

**Study of Visual Outcome in Patients Having Posterior Capsular Rent or Zonular Dialysis during Cataract Surgery at a Rural Hospital**Archana Ashok Nimmalwar<sup>1</sup>, Abhijeet Bhaidas Patil<sup>2</sup>, Prajakta P Sambarey<sup>3</sup><sup>1</sup>Ophthalmologist, Civil Hospital, Nanded<sup>2</sup>Assistant Professor, Department of Ophthalmology, Seth G S Medical College & KEM Hospital, Parel, Mumbai<sup>3</sup>Professor & Head of Department, Ophthalmology, MIMER Medical College, Talegaon-Dabhade

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Conflict of interest: Nil

**Abstract****Aim:** To know the visual outcome after cataract surgery in patients having posterior capsular rent and or zonular dialysis**Material & Methods:** The Study was done in the Department of Ophthalmology at a rural medical college hospital. Patients having posterior capsular rent or zonular dialysis during cataract surgery in the hospital from the period November 1<sup>st</sup> 2016 to October 31<sup>st</sup> 2017 were included in the study. A total of 978 patients were operated only for cataract during above mentioned time period. Purposive sampling was done after consulting the statistician and 40 patients were included in our study.**Results:** Out of the 978 cataract surgeries (MICS /PHACO) in patients satisfying inclusion criteria ,36 patients (3.68%) had PCR and four patients (0.40%) had ZD. Visual acuity was good in 0(0.0%) patients before surgery and after surgery visual acuity was found in 25(62.5%) patients. While after surgery only 3(7.5%) patients have poor acuity. There was statistically significant improvement found in visual acuity after surgery. (P<0.001)**Conclusion:** Thorough preoperative workup , attention to existing problems, early detection and proper management of posterior capsular rent(PCR) and zonular dialysis (ZD) with good follow up leads to better visual outcome.**Keywords:** Visual Outcome, Zonular Dialysis, Posterior Capsular Rent, Cataract Surgery.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

There are 1.3 billion people in the world having some form of visual impairment and cataract is one of the most important causes. In the low and middle income countries the proportion of visual impairment due to cataract is much higher. [1] Cataract is the commonest cause of preventable blindness in the world, accounting for about 51% of global blindness. [2] Presently surgery is the only available treatment for cataract. Therefore reduction in blindness due to cataract is dependent on available infrastructure, funds, equipments, skilled manpower; specially sufficient number of ophthalmic surgeons to perform cataract surgery and also intra-operative and post-operative complications. Posterior capsular rent (PCR) is one of the most common intra-operative complications of cataract surgery that can affect the postoperative visual acuity [3-4]. An improperly managed PCR can have an adverse impact on the outcome of cataract surgery. Posterior capsular rent with or without vitreous disturbance leads to increased incidence of persistent post-operative inflammation, retained

cortex, corneal edema, post-operative endophthalmitis, cystoid macular edema (CME) and tractional retinal detachment in long standing cases. [9,10] The incidence of posterior capsular rent reported in literature varies from 0.2-14%. [11-13] Posterior capsular rent occurs most commonly during cortical clean-up but can also occur during expression of the nucleus, removal of the anterior capsular flaps, polishing of the posterior capsule and implantation of intra ocular lens (IOL). [9,10] The eventual visual outcome mostly depends on vitreous loss (VL). [10]

The risk factors for posterior capsular rent are posterior polar cataract, traumatic cataract, white mature cataract, small pupil, non-co-operative patients, postural problems and deep set eyes.[9,10] Weak zonules, pseudoexfoliation(PXF), traumatic cataract, hyper mature and brown cataract are risk factors for zonular dialysis(ZD).[9,10] The reported incidence of zonular dialysis is 0.50%. [17] Timely management of complications and close follow-up possible leads to better visual outcome. [18] Com-

plicated cases are routinely encountered in a teaching institute. Hence this prospective observational study is conducted at a rural medical college hospital from 1<sup>st</sup> November 2016 to 30<sup>th</sup> April 2018 to know the visual outcome after cataract surgery in patients having posterior capsular rent and or zonular dialysis.

### Material & Methods

The Study was done in the Department of Ophthalmology at a rural medical college hospital after approval by the Ethics Committee. Patients having posterior capsular rent or zonular dialysis during cataract surgery in the hospital from the period November 1<sup>st</sup> 2016 to October 31<sup>st</sup> 2017 were included in the study. Patients undergoing cataract surgery along with pterygium surgery or any other intraocular surgery were excluded from our study. A total of 978 patients were operated only for cataract during above mentioned time period. Purposive sampling was done after consulting the statistician and 40 patients were included in our study. The follow-up period was up to 30<sup>th</sup> April 2018.

