

Original Research Article

Effect of phacoemulsification on intraocular pressure, inflammatory changes and visual acuity in cataract patients

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ABSTRACT

Background: Cataract is the leading cause of blindness worldwide. Even in India cataract is the most significant cause of bilateral blindness. For cataract extraction, phacoemulsification is the most commonly done surgery. This study aims to identify the effect of phacoemulsification in terms of intraocular pressure, inflammatory changes and visual acuity.

Methods: A cohort study was conducted in the Department of Ophthalmology, RIMS, Imphal from September 2017 to August 2019 among 218 patients who underwent phacoemulsification surgery. Post-operative examination of visual acuity with snellen visual acuity chart, slit lamp biomicroscopy for anterior chamber reaction and non contact tonometry for measuring IOP was done on day 1, 3, 7, 30 and 90 respectively.

Results: Majority (41.3%) of the patients belonged to the age group of 61-80 years. Females (53.70%) were affected more than the males (46.30%). There was a significant improvement of visual acuity following phacoemulsification with 73.9% patient achieving a vision of 6/6-6/18 on day 1 and 100% achieving best corrected visual acuity of 6/6-6/18 at the end of 1 month. Majority of the patients (71.1%) had grade 1 cells in anterior chamber on day 1. By the end of one week only 11.5% had grade 1 cells and no cells were seen by the end of one month. There was a significant ($p < 0.001$) decrease in IOP on different postoperative days.

Conclusions: We observed that there was a significant improvement in the visual acuity following phacoemulsification surgery which was comparable to the World Health Organization's recommendations. Majority had mild anterior chamber reaction which was subsided consequently. Also, there was a significant decrease of IOP post surgery.

Keywords: Phacoemulsification, Cataract, Intraocular pressure, Visual acuity

INTRODUCTION

Cataract is the leading cause of avoidable blindness worldwide which accounts for three-quarters of avoidable blindness in a developing world like India.¹ In India, cataract has been reported to be responsible for 50-80% of the bilaterally blind in the country. Although the number of the cataract operations has increased as a result of WHO/IAPB (International Agency for the Prevention of Blindness) vision 2020 initiative, poor visual outcome following surgery remains the major concern. It needs to be emphasized that outcome measures like cataract

surgery rate by themselves are inadequate to describe the benefit to the operated individuals and their quality of life. Cataract surgery should be evaluated in terms of post surgical visual acuity, inflammatory response and intraocular pressure.

Excessive disruption of the blood aqueous barrier (BAB) following cataract surgery has been reported to delay visual recovery and is associated with the need for prolonged medication. It also increases the risks of postoperative complications such as glaucoma, cystoid macula oedema, pupillary adhesions, and posterior

capsular opacification.² Any contamination of the intraocular lenses can also cause inflammation. Phacoemulsification with continuous curvilinear capsulorhexis has been found to induce a less severe BAB breakdown than other extracapsular cataract extraction surgery.³ This has caught the attention of the surgeons as lesser the inflammatory response postoperatively will result in faster visual recovery time period. In most studies measurements were taken within the first three postoperative months.

A number of studies have reported a transient rise in IOP in the early postoperative period following cataract surgery.⁴ The degree of early IOP increase has been shown to vary depending on the type of the viscoelastic agent and surgical procedures used.^{5,6} Many studies have also reported that intraocular pressure can be decreased after phacoemulsification cataract surgery even in non-glaucomatous eye.⁷

Cataract surgery to lower IOP may be especially beneficial in developing countries like India or at places where the close follow-up necessitated by traditional glaucoma surgery is difficult. Nonetheless, cataract surgery seems to be emerging as a safe way to lower IOP in patients with mild to moderate glaucoma while avoiding the morbidity of traditional glaucoma surgery.

More study is required in this area to justify the evolving trend of preferring this particular type of cataract surgery. Literature in this area of clinical science is scarce. This study aims to find out the effect of phacoemulsification surgery on intraocular pressure, the visual outcome and the inflammatory responses on the operated eye after undergoing cataract surgery.

