

Original article

Phaco-nucleotomy techniques in management of pseudoexfoliation syndrome

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Abstract

Introduction: Pseudoexfoliation syndrome is a common clinically important systemic condition characterized by the pathological production and accumulation of an abnormal fibrillar extracellular material in many intraocular and extra ocular tissues. Many studies have shown that pseudoexfoliation syndrome patients have higher rates of intraoperative complications during cataract surgery compared to the patients without it. **Objectives:** To compare Phaco-chop and Divide and Conquer techniques of phacoemulsification, in the management of pseudoexfoliation syndrome in terms of intraoperative complications. **Materials and methods:** It is a hospital based prospective study of 90 patients with cataract and pseudoexfoliation syndrome attending ophthalmology outpatient department in our hospital. **Results:** The mean age of patients in the study was 61.7 years with equal number of unilateral and bilateral cases. Intra operative complications noted in vertical chopping technique was only pupil constriction in 6.7%, no other complications were seen in this technique, whereas in horizontal chopping, 13.3% had pupil constriction, 6.7% had difficulty in chopping, 3.3% had zonular dehiscence and 3.3% had posterior capsular rent. In divide and conquer technique 16.7% had pupil constriction, 10% had difficulty in trenching, 3.3% had posterior capsular rent. Almost all the patients (97.8%) were implanted with intraocular lens after employment of various surgical modifications. **Conclusion:** Vertical chopping techniques scores over horizontal chopping and divide and conquer technique of phacoemulsification with good surgical outcome because of less complications.

Keywords: Pseudoexfoliation, phacoemulsification, zonular dehiscence, posterior capsular rent, vitreous loss

Abbreviations

PC- Pupillary constriction, DIT- Difficulty in Trenching, DIC- difficulty in Chopping, PCR- Posterior Capsule Rent, VL- Vitreous Loss, ZD – Zonulo-Dialysis

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Introduction

Pseudoexfoliation syndrome, an age related disease, is frequently associated with cataract. It is characterized clinically by small white deposits of material in the anterior segment, most commonly in the pupillary border and the anterior lens capsule. The most consistent

diagnostic feature is three distinct zones of pseudoexfoliation material seen on the lens capsule after full dilatation (Layden et al, 1974).

Additional subtle clinical signs that help in early diagnosis are loss of pigment from peripupillary area producing transillumination defects, insufficient mydriasis, pigment dispersion into anterior chamber after mydriasis and deposition of melanin over trabecular meshwork and Schwalbe's line.

Zonular instability, which may lead to phacodonesis and lens subluxation, is a major concern (Futa et al, 1989; Freissler et al, 1995). It results from active production and proliferation of exfoliative material through the capsular surface which disrupts the zonular lamella and their insertion into the anterior lens capsule.

Making the diagnosis often requires a careful slit-lamp examination after pupillary dilatation. Due to the involvement of virtually all structures by pseudoexfoliation material, patients have a significantly greater risk for a variety of complications during cataract surgery. Poor mydriasis, pigment dispersion, combined with phacodonesis and zonular dialysis predisposes to capsular rupture and vitreous loss. Breakdown of blood-aqueous barrier leads to transient elevations of intraocular pressure and fibrinoid uveitis after surgery.

Late complications include posterior capsular opacification, secondary cataract, and decentration of intra-ocular lens and decompensation of corneal endothelium. Pseudoexfoliation syndrome should not be considered a harmless anomaly of the anterior segment but a potential catastrophic disease.

Phacoemulsification is the preferred method of cataract surgery in such patients (Freyler et al, 1994). But presence

of pseudoexfoliation makes surgery challenging for the phaco surgeon, as these patients are more prone for intraoperative complications as mentioned previously.

We designed this study with the objective of determining the safest nucleotomy technique in pseudoexfoliation which in turn will help in taking preventive steps towards complications.

Materials and methods

This study was conducted over a period of 2 yrs from September 2013 upto August 2015, among patients attending the ophthalmology OPD, 90 patients fulfilling the selection criteria were prospectively analysed.

Written informed consent was taken from all the patients included in the study. Our study was approved by concerned ethics committee and followed the tenets of Declaration of Helsinki.

