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Anatomical and visual outcome of pars plana vitrectomy after dropped nucleus by eventful phacoemulsification.

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ABSTRACT… Objective: To study the anatomical and visual outcomes of patients who underwent pars plana vitrectomy for dropped nucleus or fragments of nucleus after eventful phacoemulsification. **Study Design:** Retrospective Quasi Experimental study. **Setting:** Department of Ophthalmology, Allied Hospital, PMC, FMU, Faisalabad. **Period:** 01-01-2022 to 01-01-2023. **Material & Methods:** Thirty five patients having event full phacoemulsification for dropped nucleus (Full, Half or less than half) were enrolled for either PPV with Phaco-fragmentation or PPV with vitreous cutter removal and PPV with limbal removal of nucleus. The intraocular lens was implanted at same time, or after one week or later depending upon the condition of eye. Initial examination included, visual acuity, IOP, B Scan, status of cornea, hyphema or hypopyon. Postoperative follow up period was two weeks to assess visual acuity, corneal clarity, retinal anatomy and any complications. **Results:** Out of 35 patients 24 (68.57%) were male and 11 (31.43%) were female. Age ranged between 30 to 70 years. There were 12 (34.28%) patients between age 30 to 50 years and 23 (65.72%) patients between aged 51 to 70 years. There were 13 (37.17%) patients from Eye Department, Allied Hospital, PMC, FMU, Faisalabad and 22 (62.86%) patients enrolled as referred from different districts of the Punjab. Initial vision was PL+ in one patient (2.86%) HM to CF in 28 patients (80%) , 6/60 to 6/24 in 6 patients (17.15%) while no patient (0%) had vision of 6/9 to 6/6 . while final vision was up to HM to CF in 10 patients (28.57%), 6/60 to 6/24 in 18 patients (51.43%), 6/18 to 6/9 in 10 patients (28.57%), none of patient gained vision of 6/6 . Corneal haze was in 7 (20%) patients, CME in 2 (5.71%), RD in 2 (5.71%), hyphema in 1 (2.86%) patient, raised IOP was in 8 (22.86%) patients while 15 (42.86%) patients had satisfactory condition. **Conclusion:** The loss of cataractous lens in vitreous cavity is severe complication during phacoemulsification. The early retrieval of nucleus by PPV, phaco-fragmentation, limbal removed or with vitreous cutter can improve the anatomical and visual outcomes.

Key words: Phacoemulsification, PPV (Pars Plana Vitrectomy) Phaco-fragmentation.

INTRODUCTION

The age related cataract may be sub- capsular, nuclear, cortical and Christmas tree.[1] The cataracts account for about 40 % of world blindness. The phacoemulsification is a technique in which ultrasonic energy breaks the nucleus into pieces and then they are removed by aspiration of the machine. The procedure sometimes may complicate into posterior capsule rupture (PCR) and so nucleus or piece of nucleus may drop into vitreous. The European Registry had identified various factors causing PCR.[2]

Over the last few years the cataract surgery has changed from intra- capsular cataract extraction (ICCE) to extra capsular cataract extraction (ECCE) with intraocular lens (IOL) implantation to small incision cataract extraction (SICS) and ultimately to phacoemulsification with foldable intraocular lens implantation. The technology still progressed to femtosecond laser in cataract surgery. This laser reduced many steps of phacoemulsification with automated process reducing corneal incision, best capsulorhesis and initial fragmentation of the crystalline lens.[3]

The usual and conventional phacoemulsification may complicate to Posterior capsular rupture (PCR) especially by surgeons under training.[4] There are less chances of PCR by experienced

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hands. The PCR and dropped nucleus can cause different management problems. A new technique has been developed to cleave or dissolve the lens by Microinventional filament loop (Miloop).[5]

The good visual outcomes depend on many factors, one of it may be the early pars plana vitrectomy (PPV) for removal of dropped nuclear fragments. The poor visual outcome was found in cases of full nucleus and poor pupil size.[6]

The in-experience of the Surgeon may be a major factor but advancing age, opaque cornea, poor pupillary dilation, tone less iris, high myopia, Posterior polar cataract, Pseudo exfoliation syndrome may also be the high risk causes.[7]