METHODS

This is a prospective cohort study conducted in the department of ophthalmology, RIMS, Imphal during a period of 2 years from September 2017 to August 2019. Study population consisted of the patients of age 55 years and above with uncomplicated senile cataract undergoing phacoemulsification in the Department of Ophthalmology, RIMS, Imphal irrespective of gender. Cataract other than senile cataract (eg. Secondary or congenital), any pre-existing pathology of the eye, systemic diseases (eg. rheumatoid arthritis, ankylosing spondylitis, sarcoidosis), patients with history of intraocular surgery or laser treatment and patients on systemic or topical steroids or immunomodulatory drugs were excluded from the study. Sample size was calculated to be 218.

A complete medical history and informed consent was taken from each patient. Prior to surgery, the patients were examined for visual acuity using Snellen's chart and converted into LogMAR units by conversion tables and intraocular pressure was measured using Schiotz tonometer and the presence of aqueous flare and cells

using slit lamp biomicroscopy to determine the signs of inflammation. Detailed pre-operative examination including fundus evaluation, keratometry, biometry was done. Preoperative regime consisted of topical antibiotic and NSAID i.e. Moxifloxacin plus Ketorolac combination in QID dose 24 hours prior to surgery. Two doses of tab Acetazolamide 250 mg were given. First dose was on the night prior to surgery and second on the morning of surgery.

A single surgeon performed phacoemulsification using a standardized surgical technique after giving peribulbar anaesthesia. The post operative regime consisted of 5 days course of antibiotic tablet (Amoxicillin and Clavulanic acid), topical antibiotic and steroid combination (Moxifloxacin and Difluprednate) in a tapering dose and analgesic tablet. Post operatively, the patients were examined for visual acuity, intraocular pressure and the presence of aqueous flares and cells on the 1st day, 3rd day, 7th day, 30th day and on the 60th day.

Statistical analysis

Data were described as percentage, mean and Standard deviation and were analyzed with statistical software SPSS version 21. Chi square test and t-test were used for categorical variables. Exact test was used to find the level of significance of study parameters on categorical scale between the two groups and p value of <0.05 was taken as statistically significant.

RESULTS

The age group included in the study was 55 years and above. The age ranged from 55-94 and out of the total 218 patients studied majority 154 (70.6%) belonged to 61-80 years (Table 1).

In the study female (53.70%) have more percentage than male (46.30%) counterpart (Table 2).

Table 1: Age distribution of patients studied.

| Age in years | No. of patients | % |
|---------------|-----------------|-------|
| 55-60 | 32 | 14.7 |
| 61-70 | 75 | 34.4 |
| 71-80 | 79 | 36.2 |
| 81-90 | 27 | 12.4 |
| 91-100 | 5 | 2.3 |
| Total | 218 | 100.0 |

Table 2: Distribution of patients based on sex.

| Sex of the patient | No. of patients | % |
|--------------------|-----------------|-------|
| Male | 101 | 46.3 |
| Female | 117 | 53.7 |
| Total | 218 | 100.0 |

Preoperatively 132 patients (60.6 %) had a visual acuity of <6/18–6/60. Majority of the patients 161 (73.9%) achieved good vision i.e. 6/6-6/18 on day 1 of the surgery while 100% achieved good vision by the end of 1 month (Table 3). The improvement in the visual acuity was significant on all post operative days of surgery with p value <0.001 (Table 4).

In this study majority of the patients 155 (71.1%) had grade 1 cells, while 54 (24.8%) had grade 2 cells and only 8 (3.7%) had grade 3 cells in the anterior chamber

on day 1 and by the end of one week only 25 (11.5%) had grade 1 cells and no cells were seen by the end of one month (Table 5).

Our study showed that the mean preoperative intraocular pressure was 16.51 ± 2.40 mmHg while postoperatively it was 15.74 ± 1.98 mmHg on day 1, 14.89 ± 1.63 mmHg on day 3, 14.02 ± 1.51 mmHg on day 7, 12.98 ± 1.52 mmHg on day 30 and 12.39 ± 1.47 mmHg on day 60 respectively showing a significant ($p < 0.001$) decrease in intraocular pressure on different postoperative days (Table 6).