In all patients undergoing cataract surgery a detail history was recorded that included the onset of defective vision, history of any other ocular or systemic illness.

Visual acuity testing was done using Snellen's chart. Refractive error was tested with auto-refractometer. Goldmann Applanation Tonometer was used to measure the intraocular pressure. Examination of the eyelids, ocular surface and anterior segment was done with the help of slit lamp biomicroscope before and after dilation with topical Tropicamide (0.8%w/v) and Phenylephrine (5%w/v) eye drops. Size of pupil after mydriasis was noted. Extent and grade of cataract was documented along with any other finding. Examination of the posterior segment of the eye was done by the direct and indirect ophthalmoscope and slit lamp biomicroscopy using 78D, 90D and Three Mirror Contact lenses. Lacrimal sac- syringing was done in both eyes to know the patency of lacrimal drainage passages. Manual keratometry was performed on Bausch and Lomb type keratometer. Contact ultrasonic biometer without water-bath was used for A- scan biometry. IOL power calculation was done by using SRK II formula.

General examination, recording of blood pressure and systemic examination was done. Complete blood count, Urine examination for sugar, albumin and pus cells, blood sugar level, HIV and HBsAg testing was done preoperatively in all patients.

After written informed valid consent preoperative preparation was done. Oral tablet Norfloxacin 400 mg b.i.d. was prescribed for five days starting from previous night of surgery. Eyelashes of the eye to be operated were trimmed. Injection Tetanus Toxoid

(TT) 0.5ml intramuscular was given and subcutaneous xylocaine sensitivity test was done. Adequate mydriasis was achieved by using Tropicamide (0.8%w/v) and Phenylephrine (5%w/v) eye drops three times prior to surgery. Bromfenac 0.09% eyedrops were instilled every 30 minutes one hour prior to surgery.

All surgeries were performed under peri-bulbar anesthesia with 4 ml of lignocaine hydrochloride 2% with 1:200000 Adrenaline + 2 ml of Bupivacaine 0.5%.

Lignocaine hydrochloride 2% without Adrenaline along with Bupivacaine (0.5%) was used in hypertensive patients. Topical Povidone- iodine 5% eye drops were instilled after anesthesia.

Either manual small incision cataract surgery (MSICS) or phacoemulsification (PHACO) was performed in all patients along with intraocular lens implantation.

In patients having posterior capsular rent or zonular dialysis, those willing to be included in the study were selected. Details regarding step at which the complications occurred was noted along with relevant management. Incision was extended in patients undergoing phacoemulsification. Anterior vitrectomy was performed whenever required. Depending upon the extent of posterior capsular rent, either in the bag Posterior chamber intra ocular lens (PCIOL), Sulcus fixated PCIOL, Anterior chamber IOL (ACIOL) or Iris-claw lens was implanted. PCIOL along with Capsular Tension Ring (CTR) was implanted when zonular dialysis was less than two clock hours. In all these patients wound was secured with 10 -0 nylon sutures.

In all patients subconjunctival gentamycin and dexamethasone was injected at the end of surgery, pad and bandage given after instilling chloramphenicol eye ointment and oral tab Combiflam 500mg (Paracetamol 325mg + Ibuprofen400mg) was prescribed.

On first post operative day in all patients antibiotic steroid eye drops (Chloramphenicol IP 4mg, Polymyxin B Sulphate BP 5000IU, Dexamethasone Sodium Phosphate IP 1mg, Phenylmercuric Nitrate IP 0.001%w/v) was instilled one hourly. Subsequent frequency of instillation depended on ocular inflammation. In non-responding cases with more inflammation combination of Ofloxacin (0.3%w/v) + Prednisolone acetate (1.0%w/v) was used. Topical Nepafenac (0.1% w/v) t.i.d. was prescribed for three months in all patients having posterior capsular rent or zonular dialysis. In patients where post operative intraocular pressure (IOP) was raised, oral tablet Acetazolamide 250mg and topical anti glaucoma medication was used as required.

Patients were explained about the complications and follow up visits. Visual acuity and thorough ocular examination was performed and post operative complications were documented on first post operative day and after one week, one month, three months and six months.

**Statistical Analysis:** The findings were subjected to analysis. Statistical Analysis was done by using SPSS Software version 26.0(IBM, Chicago, USA). Chi square test & Z test was applied to find significant association between diabetes & visual acuity. Significance level was fixed at <0.05.

