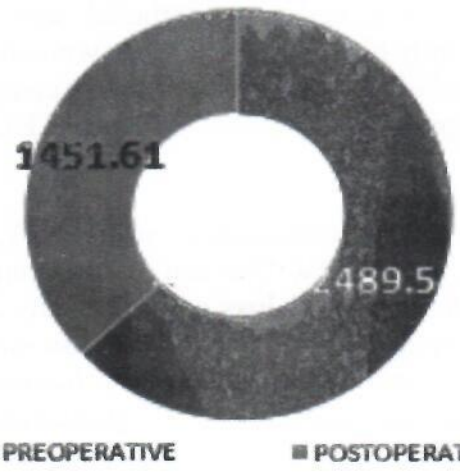

FIG-III: Comparison of Pre And Post-Operative Mean Endothelial Cell Count In Patients Who Underwent Phacoemulsification

Table I. Severe Endothelial Cell Loss (N=80)

	No. of Patients	%
Severe Endothelial Cells Loss	21	26.2
Mild-moderate Endothelial Cell Loss	59	73.8
Total	80	100

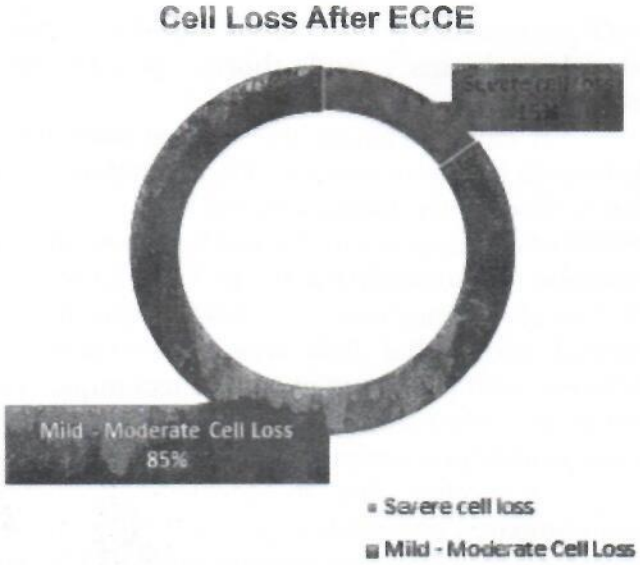

FIG-IV: Comparison of Severe Endothelial Cell Loss Among the Patients who Underwent ECCE (P<0.05)

FIG-V: Comparison of Severe Endothelial Cell Loss Among the Patients who Underwent Phacoemulsification (P<0.05)

DISCUSSION:

Cataract is the foremost cause of blindness worldwide, specifically in developing countries. With advance developments in surgical techniques in cataract surgery, small-incision techniques have become increasingly popular. The important advances in techniques have made the cataract surgery possible through smaller incisions. Incision size was curtail when extracapsular cataract extraction replaced the intracapsular cataract extraction[13]. With the use of foldable intra ocular lenses the incision size further reduced to 3.5 mm[14]. Due the smaller incision the time required for surgery was reduced with

less postoperative inflammation, less wound related problems[15], and shorter postoperative rehabilitation.

A study evaluate the corneal endothelial damage in both procedures[16]. Phacoemulsification had a eloquently increased risk (OR: 3.7, P = 0.045) of excessive cell loss in 45 cases with hard cataracts in comparison to ECCE (52.6% vs. 23.1%; chi-square test, P = 0.041). The overall corneal endothelial loss was not expressively different with these two operative technique. The results of study revealed that phacoemulsification is not an ideal procedure for hard cataracts[16].

In another study the corneal endothelium was compared morphologically and functionally during early follow up periods after ECCE and phacoemulsification[17]. The postoperative endothelial cells loss was not found to be significantly different between the two groups. The study shows that there is functional failure of endothelium in the early period after ECCE. So, postoperative functional damage to the endothelium can be reduced by phacoemulsification[11].

The findings of this study show less mean cell loss in ECCE, comparing with phacoemulsification, similar findings are reported by other workers who found a significant difference in the procedures, however more cell loss is noticed with phacoemulsification[11,16].

Most of the workers conducted the short-term studies over a period of 2 to 3 months for the evaluation endothelial cell loss, although many do not agree on the requirement of time duration for the postoperative stabilization of endothelial cell count. One researcher indicated the stabilization of cell density throughout the cornea after ECCE in three months[17]. Another researcher reported complete postoperative repairment of endothelial cell reparation without further cell loss after 12 months[18]. There was continuous cell loss lasting upto 10 years has been documented by a study after intracapsular cataract extraction and ECCE[19,20], they also revealed the progressive decrease in the density of endothelial cell even after 3 months, but with a lower rate.

In our study not a single case revealed cell loss of >80%, which is about 500 cells per mm2. Jacobs et al concludes that 500 cells per mm^2 is the threshold at which endothelial decompensation occurs[21]. We demonstrated the concept of severe cell loss <1000 cells postoperatively, which was never reported before.

Age of the subject was an important variable associated with excessive (≥15%) loss of cells (independent of the hard cataract effect). Hayashi et al found the comparable findings in their study in which phacoemulsification was done in 859 consecutive eyes. But in contrast Walkow et al did not find any effect of age[22,23]. Similarly brunescent cataracts resulted in suggestively more cell loss (independent of the effect of age)[22,23].

There were many limitations in our study as well. One limitation was that it was performed on single race. Secondly, it was performed at a single center.

CONCLUSION:

In this study we compared severe corneal endothelial cell loss following Extra capsular cataract extraction (ECCE) and Phacoemulsification in patient presenting to JPMC, and we observed that severe endothelial cell loss is significantly higher in the patients who underwent phacoemulsification cataract surgery compared to Extra capsular cataract extraction (ECCE).

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