Table 3: Comparison of visual acuity of the patients on different days before and after phacoemulsification.

| | Pre op (%) | Post op day 1 (%) | Post op day 3 (%) | Post op day 7 (%) | Post op day 30 (%) | Post op day 60 (%) | % difference |
|----------------------|------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------|
| 6/6-6/18 | 1 (0.5) | 161 (73.9) | 183 (83.9) | 201 (92.2) | 218 (100) | 213 (97.7) | 97.2 |
| <6/18-6/60 | 132 (60.6) | 51 (23.4) | 35 (16.1) | 17 (7.8) | 0 (0) | 4 (1.8) | -58.8 |
| <6/60 | 85 (39) | 6 (2.8) | 0 (0) | 0 (0) | 0 (0) | 1 (0.5) | -38.5 |
| Total | 218 (100) | 218 (100) | 218 (100) | 218 (100) | 218 (100) | 218 (100) | - |

Table 4: Visual acuity, mean and standard deviation on different days before and after phacoemulsification.

| Visual Acuity | Min-Max | Mean \pm SD | difference | t value | P value |
|------------------------------|-----------|-----------------|------------|---------|----------|
| Preoperative | 0.20-1.30 | 0.96 ± 0.31 | - | - | - |
| Post-operative day 1 | 0.00-1.30 | 0.44 ± 0.32 | 0.519 | 19.484 | <0.001** |
| Post-operative day 3 | 0.00-1.00 | 0.37 ± 0.27 | 0.591 | 23.625 | <0.001** |
| Post-operative day 7 | 0.00-1.00 | 0.20 ± 0.22 | 0.757 | 31.814 | <0.001** |
| Post-operative day 30 | 0.00-0.30 | 0.02 ± 0.06 | 0.944 | 44.746 | <0.001** |
| Post-operative day 60 | 0.00-1.30 | 0.04 ± 0.14 | 0.922 | 41.060 | <0.001** |

Table 5: Comparison of anterior chamber reaction before and after Phacoemulsification.

| Anterior chamber reaction | Pre-operative (%) | Post-operative day 1 | Post-operative day 3 | Post-operative day 7 | Post-operative day 30 | % difference |
|---------------------------|-------------------|----------------------|----------------------|----------------------|-----------------------|--------------|
| Grade 0 cell | 218 (100) | 1 (0.5) | 124 (56.9) | 192 (88.1) | 218 (100) | 0.0% |
| Grade 1 cells | 0 (0) | 155 (71.1) | 72 (33) | 25 (11.5) | 0 (0) | 0.0% |
| Grade 2 cells | 0 (0) | 54 (24.8) | 22 (10.1) | 1 (0.5) | 0 (0) | 0.0% |
| Grade 3 cells | 0 (0) | 8 (3.7) | 0 (0) | 0 (0) | 0 (0) | 0.0% |
| Total | 218 (100) | 218 (100) | 218 (100) | 218 (100) | 218 (100) | - |

Table 6: Comparison of Intraocular pressure with mean and standard deviation on different days following phacoemulsification.

| Intraocular pressure | Min-Max | Mean \pm SD | difference | t value | P value |
|-----------------------------|-------------|------------------|------------|---------|----------|
| Preoperative | 10.00-25.00 | 16.51 ± 2.40 | - | - | - |
| Post-operative Day1 | 10.00-22.00 | 15.74 ± 1.98 | 0.771 | 7.305 | <0.001** |
| Post-operative Day3 | 10.00-22.00 | 14.89 ± 1.63 | 1.624 | 15.501 | <0.001** |
| Post-operative Day7 | 10.00-18.00 | 14.02 ± 1.51 | 2.491 | 21.440 | <0.001** |
| Post-operative Day30 | 8.00-18.00 | 12.98 ± 1.52 | 3.532 | 28.428 | <0.001** |
| Post-operative Day60 | 8.00-17.00 | 12.39 ± 1.47 | 4.119 | 32.353 | <0.001** |

DISCUSSION

In the analysis of age distribution in the present study as shown in table no.1, it is observed that the highest number of cases are seen in the age group of 61-80 years,

the total number being (154) and the percentage being (41.3%). It appears that the number of senile cataract cases are lesser in the older age group. This may be due to people in the age group of 80-100 years are not seeking medical consultation or not attending outpatient

department due to old age problem. In the study done by Aarthi et al it was found that the highest percentage (51.56%) of senile cataract were found in the age group of 60-80 which is similar to our present study.⁸