The size and amount of lens matter in posterior segment is one of the serious complications and may need a specialized surgical technique. Lens matter less than 2 mm in size may often be resolved with medical treatment but sometimes can lead to phacoantigenic Uveitis or Glaucoma which is usually treated by surgical intervention.[8]

The timing for vitrectomy after first complicated Cataract Surgery varies. The time of vitroretinal intervention can be early within one week or later than one week after complicated surgery. The patients having poor vision at presentation should be treated with early PPV but even then bad visual outcome was found in patients of diabetes.[9] The surgery can be delayed till the cornea gets clear, IOP and inflammations settles but in this study PPV was delayed so that the eye can recover from the inflammation caused by initial surgery. In a study conducted at a tertiary eye Hospital of North India proved that timing of vitrectomy either performed early or late did not affect the visual outcome.[10] However some studies have advised for PPV on the same day of complicated surgery to reduce complications rate and good visual recovery.[11]

In last few years various retrospective studies were done which showed no significant differences between early and delayed pars plana vitrectomy. There are many factors associated with PCR. Previous intra-vitreal injection of Anti-VEGF is a risk factor for PCR and so should be addressed for safe surgery.[12]

The aim of this study was to determine anatomical and visual outcomes after PPV for removal of full nucleus, half or less than half with all three ports 23G or two ports 23G and one port 20G (for phaco-fragmentation) or all three ports of 23G with additional limbal retrieval.

MATERIAL & METHODS

Thirty five patients were selected who underdone pars plana vitrectomy for dropped nuclear material after eventful phacoemulsification from January 2022 to January 2023. Approval of study was taken from Institutional Ethical Review Committee (48.ERC/FMU/2022-23/351), Faisalabad Medical University, Faisalabad. Patients below age 30 and above age 70 were excluded. Also patients with Rhegmatous Retinal Detachment (RRD), Tractional Retinal Detachment (TRD), Endophthalmitis, Proliferative Vitroretinopathy (PVR), Retinal detachment and postoperative history longer than two weeks were also excluded.

Proper history including diabetes, hypertension, time of surgery, referred or local, age, other relevant ocular or systemic were noted. Complete ocular examination including vision, Slit lamp examination, IOP was performed. B-scan was performed to assess location and size of nuclear material and vitroretinal status for each patient. Procedure was planned according to location and size of nuclear material. Laboratory investigations like blood sugar random, hepatitis and urea / creatinine were ensured.

All procedures were performed by single experienced vitroretinal surgeon with Accurus vitrectomy machine. The procedure consisted of three ports of 23G for nuclear material less than half nucleus while one port 20G was made with MVR knife for phaco-fragmentation. In all cases vitreous was completely cleared after staining with triamcinolone acetonide. The small nuclear fragments were easily removed with 23G cutter and no perfluorocarbon liquid (PFCL) was used. PFCL was used for larger nuclear fragments.

The larger and more mature lens material were removed by limbal incision. Silicon oil was used as internal tamponade where indicated. Pan-retinal photocoagulation was done as optional basis. Postoperative follow up period was two weeks to examine anatomical, visual outcomes, anterior and posterior segment complications.

Data was analyzed using SPSS percentages were calculated for individual categories. Chi-square and lamda tests were applied to calculate the associations between variables. This study carried to see final visual acuity and association of time of presentation as well as the size of the dropped nucleus. The association of age, place of surgery as well as technique of procedure were also studied.

RESULTS

Thirty five patients 24 male (68.57%) and 11 female (31.43%) with age range between 30 to 70 years were included.12 patients (34.28%) out of 35 had age between 30 to 50 years while 23 patients (65.72%) out of 35 had age between 51 to 70 years. Table-I

13 patients (37.14%) were from Faisalabad while 22 patients (62.86%) were enrolled as referred from other cities of Punjab. Table-II

Dropped nucleus was full in 15 patients (42.86%), half in 6 patients (17.14%) and less than half in 14 patients (40.0%). Table-III