### Results:

Out of the 978 cataract surgeries (MICS /PHACO) in patients satisfying inclusion criteria ,36 patients (3.68%)had PCR and four patients (0.40%) had ZD. All these patients were operated in the rural medical college hospital during the period 1<sup>st</sup> November 2016 to 31<sup>st</sup> October 2017.

Table 1. shows age and sex distribution of patients having posterior capsular rent (PCR) or ZD in the study population. There were 22 females and 18 males which was not statistically significant ( $p=0.89$ ).

Forty five percent patients in our study had hypertension and 30% were diabetic (Table 2.). In our study we found high rate of PCR with vitreous loss(VL) in hypertensive and diabetic patients. Stress during surgery in these already hypertensive and diabetes patients increased the chances of PCR and vitreous loss.

Table 3.shows distribution of cases according to risk factors associated with PCR and ZD. There were 22.5% patients with hard cataracts, 17.5% had cataracts with pseudoexfoliation ,15% had poor pupillary dilation and one patient (2.5%) had shallow anterior chamber.

### Result

**Table 1: Age and sex wise distribution of cases in study group**

Age (Yrs)	Male	Female	Total	Percentage %
≤50	3	5	8	20.0
51 – 60	8	9	17	42.5
61 – 70	7	8	15	37.5
Total	18	22	40	100.0
<b>Chi-square</b>	<b>0.230</b>			
P-Value	<b>0.80(NS)</b>			

**Table 2: Distribution of cases according to systemic illness.**

Systemic illness	No of cases	Percentage
Diabetes mellitus	12	30.0
Hypertension	18	45.0
No history of systemic illness	10	25.0
Total	40	100.0

There was no statistically significant difference ( $p>0.05$ ) in the intraoperative complications in MSICS and PHACO in our study as shown in Table 4. Parikshit Gogate et al too found no significant difference in intraoperative complications in these two types of surgery.<sup>132</sup> All 36 (3.68%) patients in our study having PCR had vitreous loss. Anterior vitrectomy done in all PCR cases. There was no vitreous loss in ZD cases.

PCR was most commonly during cortex removal (47.22%) followed by emulsification of last piece of nucleus in PHACO (22.22%) and during nucleus delivery (19.44%)and prolapse of nucleus into anterior chamber (11.11%) in MSICS group. Zonular dialysis occurred during nucleus delivery(50%) and cortex removal(50%). PCR occurred more commonly during removal of subincisional cortex. (Table 5)

Table 6 shows distribution of cases according to type of IOL implantation in PCR or ZD. Eyes with PCR and PCIOL, had smaller posterior capsule tear with adequate remnant capsule support or an intact anterior capsule rim.

Corneal edema was the most frequent cause of reduced vision in the early postoperative period. It was seen in 40(100%) patients on day 1 and after 1 week it was seen in 13(32.5%) patients in the present study. One (2.5%) patient developed Pseudophakic Bullous Keratopathy (PBK) three months after surgery.

Table 8 reveals Comparison of visual acuity before cataract surgery and after 6months in study group. Visual acuity was good in 0(0.0%) patients before surgery and after surgery visual acuity was found in 25(62.5%) patients. While after surgery only 3(7.5%) patients have poor acuity. There was statistically significant improvement found in visual acuity after surgery. ( $P<0.001$ )

**Table 3: Distribution of cases according to risk factors associated with PCR or ZD**

Risk factor	Posterior capsular rent (PCR)	Zonular dialysis (ZD)	Total	Percentage (n=40)
Posterior subcapsular Cataract/posterior polar cataract(PSCC/PPC)	11	1	12	30.0
Hard cataract (NS4)	6	3	9	22.5
Pseudoexfoliation	5	2	7	17.5
Poor pupillary dilation	5	1	6	15.0
Mature Cataract	6	0	6	15.0
Hypermature Cataract	4	0	4	10.0
Shallow anterior chamber	1	0	1	2.5

**Table 4: Comparison of intraoperative(intraop) complication in MSICS and PHACO group**

Intra op complication	MSICS (n=24)	PHACO (n=16)	Z Value	P value
CCC extended	1 (4.17)	0	1.02	0.31
PC Rent	21 (87.5)	15 (93.75)	0.69	0.49
Vitreous Loss	21 (87.5)	15 (93.75)	0.69	0.49
Raised IOP	2 (8.33)	0	1.48	0.14
Iris Prolapse	2 (8.33)	0	1.48	0.14
Zonular Dialysis	3 (12.5)	1 (6.25)	0.69	0.49