These patients were arbitrarily divided into two groups: Group A: Phaco chop (60 cases: vertical and horizontal chop-30 each) and Group B: Divide and Conquer (30 cases). Patients with senile cataracts in pseudoexfoliation syndrome undergoing phacoemulsification were included in the study. The exclusion criteria consisted of traumatic cataracts, complicated cataracts, subluxated lens without pseudoexfoliation syndrome, patients with senile cataract without pseudoexfoliation syndrome and patients with raised intra ocular pressure or glaucoma.

Ophthalmic examination included visual acuity, general external examination including motility and squint, anterior segment evaluation and dilated fundus evaluation (done with +90D lens and indirect ophthalmoscope) in all eyes. Visual acuity was measured at 6 m by ophthalmic technician using Snellen's chart and 'E' – type chart, recorded as the smallest line read with one or no errors.

In slit lamp examination following findings

were specifically looked for pseudoexfoliation material in the pupillary margins, anterior chamber depth and pigment dispersion in the anterior chamber, presence of posterior synechiae, zones of pseudoexfoliation on the anterior surface of the lens capsule, phacodonesis or frank subluxation/dislocation of lens, measurement of pupil size before and after dilatation of pupil in mesopic condition and pupillary reactions.

Intraocular pressure was recorded using Goldmann applanation tonometer.

Gonioscopy was done with Goldmann three mirror lens. The grading of angle width was done according to Shaffer's grading. Keratometry, A-scan and intraocular lens power calculation by SRK-2 formula were done.

All patients were given systemic (tablet ciprofloxacin 500mg b.d.) and topical (moxifloxacin eye drops 0.5%) antibiotics on the preoperative day. Pupils were dilated using instillation of 0.8% tropicamide and 5% phenylephrine eye drops every 10 minutes, one hour before surgery. To sustain the pupil dilatation flurbiprofen eye drop was instilled half hourly for two hours immediately before surgery.

The eye was painted, draped and prepared for surgery under aseptic precautions. Standard surgical steps were followed for all patients' upto hydro procedures. Synechiolysis was done if required.

Phacoemulsification was performed following different nucleotomy techniques: Divide and Conquer Technique, Phaco Chop (Horizontal Chop), Quick Chop (Vertical Chop) for 30 patients each. Intraoperative complications faced such as pupil constriction, difficulty in trenching and chopping, capsulorrhexis extension or tear, iridodialysis, zonular dialysis, posterior capsular rent and vitreous loss

were noted and compared in all above techniques. Meticulous cortical matter was removed with bimanual I & A. Rigid Posterior chamber intraocular lens was placed in the capsular bag after extending the incision. Subconjunctival gentamycin (80mg/ml) and dexamethasone (4mg/ml) 0.5cc was given at the end of the procedure. Pad and bandage was applied.

Postoperatively all patients received a course of topical antibiotic and steroid eye drops second hourly for a week, followed by a tapering dose for 6 weeks along with flurbiprofen eye drops 0.03% 3 times a day for 4 weeks. Systemic antibiotic tab ciprofloxacin 500mg was given for 5 days postoperatively. Tab diclofenac stat was given in case the patient complained of pain.

The data was analyzed using SPSS statistical software. The Chi-square test was used to assess the results, considered significant at 5% level

Results

A total of 90 patients aged 48 – 90 years (mean age 61.7 years) were enrolled in the study. Male patients (56.66%) had slightly higher representation as compared to females (43.34%) in the sample size, however this was not found out to be statistically significant ($p>0.05$) **Table 1** shows the age distribution in different groups in detail impressing upon that groups were age matched ($p=0.847$)

Table 1: Comparison of age distribution

Age in years	Group A		Group B	
	No	%	No	%
48-50	6	10.0	2	6.7
51-60	24	40.0	12	40.0
61-70	26	43.3	16	53.3
71-80	3	5.0	0	0.0
81-90	1	1.7	0	0.0
Total	60	100.0	30	100.0
Mean ± SD	61.47±7.11		61.17±5.34	

Equal distribution of unilateral and bilateral cases of pseudoexfoliation (45 patients each) was seen in the overall sample. Pupil size pre and post dilatation was comparable in both the groups as shown in **Table 2**. Pupils were irregular on dilation in majority of the patients (95%) out of which 13 (14.44%) patients had posterior synechiae for which synechiolysis was done intraoperatively. Sphincterotomy was done in 24 (25.55%) patients during surgery due to inadequate dilatation.