Snellen vision was PL+ in one patient (2.86%), Hand movement (HM) to count fingers (CF) in 28 patients (80%), 6/60 to 6/24 in 6 patients (17.15%), 6/18 to 6/9 no patient(0%). Table-IV

Pars plana vitrectomy (PPV) with phaco-fragmentation in 15 patients (42.86%), PPV with no phaco-fragmentation in 9 patients (25.70%) and PPV with limbal removal in 11 patients (31.44%). Table-V

Intraocular lens (IOL) implanted at same time in 09 patients (25.72%), IOL implanted after one week in 23 patients (65.71%) and 03 patients (8.57%) were kept aphakic. Table-VI

A total of 19 patients (54.29%) were implanted IOL in sulcus while scleral fixation was done in 13 patients (37.14%). Table-VII

Silicon oil was used as tamponade in 02 patients (5.71%) while ringers solution was filled in 33 patients (94.29%). Table-VIII

Many of patients improved vision, before surgery there were 28 patients (80%) with HM-CF after surgery 7 patients (20%), 6/60-6/24 in 6 patients (17.14%) after surgery 18 patients (51.43%) while no patient (0%)at admission was 6/18-6/9, after surgery there were 10 patients (28.57%). Table-IX

Seven patients (20%) had corneal haze, hyphema in one patient (2.86%), RD in two patients (5.71%), CME in two patients (5.71%) and medically controlled IOP in eight patients (22.86%). Almost fifteen patients (42.86%) had satisfactory condition. Table-X.

Sex		Age		Total
M	F	30-50 years old	51-70 years old	
24 68.57 %	11 31.43%	12 34.28%	23 65.72%	35 100%

Table-I. Age and sex

Local	Preferred	Total
13 37.14%	22 62.86%	35 100 %

Table-II. Enrolled patients

Full Nucleus	Half Nucleus	Less Than Half	Total
15 42.86 %	06 17.14 %	14 40%	35 100 %

Table-III. Size of nucleus drops

At Admission					
PL+	HM – CF	6/60 to 6/24	6/18 to 6/9	6/6	TOTAL
01 2.86	28 80%	06 17.15	Nil	Nil	35 100%

Table-IV. Snellen vision at admission

PPV + Phaco Fragmentation 2 Ports: 23 G 1 Port: 20 G	PPV + Vitrectomy All Three Ports 23 G	PPV 03 Ports 23 G + Limbal Removal	Total
15 42.86%	09 25.70%	11 31.44%	35 100%

Table-V. Surgical procedure

IOL At Same Time	IOL After 1 Week	No IOL	Total
09 25.17 %	23 65.72%	03 8.57%	35 100%

Table-VI. IOL implantation

	Same Day	1 week	Total 35 Patients
Sulcus Fixation	09 25.72%	10 28.57%	19 54.29%
Scleral Fixation	0 0%	13 37.14%	13 37.14%
No IOL	03 8.57%	0 0%	03 8.57%

Table-VII. Time of IOL implantation

Ringer	Silicon OIL	Total
33 94.29%	02 5.71	35 100%

Table-VIII. Type of tamponade

HM → CF	6/60 → 6/24	6/18 → 6/9	6/6	Total
07 20%	18 51.43%	10 28.57%	Nil	35 100%

Table-IX. Vision at final visit

Our study indicated that final visual acuity was significantly associated with time of presentation as well as the amount of nucleus drop. Late presentation was associated with a poor visual acuity less than 6/48 (p value: 0.013). Similarly, good final visual outcome better than 6/36 was reported where half or less than half of the nucleus was dropped inside the vitreous cavity, while whole nucleus drop resulted in a significantly poor final visual outcome (p value: 0.006). Age, place of surgery, as well as the type of surgery had no significant association with the final visual outcome.