**Table 5: Posterior capsular rent or zonular dialysis at various surgical stages in MSICS /PHACO**

Surgical Stage	PCR(n=36)	ZD(n=4)	Total	Percentage(n=40)	P Value
Prolapse of Nucleus into the AC	4(11.11%)	2(50%)	6	15	0.13
Nucleus delivery	7(19.44%)	0	7	17.5	0.003
Cortex removal	17(47.22%)	2(50%)	19	47.5	0.92
Emulsification of last piece of nucleus	8(22.22%)	0	8	20	0.0013

**Table 6: Distribution of cases according to type of IOL implantation in PCR or ZD**

Type of IOL	PCR(n=36)	ZD(n=4)	No of cases(n=40)
ACIOL	7(19.44%)	0	7(17.5)
Posterior iris claw	9(25%)	0	9(22.5%)
PCIOL placed in sulcus	20(55.55%)	0	20(50%)
CTR with PCIOL	0	4(100%)	4(100%)
Total	36	4	40

**Table 7: Post operative complication after pc rent or zonular dialysis**

Complications	On 1day PO*	After 1wk PO	After 1mth PO	After 3mths PO	After 6mths PO
	No (%)	No (%)	No (%)	No (%)	No (%)
Corneal edema	40 (100)	13 (32.5)	1 (2.5)	0	0
SK	10 (25)	1 (2.5)	1(2.5)	0	0
D shape pupil	1 (2.5)	2 (5)	0	0	0
Retained cortex	1 (2.5)	1 (2.5)	0	0	0
Anterior uveitis	0	0	1 (2.5)	1 (2.5)	1 (2.56)
CME	0	0	0	1 (2.5)	2 (5.13)
PBK	0	0	0	1 (2.5)	0
PCO	0	0	0	0	2 (5.13)
Decentered IOL	0	0	0	0	3 (7.69)
Raised IOP	27 (67.5)	14 (35)	8 (20)	3 (7.5)	4 (10.3)
No	0	27 (67.5)	37 (92.5)	37 (92.5)	30 (76.92)
Total	40 (100)	40 (100)	40 (100)	40 (100)	39 (100)

**Table 8: Comparison of visual acuity before cataract surgery and after 6months in study group**

BCVA	BCVA	
	Before surgery	After surgery
(GOOD) 6/6–6/12	0(0.0%)	25 (62.5%)
(BORDERLINE) 6/18-6/60	13 (35%)	11 (27.5%)
(POOR) <6/60	26 (65%)	3 (7.5%)
Total	40 (100%)	39 (100%)
<b>Chi Square Value</b>	<b>43.44</b>	
<b>Significance ‘P’ Value</b>	<b>&lt;0.001</b>	

## Discussion

Timely and proper management with regular follow up in cases of complications during cataract surgery leads to better visual outcome.[18]

During the period 1<sup>st</sup> November 2016 to 31<sup>st</sup> October 2017 there were 978 patients undergoing exclusively cataract surgeries (MSICS/PHACO) in the rural medical college hospital. The number of eyes with posterior capsular rent (PCR) were 36 (3.68%). Similar incidence of PCR is reported by Dr. Sudhir Pendke et al. [11]

The incidence of PCR in phacoemulsification surgeries reported in various other studies ranges from 0.45% to 14.5% with higher incidence in cataract surgeries performed by surgeons with no formal training.[12,13]

Zonular dialysis (ZD) was present in four patients (0.40%) in our series. S Trikha et al and other studies have also reported incidence of ZD around 0.4%. [17,12]

Table 1. shows age and sex distribution of patients having posterior capsular rent (PCR) or ZD in the study population. There were 22 females and 18 males which was not statistically significant ( $p=0.89$ ). Osher et al also did not find any relation between the capsular rupture and age, sex, or family history. [13]

In our study among the patients of PCR, ten patients had white cataract (MSC and HMSC). Chakrabarti et al, Vajpayee et al and Vasada et al have stated increased intraoperative problems in white cataract that may lead to increase in complications. [14,15,16] In this study there were four patients(10%) having HMSC who had posterior capsule rupture with vitreous loss which is similar to other studies [17,18], According to Arup Chakrabarti et al there is more risk of PCR in cataracts having hard nuclei. [18]

In our study we had nine patients with hard cataract and most of the cases presented with combined nuclear sclerosis cortical and posterior subcapsular cataract. Surgery on posterior polar and sub capsular cataract is reported to pose many problems. [9,18]

Forty five percent patients in our study had hypertension and 30% were diabetic (Table 2.). In

our study we found high rate of PCR with vitreous loss(VL) in hypertensive and diabetic patients. Stress during surgery in these already hypertensive and diabetes patients increased the chances of PCR and vitreous loss.