Table 2: Comparison of pre and post pupil dilatation size

	Group A	Group B	P value
Pre-dilatation	2.92±0.38	2.87±0.35	0.547
Post-dilatation	6.02±1.03	6.07±1.05	0.830

Majority of the patients had soft cataract (Nuclear Opalescence grade 2-3) in both the groups i.e. 38.3% and 43.3% respectively. On gonioscopy examination 80 patients (89%) had open angles, while 10 patients (11%) were diagnosed with narrow angles. **Table 3** shows the basic and clinical variables among the study groups.

Table 3: Comparison of basic and clinical variables in three groups of patients

Variables	Group A		Group B (n=30)	P value
	Vertical chop (n=30)	Horizontal chop (n=30)		
Age in years	60.20±5.70	62.73±9.07	61.17±5.34	0.362
Gender M:F	17:13	11:19	23:7	0.008
Predilatation				
Size(mm)	2.83±0.38	3.00±0.37	2.87±0.35	0.181
Shape				
• Round	2(6.7%)	1(3.3%)	0	0.770
• Irregular	28(93.3%)	29(96.7%)	30(100.0%)	
Reaction				
• Normal	29(96.7%)	29(96.7%)	30(100.0%)	1.000
• Sluggish Reaction	1(3.3%)	1(3.35)	0	
Post dilatation size (mm)	5.97±1.03	6.07±1.05	6.07±1.05	0.912

Complications were noted in terms of pupillary constriction, difficulty in trenching/chopping, iridodialysis, posterior capsular rent, zonular dialysis, vitreous loss etc.

Table 4 shows the various intraoperative complications in detail in the study groups. Pupillary constriction was the only complication seen in vertical chopping group as opposed to various complications seen in other groups.

Table 4: Comparison of complications in three groups of patients

Complications	Group A		Group B (n=30)	P value
	Vertical chop (n=30)	Horizontal chop (n=30)		
PC	2(6.7%)	4(13.3%)	5(16.7%)	0.524
DIT	0	0	3(10.0%)	0.104
DIC	0	2(6.7%)	0	0.326
PCR	0	1(3.3%)	1(3.3%)	1.000
VL	0	0	0	-
ZD	0	1(3.3%)	0	1.000
OTHERS	0	0	0	-

*PC- Pupillary constriction, DIT- Difficulty in Trenching, DIC- difficulty in Chopping, PCR- Posterior Capsule Rent, VL- Vitreous Loss, ZD – Zonulo-Dialysis



Discussion

Pseudoexfoliation syndrome is of global distribution. Early and accurate diagnosis of pseudoexfoliation demands complete knowledge of the clinical criteria, the method and thoroughness of examination and awareness of the examiner. Pseudoexfoliation is looked upon as a major area of concern because of the complications it poses.

The prevalence of Pseudoexfoliation syndrome increases with age. Pseudoexfoliation syndrome usually occurs between 60 to 80 yrs, the average age being 70 yrs. In our study, as shown in **Table 1**, the average age of patients was 61.7 years with majority (51.00 %) being above 60 years of age. These findings concur with the documented literature (Sood et al, 1968; Lamba et al, 1984; Aravind et al, 2003).

In a given population, the actual prevalence of Pseudoexfoliation Syndrome is probably higher than what is visible on clinical examination. In screening camps, many cases go undetected because of failure to dilate the pupil or to examine the lens with the slit lamp after dilatation of the pupil.

Studies regarding the sex distribution of Pseudoexfoliation syndrome are conflicting. Women have predominated in some series while other studies have found equal or greater prevalence in men. We had slight predominance of male patients in study group as 51 patients (56.6%) were males and 39 (43%) were females, though this was not statistically significant.

