A Prospective Study of Use of Ultrasound in Preoperative Asessment of Patients with Mature Cataract

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ABSTRACT
Background: Advances in the field of ultrasonography has made it possible for us to study the posterior segment of the eye even in the presence of opaque media

In dense cataract the posterior segment is inaccessible to direct and indirect ophthalmoscopy. so adequate evaluation of posterior segment to rule out abnormalities becomes difficult in such cases. There is a risk of poorprognosis in eyes of patient with cataracts who may also haveco existingposteriorsegmentabnormality.

Ultra sonography is a noninvasive tool in evaluating the posterior segment which helps to predict the visual outcome post surgery, but also helps in diagnosis andmanagement of conditions such as diabetic retinopathy Diabetic Retinopathy, Retinaldetachment(RD).

Objectives: To assess the role of B scan ultrasound in detection of posterior segment pathology in mature cataract patients

Materials and Methods: A prospective diagnostic study conducted in VIMS Ballari from August 2022 to January 2024.100 patients with mature cataracts from 45 -80 years precluding visualization of fundus will be examined by b scan with frequency of 10MHz.Traumatic cataract patients excluded.

Results: Out of 100 patients 44 patients had PVD ,5 patients with optic nerve head cupping,1 patient with RD and 1 patient with VH and 1 patient with RD and VH,1 case of posterior staphyloma was diagnosed with B scan.

Conclusion: B scan is efficient tool in diagnosing posterior segment pathologies in mature cataract patients.It also helps in explaining accurate prognosis postoperatively although diseases such as vein occlusion macular hole , diabetic maculopathy can be missed in ultrasound .Diagnosis of pre-existing disease conditions by B scan can influence the surgical strategy and postoperative visual outcome.

KEYWORDS: Diabetic retinopathy, Vitreous haemorrhage, retinal detachment, Brightness scan

I. INTRODUCTION

The most recent estimates from the World Health Organization reveal that 47.8% of global blindness is due to cataract and in the South Asia region which includes India, 51% of blindness is due to cataract .[1] As per the National Program for Control of Blindness and Visual Impairment, the incidence of cataract in India is 0.4%–0.5%.[2]

In patients with dense or mature cataract, fundus view may be obscured or not visible at all. In these cases, B-scan ultrasonography before surgery can help in surgical planning and guiding the expectations of patients. It is an indispensable diagnostic tool. It gives vital information regarding the status of vitreous, retina, choroid, and sclera. There are few studies done to evaluate posterior segments using B-scan ultrasonography in cases of dense cataract. [3]

This study was done to determine the abnormalities of the posterior segment in the presence of dense cataracts using B-scan ultrasonography.

B scan ultrasound is most useful when direct visualisation of intraocular structures is difficult or impossible. Situations that prevent normal examination include lid problems like severe lid edema ,total tarsorrhaphy ,Corneal opacities like scars or severe corneal edema, hyphema , hypopyon, miosis ,pupillary membranes ,dense mature cataract and vitreous opacities. [4]

In such cases B scan ultrasound can help to image intraocular structures.

The goal of our study was to assess the role of ultrasound in detection of posterior segment anomalies in mature cataract patients.

The assessment of the possible coexisting posterior segment pathology will help in selection of patients for surgery and helps in making accurate preoperative diagnosis[5]

II. MATERIALS AND METERIALS

This study entitled A PROSPECTIVE STUDY OF USE OF ULTRASOUND IN PREOPERATIVE ASESSMENT OF PATIENTS WITH MATURE CATARACT was conducted in the department of ophthalmology VIMS Ballari

over a period of 18 months from August 2022 to January 2024

SOURCE OF DATA

This study consisted of 100 cases of dense cataract whose age ranged from 45 to 80 years attending VIMS Ballari outpatient department irrespective of gender were examined.

INCLUSION CRITERIA-Patients with dense cataract in the age group of 45 to 80 years in whom posterior segment examination is not possible with indirect ophthalmology

EXCLUSION CRITERIA-Patients with cataract secondary to trauma

METHOD OF COLLECTION OF DATA

Patients who were needed to meet the eligibility criteria have been enrolled in the study, a written and informed consent had been obtained from all patients after explaining the procedure.

Detailed ocular, systemic, family history was taken.Preoperative evaluation were recorded such as Visual acuity testing for distant vision using Snellen's chart, anterior segment examination by using of slit lamp biomicroscopy, measurement of IOP with Schiotz tonometer and Goldmann's applanation tonometer after instilling paracaine eye drop and staining with fluorescein strip and B-scan examination.