Percentage of male and female are 46.3% and 53.7% respectively. These findings are consistent with the findings of a study conducted by Pant et al where they found that the highest percentage (55%) of senile cataract were found in the female sex population and 45% in the male population.⁹

The visual acuity significantly improved at the end of 1 month where 218 (100%) of the patients achieved best corrected visual acuity between 6/6-6/18. At the end of two months follow up 4 (1.8%) patient had best correct visual acuity of less than 6/18-6/60 and 1 (0.5%) had best corrected visual acuity of less than 6/60. On further examination it was found out that posterior capsular opacification was responsible for the significant decrease in the best corrected visual acuity of those patients. Hashmi et al in their study found out that overall, 93.3% of the operated eyes had good visual outcome, while 4.4% and 2.2% had borderline and poor outcomes, respectively.¹⁰ The study showed good visual outcome of cataract surgeries performed using phacoemulsification with intraocular lens (IOL) implantation. This is similar to our finding from our study where by the end of 2nd month 97.7% had good visual outcome and only 2.3% had borderline or poor visual outcome due to posterior capsular opacification. Good visual outcome is essential from the perspective of visual function and patient's satisfaction. In order to achieve good result, it is important that surgeons and the eye care centre audit their performances regularly.

It is observed that majority of the patients 155 (71.1%) had grade 1 cells on day 1 and by the end of one week only 25 (11.5%) had grade 1 cells and no cells were seen by the end of one month. This is similar to the study done by Alio et al who also found that the highest level of flare and cell always occurred the day following surgery regardless of which IOL was used.¹¹ A small increase in flare was observed on the 30th day. A similar study conducted by Luo et al found that the post operative flare count decreased from (26.27±1.37) on day 1 to (13.96±1.05), (9.07±0.43) and (7.16±0.27) photon counts/ms on days 3, 7, 30 and 90 after the surgery, respectively.¹²

As shown in table no.6 we compared the preoperative mean intraocular pressure and the post operative intraocular pressure on the first, third, seventh day and also after one month and two months after the phacoemulsification. Study similar to our study were conducted by Jamil et al where they found that the mean pre-operative IOP decreased significantly ($p < 0.001$) at final follow-up visit.¹³ In another study conducted by Cetinkaya et al it was found that the preoperative mean IOP value was 24.67±2.14 mmHg (SD), which decreased

from 21.60±1.93 mmHg (SD) to 21.07±1.67 mmHg (SD), 21.32±1.88 (SD) 21.00±1.76 mmHg (SD), 23.71±1.11 mmHg (SD), 24.42±1.85 mmHg (SD) at the end of 1st week, 1st month, 3rd month, 6th month, and 1st year was statistically significant but that of the 2nd year was not significant.¹⁴ This is similar to the findings in our study whereby at the end of 1 week and 1 month the IOP decreased from 16.51±2.40 to 14.02±1.51 and 12.98±1.52 respectively.

CONCLUSION

This study has been done to identify the effect of phacoemulsification surgery on the visual outcome, the anterior chamber reaction and the change in IOP on patients with cataract undergoing the procedure. WHO recommends that after cataract surgery atleast 80% of the operated eye should have presenting visual acuity of 6/6-6/18 which is referred to as good visual outcome. After best correction atleast 90% of the eyes should achieve this vision. The best corrected visual acuity and AC reaction should be stabilized by the end of one month. We observed that there was a significant improvement ($p \leq 0.001$) in the visual acuity following the surgery in which 73.9% of the patients could achieved good vision without correction and 100% of the patients could achieve good best corrected visual acuity after one month of surgery. This is comparable to the World Health Organization's recommendations. We also found that vision of 5 (2.3%) of the patients decreased after 2 months which was due to posterior capsular opacification. Out of 218 patients 72 (33%) of them had significant anterior chamber reaction postoperatively till the end of one week after which the reaction subsided. This study also concludes that majority of the patients presented with intraocular pressure ranging between 10-20 mmHg and that there was a significant ($p \leq 0.001$) decrease in intraocular pressure following phacoemulsification cataract surgery of which the lowest intraocular pressure were recorded at the end of 2 months. There are very few similar studies conducted and hence more research and large scale studies for longer duration are recommended.

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