A review of literature comparing the frequency of monocular versus binocular involvement in various series is not conclusive. In our study we had equal number of patients with unilateral and bilateral disease i.e.45 patients each. An ultra structural study of the contralateral eye in patients with unilateral pseudoexfoliation syndrome concluded that basically pseudoexfoliation syndrome is a bilateral

disease with clinically marked asymmetric manifestations. The reasons for this marked asymmetry remain unknown (Hammer et al, 2001). Clinically unilateral involvement is often a precursor to bilateral involvement within 5- 10 yrs after diagnosis.

Out of 90 patients, 80 (89%) of patients had open angles and 10 (11%) patients had narrow angles. Out of 10 narrow angles, 4 patient had narrow angle due to anterior subluxation of the lens, 3 patient had narrow angles due to synechial angle closure and 3 patient had narrow angles due to appositional angle closure. These findings are in concurrence with earlier published data, which states the prevalence of narrow angles in Pseudoexfoliation syndrome may range from 9-32% (Wishart et al, 1985).

Patients having synechial angle closure presented with high intraocular pressure as which was controlled with topical and systemic medications prior to surgery.

In our study 57 (63 %) patients had sufficient mydriasis, and 33 (37 %) patients had insufficient mydriasis. Poor mydriasis in pseudoexfoliation syndrome to degenerative changes of sphincter and dilator muscle tissues and apparent involvement of the muscle cells in pseudoexfoliation material fibre formation. Reduction of stromal elasticity by accumulation of pseudoexfoliation material may also play a role in poor mydriasis.

Earlier published data by various authors all over suggests increase in the complications in Pseudoexfoliation syndrome when operated for cataract. We have summarised the intraoperative complications encountered during our study in **Table 4**. Patients who underwent vertical chopping technique had fewer complications as compared to other groups in our study.

A statistically significant increase in intraoperative and postoperative complication in eyes with pseudoexfoliation syndrome was found in a study of 436 patients (Kuchle

M et al, 1989). Another concluded that PEX patients were five times more likely to develop intraoperative complications during cataract surgery compared to patients without the condition (Scrolloli et al, 1998). Overall complication rate in our study was 21.1% which is significantly higher as opposed to routine cataract surgery.

Zonular fragility in pseudoexfoliation syndrome increases the risk of lens dislocation, zonular dehiscence and vitreous loss up to 10 times (Ritch et al, 2001). Various studies in eyes with pseudoexfoliation syndrome have quoted the incidence of zonular dehiscence to be ranging from 13-18% (Hovding et al, 1988; Lumme et al, 1993; Avramides et al, 1997).

In our study vitreous loss was seen in a single patient in the horizontal chop group which is significantly lower than the above quoted data. This may be due to better surgical understanding of the disease and superior dynamics of the currently available phaco machines as opposed to earlier studies which were conducted long time back. Surgeon's expertise may also be a contributing factor.

There are higher chances of vitreous loss along with posterior capsular rent in pseudoexfoliation syndrome. The occurrence of posterior capsular rent and vitreous loss was found to be 10.4% and 7.14% respectively in a study of 84 patients with pseudoexfoliation syndrome undergoing cataract surgery (Avramides et al, 1997). The incidence of vitreous loss in eyes with pseudoexfoliation syndrome undergoing cataract surgery has been reported by various authors as 11.9% and 6.7% respectively (Kuchle et al, 1989; Viestenz A et al, 2000). We did not encounter vitreous loss in any of our patients intraoperatively. This was due to early detection of posterior capsular rent intraoperatively and timely management.

High rates of vitreous loss may be attributed to changes in the composition of vitreous in pseudoexfoliation syndrome. Since hyaluronic acid and pseudoexfoliation material are both acid mucopolysaccharides, pseudoexfoliation deranges the metabolism of hyalocytes leading to impaired production of hyaluronic acid and liquefaction.

Conclusion

We found that chopping techniques are best suited for pseudoexfoliation and amongst these vertical chopping scores over horizontal chopping.

Patients with pseudoexfoliation syndrome and cataract for phacoemulsification surgery, have to be carefully looked for zonular weakness, insufficient mydriasis, IOP, subluxation or dislocation of cataractous lens because these preoperative factors have bearing on the intraoperative complications. Inadequate mydriasis is one of the major pre operative complications.

Pseudoexfoliation syndrome has an increased intraoperative posterior capsule complication rate that increases as the level of cataract maturity increases.

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