For B-scan procedure, patients had been briefly explained about the procedure for their co-operation. The patients have been examined in supine position on the examination table. Contact method of examination have been used. Ultrasonic probe had been placed over the closed eyelid after application of coupling gel.

Axial images were obtained from the upper to lower poles of the entire globe. Sagittal images were obtained from the temporal to the nasal side. Oblique views and dynamic images were also performed with eye movements from right to left and up to down.B-scan images along with A scan were taken.High gain (80-90dB) and low gain (60-70 dB) sensitivity have been used in selected patients during ultrasonography. Care was taken not to touch the cornea. B scan findings were recorded.

Follow Up

Patients were followed up postoperatively to confirm the B scan findings by dilatation and fundus examination.

III.   RESULTS
Table No.1: Age and gender wise distribution of mature cataract patients

NS-not significan

Age in years	Males		Females		Total	
45—55	12	27.3	17	30.4	29	29.0
56—65	21	47.7	26	46.4	47	47.0
66—75	9	20.5	11	19.6	20	20.0
76—85	2	4.5	2	3.6	4	4.0
Total	44	100.0	56	100.0	100	100.0
Mean ± SD	60.20 ± 8.64		60.45 ± 8.96		60.33 ± 8.74	
P-value	t = 0.126 P = 0.900, NS					

NS-not significant,S-significant,HS-highly significant

Study observes that maximum number of patients 47(47%) were belongs to the age group of 56-65 years , followed by 29(29%)of patients were belonging to the age group of 45-55 years.

Minimum age of patient was 45 years and maximum age of patient was 81 years. The mean age of male patient was 60.20 years and mean age of female patient was 60.45 years and mean of all

patients was 60.33 years. There was no statistical difference of age among gender(P>0.05)

Table No.2: Co-morbid wise distribution of patients

Co-morbid	Number of patients	Percentage
Diabetes Mellitus (DM)	5	5.0
Hypertension (HTN)	12	12.0
DM and HTN	12	14.0
Nil	71	71.0
Total	100	100.0

In the study no comorbidity were seen in 71 (71%) and 29 (29%) had seen comorbidities.Among them 5 percent had DM,12 (12%) had HTN and 12% had both HTN and DM

Table No.3: Residential area wise distribution of patients

Residential Area	Number of patients	Percentage
Urban	79	79.0
Rural	21	21.0
Total	100	100.0

Study observed that; majority of patient 79 (79.0%) were belongs to urban area and 21 (21.0%) of patients were rural area.

Table No.4: Distribution of patients according to type of cataract

Clinical diagnosis of cataract	Number of patients	Percentage
SMC	80	80.0
SHMC	12	12.0
LIG	6	6.0
Brown cataract	2	2.0
Total	100	100.0

Study observed that; majority of patients 80 (80.0%) were seen Senile mature cataract (SMC), 12 (12.0%) of patients were seen SHMC, 6 (6.0%) of patients were seen LIG and 2 (2.0%) of patients were seen brown cataract.

Table No.5: Distribution of patients based on vision

Vision	Number of patients	Percentage
PR accurate	38	38.0
PR inaccurate	25	25.0
Hand movements	35	35.0
Denies PL	2	2.0
Total	100	100.0

Study observed that; 38 (38.0%) were patient's vision was observed projections of rays accurate, followed by 35 (35.0%) of patient's vision was observed projections of rays inaccurate, 25 (25.0%) of patient's vision hand motion vision and 2 (2.0%) of patients were seen the denies PL vision

Table No.6: Presenting complaints wise distribution of patients

Presenting complaints	Number of patients	Percentage
Diminution of vision (DOV)	93	93.0
DOV and pain	7	7.0
Total	100	100.0

Study observed that; out of 100 sample cataract patient's chief complaints; majority of patients 93 (93.0%) had the complaints of diminution of vision (DOV) and 7 (7.0%) of patients had the complaints of diminution of vision (DOV) with pain

Table No.7: Distribution of patients based on Anterior Segment Examination Finding

Anterior Segment Examination Finding	Number of patients	Percentage
Within Normal Limits	82	82.0
Corneal edema	5	5.0
Phacodonesis	4	4.0
RAPD	3	3.0.
PXF	2	2.0
Myopia	2	2.0
RAPD with Macular Opacity	1	1.0
Leucomatous opacity	1	1.0
Total	100	100.0

Study reveals that; 82 (92.0%) of patients Anterior Segment Examination was within normal limits,5 (5.0%) of patient's Anterior Segment Examination Finding was cataract extraction, followed by 4 (4.0%) of patient's Anterior Segment Examination Finding wasp hacodonesis, 3 (3.0%) of patient's Anterior Segment Examination Finding was Relative Afferent Pupillary Defect (RAPD)

