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Research Article

Comparative Study of Visual Outcomes Following Vitrectomy for Nucleus Drop Caused by Various Aetiologies

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Abstract

Purpose: Nucleus drop is a rare and serious complication. We investigated visual outcomes following corrective surgery and compared outcomes between surgeries performed in various aetiologies.

Method: A retrospective cohort study was performed after obtaining the approval of the ethical committee. The data of patients who underwent vitrectomy for nucleus drop were collected from electronic medical records. Patients were grouped based on the following aetiologies: traumatic, iatrogenic, spontaneous, and congenital. After pars plana vitrectomy and nucleus removal, comorbidities were managed either medically or surgically. All data were collected according to a pretested format and exported to SPSS 22.

Results: Our cohort consisted of 169 eyes of 169 patients. The mean age of patients was 55.36 ± 15.7 years. Of 169 patients, 107 (63.3%) were men and 62 (33.7%) were women. Of 169 patients, 44 (26%) were classified as having traumatic nucleus drop and 125 (74%) developed spontaneous nucleus drop without trauma following cataract surgeries (Table 2). In the iatrogenic group, 33 (38.56%) patients developed nucleus drop during phacoemulsification and 59 (62.9%) following MSICS.

Conclusion: The visual outcome following corrective vitrectomy for nucleus drop may be satisfactory if managed well; no significant difference in the outcome was noted based on the aetiology.

Keywords: Nucleus Drop; Traumatic Nucleus Drop; Iatrogenic Nucleus Drop; Visual Outcome

Introduction

Cataracts are responsible for 47% of all cases of blindness worldwide. The epidemiological effect of cataracts varies among different countries, and its rate of occurrence is associated with economic conditions. All stakeholders aim to improve the quality and quantity of cataract surgery [1,2].

Various postgraduate training programs in cataract surgery are currently available in many countries at different government and nongovernmental institutions, with a wide range of facilities [1,2].

Differences in infrastructure, patient load, and faculty's skill at various training facilities lead to the development of different skill levels and thus varying surgical results. Modern cataract surgery has a steep learning curve.

Monitoring the outcomes of surgical treatment for cataracts is crucial [3]. Although cataract surgery is usually performed by phacoemulsification, manual small-incision cataract surgery (MSICS) is an important technique often used in developing countries, with its surgical outcome, safety, and efficacy being comparable to those of phacoemulsification [4,5].

Nucleus drop is a serious complication of cataract surgery and may result in severe sight loss. Visual outcomes are poor following the development of nucleus drop [6,7].

Trauma is a cause of monocular blindness in developed countries; however, few studies have addressed the problem of trauma in rural areas [8-11].

Ocular trauma can cause ectopia lentis [8]. Methods used to evaluate visual outcomes in eyes managed for traumatic cases may not be similar [11]; however, damage to other ocular tissues may compromise visual gain in eyes operated on for traumatic cases. Hence, the success rate may differ between eyes with different aetiologies. Traumatic cataract is a crucial cause of vision loss following ocular trauma [11-13].

With the introduction of the Birmingham Eye Trauma Terminology System (BETTS), the documentation of ocular trauma has been standardised [5]. Therefore, studying visual outcomes following traumatic nucleus drop by using the BETTS would be valuable. Nucleus drop may result from both open and closed globe injuries [14,15].

Methods

This retrospective cohort study was approved by the ethical committee of our hospital. We enrolled all patients who developed nucleus drop with any aetiology between 2008 and 2019 Iatrogenic cases following cataract surgery by phacoemulsification or MSICS. We retrieved patients' data from electronic medical records All surgeries performed by two senior surgeons in department of single institution. All data were exported in an Excel sheet and processed using Statistical Package SS 22 (IBM inc). We excluded patients with a follow-up period of less than four weeks following surgical treatment.

All enrolled patients underwent vision examination and an anterior examination using a slit lamp, as well as had their posterior segment findings documented using indirect ophthalmology. When the fundus was not visible, B-scan ultrasonography was used to access the posterior segment. The nucleus was removed through the anterior or posterior route depending on clinical conditions. Pars plana vitrectomies were performed using a noncontact viewing system. We removed the nuclei of varying toughness through anterior or pars plana route using phacofragmentation. We followed up patients following a standard format and schedule.

All comorbidities following ocular trauma or surgical procedures were managed medically or surgically. All cases of nucleus drop resulting from ocular trauma were treated using systemic corticosteroids.

All data were entered in an online pretested form, exported to an Excel spreadsheet, and analysed using SPSS 22. Frequency distribution and cross-tabulation were analysed, and 95% confidence intervals were calculated. Effects were considered significant if the P value was < 0.05.