RD Jager et al reported high rate of vitreous loss in hypertensive patients compared to those non hypertensive. Diabetic patients, also had increased rate of intraoperative posterior capsular rupture with vitreous loss as compared to nondiabetic patients. [20]

But various other studies reported that there is no association between systemic hypertension and vitreous loss. [21] Cataracts develop at relatively younger age and prevalence of cortical and posterior subcapsular cataracts is high in Diabetes mellitus which increases the chances of complications. [23]

Table 3. shows distribution of cases according to risk factors associated with PCR and ZD. There were 22.5% patients with hard cataracts, 17.5% had cataracts with pseudoexfoliation, 15% had poor pupillary dilation and one patient (2.5%) had shallow anterior chamber. Arup chakrabarti et al and various other studies have reported association of PXF with weak zonules, hard cataracts, poor dilation of pupils and shallow anterior chamber leading to increased incidence of PCR and ZD. [17,18], Drosium et al has mentioned that eyes with PXF had 2.6-fold increase risk of PCR or ZD compared to eyes without PXF undergoing cataract surgery. [25]

White cataracts (HMSC and MSC) were present in 25% patients. Gogate PM in his study has reported increased incidence of posterior capsule rent in hypermature and hard cataracts.[26]

In this study posterior polar cataract and posterior sub capsular cataract was there in 30% cases. Osher R.H. et al, Vasavada A.R et al and others have reported these types of cataract as risk factors for PCR. [13,20]

Other risk factors like high myopia, traumatic cataract were not included in this study. A few cases had more than one risk factor.

Twenty four (60%) patients underwent MSICS and PHACO was done in 16 (40%) patients.

There was no statistically significant difference ( $p>0.05$ ) in the intraoperative complications in

MSICS and PHACO in our study as shown in Table 4. Parikshit Gogate et al too found no significant difference in intraoperative complications in these two types of surgery. [32] All 36 (3.68%) patients in our study having PCR had vitreous loss. Anterior vitrectomy done in all PCR cases. There was no vitreous loss in ZD cases. Similar findings are seen in studies done by Mishra and also Tan JH et al., [33] The reported Incidences of posterior capsule rent with vitreous loss ranges from 1.6% to 5.1%. [11,26]

We had zonular dialysis in 0.40% of cataract surgeries similar to other study [12]

The causes of zonular dialysis reported include excessive maneuvering of the nucleus, or aspiration of either the anterior, equatorial, or posterior capsule with the irrigation–aspiration tip.<sup>121</sup> We had similar causes for ZD in our study group. In our study incidence of PCR and ZD is well below the maximum limit of 5% as per guidelines given by WHO and similar to other mentioned studies.

In our study as shown in Table 5. PCR was most commonly during cortex removal (47.22%) followed by emulsification of last piece of nucleus in PHACO (22.22%) and during nucleus delivery (19.44%) and prolapse of nucleus into anterior chamber (11.11%) in MSICS group. Zonular dialysis occurred during nucleus delivery (50%) and cortex removal (50%).

PCR occurred more commonly during removal of subincisional cortex.

Thevi Thanigasalam et al, Basti et al and Chakrabarti et al and others also mention that PCR occurred most commonly during cortical removal. Taskpili M et al reported that posterior capsular rent most frequently occurs during phacoemulsification in 59.56% followed by Irrigation Aspiration in 28.8 %.

Table 6. shows distribution of cases according to type of IOL implantation in PCR or ZD. Eyes with PCR and PCIOL, had smaller posterior capsule tear with adequate remnant capsule support or an intact anterior capsule rim. Fiona M et al too have implanted sulcus fixated PCIOLs and ACIOLs in cases of PCR. Our study very well matches with the study by these authors and other similar studies.

Capsular tension ring (CTR ) with PCIOL was inserted in all four patients in our study group who had zonular dialysis. Other studies too recommend CTR for ZD. [17].

Corneal edema was the most frequent cause of reduced vision in the early postoperative period. Varying rates of corneal edema ranging from 11.6 - 59 % are reported.

One (2.5%) patient developed Pseudophakic Bullous Keratopathy (PBK) three months after surgery. The patient was sent elsewhere for

keratoplasty and did not visit our hospital since then. Pseudophakic bullous keratopathy is reported to present as long-standing corneal edema, unresponsive to medical management. It is due to corneal decompensation as a result of the inadequate endothelial function and in patients with an intraoperative VL the risk of corneal decompensation is increased. [18]

### Conclusion

Thorough preoperative workup, attention to existing problems, early detection and proper management of posterior capsular rent(PCR) and zonular dialysis (ZD) with good follow up leads to better visual outcome.

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