Table No 8: Systemic risk factors and incidence of abnormal ultrasonography

Systemic risk factor	No. of patients with risk factors (100)	No. of patients with abnormal USG	Percentage (of patients with risk factor having abnormal USG
None	71	36	36
HTN and DM	12	6	6
HTN	12	6	6
DM	5	5	5

Study revealed that out of 71 patients with no systemic risk factors ,36 cases had abnormal USG. Among 12 patients with both DM and HTN, 6 patients were having posterior segment lesions. Among 12 HTN patients 6 cases were having posterior segment lesions. Among 5 DM patients all 5 patients were having posterior segment lesions.

Table No 9: Ocular Risk factors and incidence of abnormal ultrasonography

Ocular Risk factor	No. of patients affected	No of patients with abnormal ultrasound	Percentage of patients with abnormal ultrasound
None	82	37	37
Corneal edema	5	5	5
Phacodonesis	4	3	3
RAPD	3	3	3
Pseudo exfoliation	2	1	1
Myopia	2	2	2
RAPD with macular opacity	1	1	1
Leucomatous opacity	1	1	1

Among 82 patients without any ocular risk factors 37 patients were having abnormal ultrasound findings. Among 5 patients with corneal edema all 5 patients were having abnormal posterior segment lesions. Among 4 patients with phacodonesis,3 cases had posterior segment lesions. Among 3 patients with RAPD all three patients had posterior segments lesions. Among 2 patients with Pseudo exfoliation 1 patient had ONH cupping.Among 2 patients of myopia 1 patient had posterior staphyloma and 1 patient had PVD.

Among one patient who had RAPD with macular opacity had optic nerve head cupping. One patient with leucomatous opacity had PVD.

Table No.10: Diagnosis B scans wise distribution of patients

Types of cataract	Number of patients	Percentage
WNL	47	47.0
PVD	44	44.0
Optic nerve head cupping	5	5.0
Posterior staphyloma	1	1.0
RD	1	1.0
VH	1	1.0
RD and VH	1	1.0
Total	100	100.0

Study observed that; majority of patients 47 (47.0%) were diagnosed WNL and 44 (44.0%) of patients were diagnosed PVD and 5 (5.0%) of patients were diagnosed optic nerve head cupping

IV.   DISCUSSION

Since the posterior segment examination is not possible with indirect ophthalmoscopy in cases of maturecataractpatient ultrasound becomes a valuable tool in diagnosing the posterior segment pathologies.[5]

As cataract progress, they go through different stages of maturity. In later stage cataracts may leak proteins that may cause an allergic like reaction.Lens induced Uveitis which may cause complications like glaucoma, retinal detachment or retinal degenerations. Even without these complications cataract may coexist with other posterior segment pathology [4]

Ultrasound is a non-invasive easy tool to detect these pathologies.Detection of pathologies preoperatively helps in knowing the decreased postoperative prognosis and helps to reduce medico legal problems to surgeon and patient can be informed prior which would help in predicting postvisual outcome following surgery. Vitreous hemorrhage may complicate cataract surgery and detection of these conditions preoperatively helps in planning cataract surgery [5]

In our study which was conducted over 18 months, majority of the patients were belonging to the age group 56-65 year (47%) Mean age of the patient was 60.33 and majority of the patients were female (56 %) Most of the patients were from urban area (79%)

In comparable to our study in the study conducted by**T.O.Bello and C.O.Adeoti**included patients with dense cataract whose age ranged between 1.5 to 95 years .75 percent of patients were between the ages of 45-70 years. Male to female ratio was 1:1.3.[5]

Manzoor A Qureshi, Khalida Laghari et al conducted study on patients whose age ranged from 1-79 years where the mean age of patients was 54 years out of which females were more (42.12%).[6]

In the study conducted by **Madhu Chanchlani and Roshan Chanchlani**included patients whose age ranged from0-80 years. Contrast to our study males were more compared to female with sex ratio of 1.37:1.More patients were from rural area (66.37%) [7]

In the study conducted by**Mujeeb Ur Rehman Parrey et al**mean age of patients was 62+/_12.02 years. Most of the patients (72%) were more than 61 years. 60 percent of patients were male [8]

Faheem ullahshaik et alconducted a study which had patients whose age was between 43 to 81 years Mean age of the patients was 51 years .58% patients were male .42 % patients were female.Most of the patients were from urban area.[9]

In the study conducted by**JasmineMary Jacob, Jennifer Joseph K Thadam, Sheldon Goudinho**patient's age ranged from 37 to 89 years Majority of the patients (46.3%) were 60-70 years age group and majority of the patients were female (62.4%)[10]

In the study conducted by**Vepa Meenakshi, Tammana Jyothirmayi and Bharani

Sree Age of the patients ranged from 5 to 75 years.Majority of the patients were female .and most of the patients (75%) were of 50 to 70 years.[11]

In study conducted by **Ram Kumar, Deepthi Yadav et al**Most of the patients(43.75%) were belonging to the group of 61 to 70 years age group and most of the patients were male(61.61%).[12] .In all the above studies majority of the patients were belonging to the older age where senile cataract is more common cause of decreased vision loss.