Results

Our cohort consisted of 169 eyes of 169 patients. The mean age of patients was 55.36 ± 15.7 years. Of 169 patients, 107 (63.3%) were men and 62 (33.7%) were women (Table 1). Of 169 patients, 44 (26%) were classified as having nucleus drop due to trauma and 125 (74%) developed spontaneous nucleus drop without trauma following cataract surgery (Table 2). In the iatrogenic group, 33 (38.56%) and 59 (62.9%) patients developed nucleus drop during phacoemulsification and following MSICS, respectively. The mean follow-up period was 142 days.

	Sex		Total
	F	M	
.00	1	3	4
0 - 10	3	2	5
21 - 30	2	9	11
31 - 40	3	9	12
41 - 50	12	12	24
51 - 60	25	26	51
61 - 70	12	36	48
71 - 80	4	9	13
> 80	0	1	1
Total	62	107	169

Table 1: Age and sex distribution.

Post-operative vision	IOL status		Total
	Aphakia	Pseudophakia	
< 1/60	23	22	45
1/60 - 3/60	10	20	30
6/60 - 6/36	7	15	22
6/24 - 6/18	6	26	32
6/12 - 6/9	5	31	36
6/6 - 6/5	0	2	2
LF	2	0	2
Total	53	116	169

Table 2: Comparative study of visual outcome with insertion of intra ocular lens.

P-0.002.

Nucleus drop had varying aetiologies: iatrogenic, spontaneous, congenital, and traumatic in 89 (52.7%), 27 (16%), 9 (5.3%), and 44 (26%) patients, respectively. Nucleus drop was bilateral in 10 (5.9%) patients.

Between 2008 and 2019, we performed 100946 cataract surgeries. Overall surgical complications amounted to 2998 (2.49%), of which 89 (0.08%) had nucleus drop; of a total of 12687 trauma cases, 128 (1%) had nucleus drop.

In the entire cohort, we could insert a posterior chamber intraocular lens in 115 (68%) patients; the remaining 53 (32%) patients remained aphakic. Of a total of 115 (68%) eyes in which we inserted a posterior chamber lens, 68 (40.2%) were scleral-fixated

lens and 43 (25.4%) were sulcus-fixated lens. When we compared the visual outcome between aphakic and pseudophakic eyes, the difference was significant (P = 0.04).

When we examined the visual outcomes of all patients following the surgical management of nucleus drop, we found significant improvements (P = 0.005, Table 3). We found that 70 (41.4%) patients improved by more than 6/24, and 45 (26.5%) did not improve by more than 1/60 because of comorbidities. When we compared the visual outcome with aetiologies, we did not find a significant difference (P = 0.206).

We compared visual outcomes by aetiologies between traumatic and nontraumatic causes following surgical management

Post operative vision	Pre operative vision					Total
	< 1/60	1/60 - 3/60	6/60 - 6/36	6/24 - 6/18	6/12 - 6/9	
< 1/60	26	4	9	6	0	45
1/60 - 3/60	15	5	4	4	2	30
6/60 - 6/36	6	6	8	1	1	22
6/24 - 6/18	8	4	15	5	0	32
6/12 - 6/9	8	11	9	8	0	36
6/6 - 6/5	1	0	1	0	0	2
LF	1	1	0	0	0	2
Total	65	31	46	24	3	169

Table 3: Comparative study of visual outcome pre and post operative vision.

P = 0.03.

non traumatic category and did not find any significant difference between these groups (P = 0.237, Table 4).

When we compared the visual outcomes of surgical management among different time lags after the primary procedure or trauma, we found no significant difference (P = 0.135).

In nontraumatic cases, no significant difference in the visual outcome following surgical management was observed between primary surgery performed by phacoemulsification or MSICS. (P = 0.122) Difference is insignificant when scleral fixated or other intra ocular lens (p = 0.131, Table 5).

The main causes of non-improvement were corneal edema (18.9%), secondary glaucoma, and optic atrophy (9.46%).

Discussion

In this patient cohort, we determined that crystalline lens dislocation occurred due to various reasons such as ocular trauma, iatrogenic complications during surgery, and spontaneous or con-

Post operative vision	Aetiology					Total
	Congenital	Iaterogenic	Spontaneous	Spontaneus	Traumatic	
< 1/60	3	20	0	6	16	45
1/60 - 3/60	2	17	0	5	6	30
6/60 - 6/36	0	11	1	5	5	22
6/24 - 6/18	0	20	0	4	8	32
6/12 - 6/9	3	19	0	6	8	36
6/6 - 6/5	0	1	0	0	1	2
LF	0	1	0	1	0	2
Total	8	89	1	27	44	169

Table 4: Comparative study of visual outcome according to aetiology.