DISCUSSION

Pars plana vitrectomy is a preferred method for management of dropped nuclear material after event-full phacoemulsification. In a study of Lashgari et al most of treated cases lead to improvement in vision, and reduces inflammation and IOP.[13]

The retained lens fragments can only be removed by phaco-fragmentation after doing Pars Plana vitrectomy with or without use of perfluorocarbon liquid (PFCL), this was similar to this study where some times PFCL was used and sometimes none of PFCL. The retained lens fragments can only be removed by phaco-fragmentation after pars plana vitrectomy with or without use of perfluorocarbon liquid (PFCL). In all cases the previous history of vitrectomy is important. The prior pars plana vitrectomy may be associated with adverse intraoperative events during cataract surgery.[14]

The common complication of phacoemulsification is PCR, so early recognition of a PCR is important to prevent nucleus drop into vitreous. If so then perioperative measures should be adopted to reduce risk of complications. This may require a combined effort of anterior segment surgeon and vitroretinal surgeon.[15]

There may be many complications after PPV and phaco-fragmentation, this was similar to studies of Soliman et al.[16]

This study shown better anatomical and visual recovery when 23G PPV was done for nucleus material less than half. In such cases, duration of surgery was small and visual and anatomical rehabilitation was better. This was similar to study of Senpola et al in 2015 with 25G PPV for retained less material.[17]

The early or delayed vitrectomy for dropped nucleus material showed no significance differences. This was similar to the studies of Meta Analysis review published in 2014.[18]

Another study showed quicker visual recovery results and reduced the morbidity in early PPV. The mean improvement seen in BCVA was 4.83,

Corneal Haze	Optic Atrophy	CME	RD	Hyphema	Raised IOP	Satisfactory Condition	Total
07 20%	Nil 0%	02 5.71%	02 5.71%	01 2.86%	08 22.86%	15 42.86%	35 100%

Table-X. Complications at final visit of follow-up

1.39 lines of Snellen chart in one group and 4.67, 1.94 lines in other group compared to the preoperative visual acuities.[19]

The 03 port PPV should be employed for removal of dropped nuclear fragments by any way either 20 G, 23G, 25G, or 27G system. The smaller gauge may allow for faster recovery and less inflammation or other complications but the smaller gauge may be more suitable for smaller lens material and for larger fragments, a phacoemulsification probe may be needed and 20G entery may be required. In such cases the smaller gauge sclerostomy may be converted to 20G.[20]

In this study smaller lens material were removed by 23G vitrectomy cutter but in some studies the larger lens fragments were removed by manual traction after vitrectomy. Larger lens fragments were brought to mid vitreous using suction and then secured to the phacoemulsification tip with a short burst of ultrasound then by extra-capsular extraction via and enlarged corneal incision. This was similar to study of Watanabe et al.[21]

A device "Frag Bag" has been invented to assist vitreoretinal procedures in stabilizing lens fragments during removal. This is like a basket of nitinol which stabilizes the lens material in vitreous cavity.[22]

The decision for secondary IOL was made on examination of status of posterior capsule, anterior capsule rim, missing of both anterior and posterior capsules, pupillary size configuration, corneal clarity and posterior segment. Single piece acrylic IOL was not used having many complications as noted in a study.[23]

The 03 piece IOL was not used in any case either in sulcus or scleral fixation, polymethyl methacrylate posterior chamber IOLs were used in both sulcus or scleral fixation. For scleral fixation, such lens had a hole in haptics, where 10/0 proline was tied and then procedure was completed. None of case was done with anterior chamber IOLs (AC IOL), Iris sutured IOL or suture less scleral fixation IOL as was mentioned in another study by Dick HB et al.[24]

The IOL insertion was delayed when the dislocated nucleus fragments were larger and dense, while the IOL inserted at same setting when nuclear fragments were smaller. There are multiple options for management of dislocated lens and placement of secondary IOLs in absence of capsular support.[25]

There are some limitations of this study as having short follow up period, study carried out in one department and no treatment of post-PPV complications. Only one type of IOL was used no ACIOL, no iris sutured, no suture-less scleral-fixed IOLs or multi-piece IOL was used.

CONCLUSION

The final visual and anatomical outcomes after dropped nucleus depends upon size of nucleus, time of presentation, time of second surgical procedure, type of surgery, type of IOL insertion and post-operative complications. This study recommends early presentation and early second surgery in established vitro-retinal theatre. The follow up should be short and post-operative complications of PPV should be addressed.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Ejaz Ahmad Javed	All done by myself.