In our study PVD was the most common pathology detected by B scan (47%)Retinal detachment was found in one diabetic patient and RD with VH was seen in patient with a patient with DM and HTN indicating complications were more seen in patients with comorbidities.Optic nerve head cupping was seen in 5 % and posterior staphyloma was seen in 1 % patients.

In contrast to our study, in the study conducted by **Salman A, Parmar P et al**detected only 8.6 percentageposterior segment pathology among 418 eyes. Our study detected 53 percentage of patients with posterior pathologies.RD was the most common pathology detected in this study and in our study PVD was the most common anomaly detected.[3]

In the study conducted by**Vepa Meenakshi, Tammana Jyothirmayi and Bharani Sree**11.02% cases showed posterior segment lesions.RD was the most common lesion detected RD was seen in 2.85%,vitreous haemorrhage was seen in 2.5%,posterior staphyloma and asteroid hyalosis in 0.8% PVD was seen in 1.2%[11]

In contrast to our study in the study conducted by **T.O.Bello and C.O.Adeoti** 94.8% had normal posterior segment. In 3 eyes (2.59%) had total retinal detachment.Partial detachment observed in 1 eye (0.87%) 2 eyes with total RD along with vitreoushaemorrhage was notedinsingle patient. [5]

In the study conducted by **Madhu Chanchlani and Roshan Chanchlani,** most common pathology detected was posterior staphyloma.400 patientsof dense cataract by USG evaluation.Among them 62 patients (3.52%) were diagnosed withposteriorstaphyloma,28 patients (1.64%) vitreoushaemorrhage, vitreousmembrane (30) in1.20 %Chorioretinal thickening in 25(1.41%) and retinal detachment in 20 (0.94%) cases[7]

In study conducted by**Faheem ullahshaik et al** 227 eyes18(7.90%) eyeshad finding suggestive ofposterior segment pathology. Most common finding detected was posterior staphyloma

in 3.52%patients.[9]

Mujeeb Ur Rehman Parrey et alconducted study on 150 patients and it revealedonly17.3% of the patients had posterior segment diseases. These included 6% cases of retinaldetachment, 5.3% vitreous haemorrhage, 2.6% optic nerve head cupping, 2%posteriorstaphyloma and1.3%posterior vitreousdetachment[8]

In study conducted by **Navneeth Saxena** out of 200 patients 23 patients were having posterior segment pathology out of 14 non traumatic cataract patients. 5 Patients (25%) had PVD and 2 patients (1%) had asteroid hyalosis and 1 (0.55) patient had intraocular foreign body, 2 (1%) had posterior staphyloma. In comparision to our study in this study also PVD was the most commonly detected pathology in B scan**.**[13]

In study conducted by**JasmineMary Jacob , Jennifer Joseph K Thadam , Sheldon Goudinho**

Pre-operatively, 365 (71.6%) eyes had normal B scan findings. Out of 365 patients 130 patients had normal findings and PVD was detected in 130 (25.5%) which was comparable to our study. In 283(55.5%) eyes normal B scan findings corresponded with a normal Fundus picture. In 125(24.5%) eyes positive findings on B scan corresponded with positive Fundus findings.

Positive retinal pathologies detected were Posterior vitreous detachment, retinal detachment, vitreous hemorrhage, asteroid hyalosis and posterior Staphyloma. In 102 (20%) eyes B scan findings did not correspond to Fundus findings. Sensitivity and specificity were calculated. Specificity was 100% and sensitivity was 55%.[10]

Manzoor A Qureshi, Khalida Laghari et al conducted study on 750 patients out of which 90 patients detected posterior pathology. Out of679 non traumatic patients only 7 % cases had posterior segment pathology. RD was the most common anomaly detected.[6]

In study conducted by**Ram Kumar, Deepthi Yadav et al,** Out of 240 eyes, 31 eyeswere detected with abnormal posterior segment. RD was the most common abnormality detected in 10 eyes.[12]