P = 0.783.

Post operative vision	Scleral fixation		Total
	SF IOL	ELSE	
< 1/60	13	32	45
1/60 - 3/60	14	16	30
6/60 - 6/36	8	14	22
6/24 - 6/18	11	21	32
6/12 - 6/9	21	15	36
6/6 - 6/5	1	1	2
LF	0	2	2
Total	68	101	169

Table 5: Comparative study of visual outcome with scleral fixated intra ocular lens.

P = 0.131.

genital causes. To our knowledge, no study has reported all aetiologies and compared visual outcomes among different aetiologies.

All other studies have included less number of cases.

Various authors have reported lens dislocation because of following reasons.

In our study, nucleus drop occurred in 128 (1%) patients due to ocular trauma and as a surgical complication in 89 (0.08%) patients. Rotim reported that 0.68% of patients who underwent MSICS had lens dislocation, and Hashemi reported that the incidence of lens dislocation was 3.72% in an Iranian cataract surgery survey [18,19].

Both Rotim and Hashemi have reported that nucleus posterior dislocation occurred during MSICS [18,19]. Furthermore, Fesharak and Hashemi have reported that nucleus fragment dislocation occurred during phacoemulsification [19,20].

Nucleus drop per operatively has been reported by many authors in case of posterior polar cataract. In addition, various measures to prevent and methods for managing nucleus dislocation have been described by various authors. Malhotra., *et al*. reported the occurrence of nucleus drop in posterior polar-type cataracts; however, we found that nucleus drop is associated with all types of morphology because many surgeries are performed by junior surgeons [7,21-24].

Kagmeni and Rosignoli have reported that lens dislocation following ocular trauma occurred due to various objects such as a boxer and an exercise belt [25,26].

Shanmugam reported the occurrence of traumatic dislocation in the suprachoroidal space, and Bawankar reported that nucleus drop occurred in the subretinal region; however, we did not find any nucleus drop in these locations [27,28].

Dropped fragments may cause complications such as retinal ischaemia, secondary glaucoma, and retinal breaks [29-32].

Ke and Fujikawa have reported nucleus dislocation in the vitreous cavity following ocular trauma or spontaneously [32-34]. Weave predicted injury risk by performing computational simulations of ocular blast loading risk of dislocated lens with model is 1 to 100% [35].

Wu, Kuruvilla, and Bhattacharjee have reported the occurrence of nucleus dislocation in the anterior segment either because of trauma or spontaneously [36-38].

Radiodiagnosis may be performed through ultrasonography b-scan or CT scan with good sensitivity and specificity [39-41].

Pati, Gurunadh, and Kaynak have reported the management of nucleus drop in the vitreous cavity by using the pars plana route 23 gauge hand piece and anteriorly by using anterior vitrectomy techniques such as those employed in the current study [42-44].

Specific histopathological and chemical factors may be responsible for weak zonules [45].

Visual outcomes significantly improved following surgical management [6,7].

The visual outcome was not significantly different among different aetiologies (P = 0.606). We are not aware of any other study that examined this variable. In cases of ocular trauma, the lens is not the only structure that affects the visual outcome [16,17].

When we examined the time duration between primary insults and corrective surgery, we found no significant effect of a greater time lag (P = 0.135) on later vision. This may be because inflammation following the primary insult had subsided during the early period. When vitrectomy is performed late, visibility is better and no retinal detachment is found, suggestive of a better prognosis. Shah., *et al*. suggested late intervention in traumatic cases [17].

We did not find significant differences due to vitrectomy gauge, primary procedure, or presence or absence of an intraocular lens. Furthermore, we did not find any other study with which to compare these findings.

When we compared vision with pseudophakia and best-corrected aphakia, we found a significant difference (P = 04).

We used intra ocular lens in sulcus- and scleral-fixated lens for the management of aphakia but did not find a significant difference with the type of lens used (P = 0.237).

Other authors used iris claw lens fixated on the posterior surface of the iris or artisan lens for the management of aphakia [46]. Agarwal., *et al.* also reported the usage of a glued lens and its learning curve [47], and Farrah compared the outcome between the iris claw lens and scleral-fixated lens [48]. Fiorentzis reported lens insertion according to retained anatomical structures, and similar guidelines were used in the current study [49].

The reason for non improvement of vision was comorbidities in traumatic cases and surgical damage to other tissues during primary surgery in iatrogenic cases.

Conclusion

Although nucleus drop is a serious complication, if it is managed well, a favourable visual outcome can be achieved. No difference was observed in visual outcomes between various aetiologies.

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