Sooraj Singh, kavitha Kumar et al conducted a prospective study of 100 eyeswith mature cataract for a period of one year. Out of 100 eyes, 27 eyes were shown tohave detectable posterior segment pathology. 9 eyes with retinal detachment with abnormal posterior segment. RD was the most common anomaly detected.[14]

In our study comorbidities were seen in 29 percentage people. Diabetes was seen in 5 % , HTN

was seen in 12 % both HTN and DM was seen in 12% people. Study revealed that out of 71 patients with no systemic risk factors ,36 cases had abnormal USG. Among 12 patients with both DM and HTN , 6 patients were having posterior segment lesions. Among 12 HTN patients 6 cases were having posterior segment lesions. Among 5 DM patients all 5 patients were having posterior segment lesionsindicating systemic risk factors were associated with posterior segment lesions

Faheem ullahshaik et alconducted a study in which out of 200 patients 163(81.5%) had no risk factors and 37(18.5%) were associated with systemic and ocular risk factors.Among them diabetes,HTN,early   age   posterior synechiae,elevated IOP, KPs were more frequently seen [9]

In **Madhu Chanchlani and RoshanChanchlani study** 20.1% patients were having ocular and systemic risk factors like HTN,DM, Increased IOP,Uveitis [7]

In the study conducted by **Mujeeb Ur Rehman Parrey et al**23 percentage of the had either   diabetes   alone   (18%)   or   with hypertension.Anterior   segment   examination findings were seen in 9% of patients in which anterior uveitis with posterior synechiae was seen in 6 percent of patients and corneal opacity was seen in 3% of people .[8]

In study conducted by **Salman A, Parmar P et al,**among patient features, diabetes mellitus and age below 50 yearswere associated with ahigh incidence of abnormal ultrasound scans.In ocular features, posteriorsynechiae (OR= 20.2, P=0.000), iris coloboma (OR= 34.6, P=0.000), inaccurateprojection of rays (OR= 15.1, P=0.002), elevated intraocular pressure (OR=15.1, P=0.004), and keratic precipitates (OR= 22.4, P=0.004) were associatedwith high incidence of posterior segment pathology. Only four eyes (1.5%)withoutthesefeatureshadabnormalposterior segmentonultrasonographyabout9% of eyes undergoing surgery for advanced cataract will have significantposteriorsegmentpathology [3]

Among 82 patients without any ocular risk factors 37 patients were having abnormal ultrasound   findings. Among 5 patients with corneal edema all 5 patients were having abnormal posterior segment lesions. Among 4 patients with phacodonesis,3 cases had posterior segment lesions. Among 3 patients with RAPD all three patients had ONH cupping. Among 2 patients with Pseudo   exfoliation   1   patient   had   ONH cupping.Among 2 patients of myopia 1 patient had posterior   staphyloma   and   1   patient   had PVD.Among one patient who had RAPD with

macular opacity had optic nerve head cupping. One patient   with   leucomatous   opacity   had   PVD indicating that Ocular risk factors were associated with more posterior segment lesions.

It was comparable to study conducted by**Ram Kumar, Deepthi Yadav et al**where out of 224 patients 12 patients had DM and 6 patients had hypertension and 2.23% of patients withDM had abnormal ultrasound findings and none of the hypertensive patients had abnormal ultrasound findings .Ocular   risk   factors   like   posterior synechiae ,Iris coloboma ,Elevated IOP ,Keratic precipitates and Small corneas were seen in 20 percentage of the eyes .Out of 240 eyes examined 200 eyes had no ocular risk factors ,2 eyes (0.83%) detected with posterior segment abnormalities .Out of 22 eyes with posterior synechiae 6 eyes (2.50%) detected with posterior segment abnormalities .Out of 8 eyes had iris coloboma 6 eyes (2.50%) detected with posterior segment abnormality. Out of 12 eyes with elevated IOP ,4 eyes (1.67%) detected with abnormal ultrasound [12]

V.   CONCLUSSION

B scan is very efficient tool in diagnosing posterior segment pathologies in mature cataract patients. It is a non-invasive tool which helps in explaining   accurate   prognosis   postoperatively. Study showed that even patients without systemic risk factors and ocular risk factors also had posterior segment lesions, indicating importance of B scan in patients without ocular or systemic risk factors. Only disadvantage of B scan was diseases such as vein occlusion , macular hole ,optic atrophy, diabetic maculopathy could be missed in ultrasound pre operatively .Therefore diagnosis of pre-existing disease conditions in mature cataract patients by B scan can influence the surgical strategy andthe postoperative visual outcome.

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